MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-R series

MELSEC iQ-R Motion Module User's Manual (Application for Simple Motion Mode)

-RD78G4
-RD78G8
-RD78G16

SAFETY PRECAUTIONS

(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.

The precautions given in this manual are concerned with this product only. For the safety precautions of the programmable controller system, refer to the MELSEC iQ-R Module Configuration Manual.

In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

⚠ **WARNING**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ **CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.

Observe the precautions of both levels because they are important for personal and system safety.

Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

⚠WARNING

- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Emergency stop circuits, protection circuits, and protective interlock circuits for conflicting operations (such as forward/reverse rotations or upper/lower limit positioning) must be configured external to the programmable controller.
  (2) When the programmable controller detects an abnormal condition, it stops the operation and all outputs are:
    - Turned off if the overcurrent or overvoltage protection of the power supply module is activated.
    - Held or turned off according to the parameter setting if the self-diagnostic function of the CPU module detects an error such as a watchdog timer error.
  (3) All outputs may be turned on if an error occurs in a part, such as an I/O control part, where the CPU module cannot detect any error. To ensure safety operation in such a case, provide a safety mechanism or a fail-safe circuit external to the programmable controller. For a fail-safe circuit example, refer to "General Safety Requirements" in the MELSEC iQ-R Module Configuration Manual.
  (4) Outputs may remain on or off due to a failure of a component such as a relay and transistor in an output circuit. Configure an external circuit for monitoring output signals that could cause a serious accident.
- In an output circuit, when a load current exceeding the rated current or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
- Configure a circuit so that the programmable controller is turned on first and then the external power supply. If the external power supply is turned on first, an accident may occur due to an incorrect output or malfunction.
- Configure a circuit so that the external power supply is turned off first and then the programmable controller. If the programmable controller is turned off first, an accident may occur due to an incorrect output or malfunction.
- For the operating status of each station after a communication failure, refer to manuals for the network used. For the manuals, please consult your local Mitsubishi representative. Incorrect output or malfunction due to a communication failure may result in an accident.

[Design Precautions]

⚠WARNING

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents. When a Safety CPU is used, data cannot be modified while the Safety CPU is in SAFETY MODE.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not write any data to the "system area" and "write-protect area" of the buffer memory in the module. Also, do not use any "use prohibited" signals as an output signal from the CPU module to each module. Doing so may cause malfunction of the programmable controller system. For the "system area", "write-protect area", and the "use prohibited" signals, refer to the user's manual for the module used. For areas used for safety communications, they are protected from being written by users, and thus safety communications failure caused by data writing does not occur.
- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock circuit in the program to ensure that the entire system will always operate safely even if communications fail. Incorrect output or malfunction due to a communication failure may result in an accident. When safety communications are used, an interlock by the safety station interlock function protects the system from an incorrect output or malfunction.
- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Machine homing is controlled by two kinds of data: a homing direction and a homing speed. Deceleration starts when the proximity dog signal turns on. If an incorrect homing direction is set, motion control may continue without deceleration. To prevent machine damage caused by this, configure an interlock circuit external to the programmable controller.
  (2) When the module detects an error, the motion slows down and stops or the motion rapidly stops, depending on the stop group setting in parameter. Set the parameter to meet the specifications of a positioning control system. In addition, set the homing parameter and positioning data within the specified setting range.
  (3) Outputs may remain on or off, or become undefined due to a failure of a component such as an insulation element and transistor in an output circuit, where the module cannot detect any error. In a system that the incorrect output could cause a serious accident, configure an external circuit for monitoring output signals.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the module, drive unit, and servo motor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the module or drive unit if the abnormal operation of the module or drive unit differs from the safety directive operation in the system.

[Design Precautions]

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Doing so may result in malfunction due to electromagnetic interference. Keep a distance of 100mm or more between those cables.
- During control of an inductive load such as a lamp, heater, or solenoid valve, a large current (approximately ten times greater than normal) may flow when the output is turned from off to on. Therefore, use a module that has a sufficient current rating.
- After the CPU module is powered on or is reset, the time taken to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size. Design circuits so that the entire system will always operate safely, regardless of the time.
- Do not power off the programmable controller or reset the CPU module while the settings are being written. Doing so will make the data in the flash ROM and SD memory card undefined. The values need to be set in the buffer memory and written to the flash ROM and SD memory card again. Doing so also may cause malfunction or failure of the module.
- When changing the operating status of the CPU module from external devices (such as the remote RUN/STOP functions), select "Do Not Open by Program" for "Opening Method" of "Module Parameter". If "Open by Program" is selected, an execution of the remote STOP function causes the communication line to close. Consequently, the CPU module cannot reopen the line, and external devices cannot execute the remote RUN function.

[Security Precautions]

⚠WARNING

- To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from external devices via the network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

[Installation Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in electric shock or cause the module to fail or malfunction.

[Installation Precautions]

⚠CAUTION

- Use the programmable controller in an environment that meets the general specifications in the Safety Guidelines (IB-0800525). Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount a module, place the concave part located at the bottom onto the guide of the base unit, push in the module, and fix it with the screw. Incorrect interconnection may cause malfunction, failure, or drop of the module.
- To mount a module with no module fixing hook, place the concave part(s) located at the bottom onto the guide(s) of the base unit, push in the module, and fix it with screw(s). Incorrect interconnection may cause malfunction, failure, or drop of the module.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction. For the specified torque range, refer to the MELSEC iQ-R Module Configuration Manual.
- When using an extension cable, connect it to the extension cable connector of the base unit securely. Check the connection for looseness. Poor contact may cause malfunction.
- When using an SD memory card, fully insert it into the SD memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
- Securely insert an extended SRAM cassette or a battery-less option cassette into the cassette connector of the CPU module. After insertion, close the cassette cover and check that the cassette is inserted completely. Poor contact may cause malfunction.
- Beware that the module could be very hot while power is on and immediately after power-off.
- Do not directly touch any conductive parts and electronic components of the module, SD memory card, extended SRAM cassette, battery-less option cassette, or connector. Doing so can cause malfunction or failure of the module.

[Wiring Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before installation and wiring. Failure to do so may result in electric shock or cause the module to fail or malfunction.
- After installation and wiring, attach a blank cover module (RG60) to each empty slot before powering on the system for operation. Also, attach an extension connector protective cover[*1] to each unused extension cable connector as necessary. Directly touching any conductive parts of the connectors while power is on may result in electric shock.
  *1 For details, please consult your local Mitsubishi Electric representative.

[Wiring Precautions]

⚠CAUTION

- Individually ground the FG and LG terminals of the programmable controller with a ground resistance of 100 ohms or less. Failure to do so may result in electric shock or malfunction.
- Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- Check the rated voltage and signal layout before wiring to the module, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause fire or failure.
- Connectors for external devices must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete connections may cause short circuit, fire, or malfunction.
- Securely connect the connector to the module. Poor contact may cause malfunction.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Doing so may result in malfunction due to noise. Keep a distance of 100mm or more between those cables.
- Place the cables in a duct or clamp them. If not, dangling cables may swing or inadvertently be pulled, resulting in malfunction or damage to modules or cables.
  In addition, the weight of the cables may put stress on modules in an environment of strong vibrations and shocks.
  Do not clamp the extension cables with the jacket stripped. Doing so may change the characteristics of the cables, resulting in malfunction.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
- Tighten the terminal screws or connector screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. For the cable connected to the terminal block, loosen the terminal screw. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- When a protective film is attached to the top of the module, remove it before system operation. If not, inadequate heat dissipation of the module may cause a fire, failure, or malfunction.
- Programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring, refer to the MELSEC iQ-R Module Configuration Manual.
- For Ethernet cables to be used in the system, select the ones that meet the specifications in the user's manual for the module used. If not, normal data transmission is not guaranteed.

[Startup and Maintenance Precautions]

⚠WARNING

- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.
- Correctly connect the battery connector. Do not charge, disassemble, heat, short-circuit, solder, or throw the battery into the fire. Also, do not expose it to liquid or strong shock. Doing so will cause the battery to produce heat, explode, ignite, or leak, resulting in injury and fire.
- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the terminal screws, connector screws, or module fixing screws. Failure to do so may result in electric shock.

[Startup and Maintenance Precautions]

⚠CAUTION

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not disassemble or modify the modules. Doing so may cause failure, malfunction, injury, or a fire.
- Use any radio communication device such as a cellular phone or PHS (Personal Handy-phone System) 25cm or more away in all directions from the programmable controller. Failure to do so may cause malfunction.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- After the first use of the product, do not perform each of the following operations more than 50 times (IEC 61131-2/JIS B 3502 compliant).
  Exceeding the limit may cause malfunction.
  - Mounting/removing the module to/from the base unit
  - Inserting/removing the extended SRAM cassette or battery-less option cassette to/from the CPU module
  - Mounting/removing the terminal block to/from the module
  - Connecting/disconnecting the extension cable to/from the base unit
- After the first use of the product, do not insert/remove the SD memory card to/from the CPU module more than 500 times. Exceeding the limit may cause malfunction.
- Do not touch the metal terminals on the back side of the SD memory card. Doing so may cause malfunction or failure of the module.
- Do not touch the integrated circuits on the circuit board of an extended SRAM cassette or a batteryless option cassette. Doing so may cause malfunction or failure of the module.

[Startup and Maintenance Precautions]

⚠CAUTION

- Do not drop or apply shock to the battery to be installed in the module. Doing so may damage the battery, causing the battery fluid to leak inside the battery. If the battery is dropped or any shock is applied to it, dispose of it without using.
- Startup and maintenance of a control panel must be performed by qualified maintenance personnel with knowledge of protection against electric shock. Lock the control panel so that only qualified maintenance personnel can operate it.
- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Wearing a grounded antistatic wrist strap is recommended. Failure to discharge the static electricity may cause the module to fail or malfunction.
- After unpacking, eliminate static electricity from the module to prevent electrostatic discharge from affecting the module. If an electrostatically charged module comes in contact with a grounded metal object, a sudden electrostatic discharge of the module may cause failure.
  For details on how to eliminate static electricity from the module, refer to the following.
  Antistatic Precautions Before Using MELSEC iQ-R Series Products (FA-A-0368)
- Use a clean and dry cloth to wipe off dirt on the module.
- Before testing the operation, set a low speed value for the speed limit parameter so that the operation can be stopped immediately upon occurrence of a hazardous condition.
- Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- When using the absolute position system function, on starting up, and when the module or absolute position motor has been replaced, always perform a home position return.
- Before starting the operation, confirm the brake function.
- Do not perform a megger test (insulation resistance measurement) during inspection.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detection function is correct.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.

[Operating Precautions]

⚠CAUTION

- When changing data and operating status, and modifying program of the running programmable controller from an external device such as a personal computer connected to an intelligent function module, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.
- Do not power off the programmable controller or reset the CPU module while the setting values in the buffer memory are being written to the flash ROM in the module. Doing so will make the data in the flash ROM and SD memory card undefined. The values need to be set in the buffer memory and written to the flash ROM and SD memory card again. Doing so can cause malfunction or failure of the module.
- Note that when the reference axis speed is specified for interpolation operation, the speed of the partner axis (2nd, 3rd, or 4th axis) may exceed the speed limit value.
- Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

[Computer Connection Precautions]

⚠CAUTION

- When connecting a personal computer to a module having a USB interface, observe the following precautions as well as the instructions described in the manual for the personal computer used. Failure to do so may cause the module to fail.
  (1) When the personal computer is AC-powered
  When the personal computer has a 3-pin AC plug or an AC plug with a grounding wire, connect the plug to a grounding receptacle or ground the grounding wire. Ground the personal computer and the module with a ground resistance of 100 ohms or less.
  When the personal computer has a 2-pin AC plug without a grounding wire, connect the computer to the module by following the procedure below. For power supplied to the personal computer and the module, using the same power source is recommended.
  1. Unplug the personal computer from the AC receptacle.
  2. Check that the personal computer is unplugged. Then, connect the personal computer to the module with a USB cable.
  3. Plug the personal computer into the AC receptacle.
  (2) When the personal computer is battery-powered
  The personal computer can be connected to the module without taking specific measures.
  For details, refer to the following.
  Cautions When Using Mitsubishi Electric Programmable Controllers or GOTs Connected to a Personal Computer With the RS-232/USB Interface (FA-A-0298)
  When the USB cable used is the GT09-C30USB-5P manufactured by Mitsubishi Electric, specific measures are not required to connect the AC-powered personal computer to the module. However, note that the signal ground (SG) is common for the module and its USB interface. Therefore, if an SG potential difference occurs between the module and the connected devices, it causes failures of the module and the connected devices.

[Disposal Precautions]

⚠CAUTION

- When disposing of this product, treat it as industrial waste.
- When disposing of batteries, separate them from other wastes according to the local regulations. For details on battery regulations in EU member states, refer to the MELSEC iQ-R Module Configuration Manual.

[Transportation Precautions]

⚠CAUTION

- When transporting lithium batteries, follow the transportation regulations. For details on the regulated models, refer to the MELSEC iQ-R Module Configuration Manual.
- The halogens (such as fluorine, chlorine, bromine, and iodine), which are contained in a fumigant used for disinfection and pest control of wood packaging materials, may cause failure of the product. Prevent the entry of fumigant residues into the product or consider other methods (such as heat treatment) instead of fumigation. The disinfection and pest control measures must be applied to unprocessed raw wood.

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC iQ-R series programmable controllers.
This manual describes the functions and programming of the relevant products listed below. Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC iQ-R series programmable controller to handle the product correctly.
When applying the program examples provided in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.
Please make sure that the end users read this manual.

Relevant products

RD78G4, RD78G8, RD78G16

Point

Symbols used in this manual are shown below.
A serial No. is inserted in the "**" mark.

- [Pr.**]: Symbols indicating positioning parameter or home position return parameter items
- [Da.**]: Symbols indicating positioning data or block start data items
- [Md.**]: Symbols indicating monitor data items
- [Cd.**]: Symbols indicating control data items

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

Method of ensuring compliance

To ensure that Mitsubishi programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.
MELSEC iQ-R Module Configuration Manual
Safety Guidelines (IB-0800525)
The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

Additional measures

To ensure that this product maintains EMC and Low Voltage Directives, please refer to one of the following manuals.
MELSEC iQ-R Module Configuration Manual
Safety Guidelines (IB-0800525)

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RELEVANT MANUALS

The following manuals are relevant to this product.

Manual name [manual number]	Description
MELSEC iQ-R Motion Module User's Manual (Application for Simple Motion Mode) [IB-0300572ENG] (this manual)	Functions, I/O signals, buffer memory, parameter settings, programming, and troubleshooting of the Simple Motion mode
MELSEC iQ-R Motion Module User's Manual (Startup) [IB-0300406ENG]	Specifications, procedures before operation, system configuration, and wiring of the Motion module
MELSEC iQ-R Motion Module User's Manual (Network) [IB-0300426ENG]	Functions, parameter settings, troubleshooting, and buffer memory of CC-Link IE TSN
MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode) [IB-0300575ENG]	Functions and programming for the synchronous control of the Simple Motion mode
MELSEC iQ-R Motion Module (Simple Motion Mode) Function Block Reference [BCN-B62005-1040]	Specifications, functions, and I/O labels of the function blocks of the Motion module (Simple Motion module)

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
16-axis module	Another term for RD78G16.
4-axis module	Another term for RD78G4.
8-axis module	Another term for RD78G8.
Axis	A target for motion control.
Buffer memory	A memory in an intelligent function module, where data (such as setting values and monitoring values) are stored.
CC-Link IE TSN	An open network that uses "TSN (Time-Sensitive Networking)", which is an extension of the Ethernet standard, to ensure real-time control and handle information from other open networks simultaneously.
CC-Link IE TSN Class	A group of devices and industrial switches with CC-Link IE TSN, classified according to the functions and performance by the CC-Link Partner Association. For CC-Link IE TSN Class, refer to the CC-Link IE TSN Installation Manual (BAP-C3007ENG-001) published by the CC-Link Partner Association.
Command generation axis	An axis that performs only command generation. "Command generation axis" is not included in the number of controlled axes of the controller.
Cyclic transmission	A function by which data is periodically exchanged among stations on the network.
Dedicated instruction	An instruction for using functions of the module.
Device	Various types of memory in a module. Some devices are handled in units of bits and some in units of words.
Disconnection	A process of stopping data link if a data link error occurs.
Global label	A label that is enabled for all program data when creating multiple program data in the project. The global label in the motion system can be made public as the module label (global label) in the control CPU module.
GX Works3	The product name of the software package for the MELSEC programmable controllers.
Industrial switch (for CC-Link IE TSN Class B)	A CC-Link IE TSN Class B industrial switch certified by the CC-Link Partner Association.
Intelligent function module	A module that has functions other than input and output, such as an A/D converter module and D/A converter module.
Label	A variable used in a program.
Link device	A device in a module on CC-Link IE TSN.
Local station	A station that performs cyclic transmission and transient transmission with the master station and other local stations.
Master station	A station that controls the entire network. This station can perform cyclic transmission and transient transmission with all stations. Only one master station can be used in a network.
Module label	A label that represents one of memory areas (I/O signals and buffer memory areas) specific to each module in a given character string. From the module used, GX Works3 automatically generates this label, which can be used as a global label in the CPU module.
Motion control FB	FB related to motion control whose name begins with MC_ or MCv_.
Motion control station	A device station that exchanges cyclic data by using device labels and the motion control.
Motion module	Another term for RD78G.
MR Configurator2	The product name of the setup software for the servo amplifier.
MR-J5-G	Servo amplifier model MR-J5-_G_(-RJ).
MR-J5D-G	Servo amplifier model MR-J5D_-_G_.
MR-J5W-G	Servo amplifier model MR-J5W_-_G.
MR-JET-G	Servo amplifier model MR-JET-_G.
Object	Various data held by the CANopen-compatible device station.
RD78G	Another term for the MELSEC iQ-R series Motion module (compatible with CC-Link IE TSN).
Reconnection	A process of restarting data link when a faulty station recovers from an error.
Safety communications	A function to exchange safety data between safety stations on the same network.
Servo amplifier axis	A servo amplifier or virtual servo amplifier controlled by a controller. "Servo amplifier axis" is included in the number of controlled axes of the controller.
Servo network	A network between the Motion module and drive unit. • CC-Link IE TSN
Standard station	A device station other than a motion control station.

Term	Description
Transient transmission	A function of non-periodic data communication among nodes (station) on network. A function used to send message to the target station when requested by a link dedicated instruction or the engineering tool. Communication is available with station on another network via relay station, or gateway.
Unicast mode	A communication mode used to send cyclic data to one station.

GENERIC TERMS AND ABBREVIATIONS

Unless otherwise specified, this manual uses the following generic terms and abbreviations.

Generic term/abbreviation	Description
CC-Link IE	A generic term for the following: • CC-Link IE TSN • CC-Link IE Controller Network (MELSEC iQ-R CC-Link IE Controller Network User's Manual (Application)) • CC-Link IE Field Network (MELSEC iQ-R CC-Link IE Field Network User's Manual (Application))
CPU module	An abbreviation for the MELSEC iQ-R series CPU module.
csp	An abbreviation for the cyclic synchronous position mode (one of the control modes on the driver side).
cst	An abbreviation for the cyclic synchronous torque mode (one of the control modes on the driver side).
csv	An abbreviation for the cyclic synchronous velocity mode (one of the control modes on the driver side).
ct	An abbreviation for the continuous operation to torque control mode (one of the control modes on the driver side).
Data link	A generic term for a cyclic transmission and a transient transmission.
Device station	A generic term for a local station and remote station on CC-Link IE TSN.
Drive unit	A generic term for motor drive devices, such as servo amplifiers.
Engineering tool	A generic term for GX Works3 and MR Configurator2.
FB	An abbreviation for function blocks. A graphical programming language for programmable controllers that is one of the five languages defined in the IEC 61131-3 standard.
GOT	A generic term for the Mitsubishi Electric GOTs (GOT1000, GOT2000 series).
High-speed counter module	An abbreviation for the MELSEC iQ-R series high-speed counter module.
hm	An abbreviation for the homing mode (one of the control modes on the driver side).
Manual pulse generator	An abbreviation for a (user-arranged) manual pulse generator.
Motion system	A generic term for software that performs the motion control and the network control.
MR-J5(W)-G	A generic term for MR-J5-_G_(-RJ)/MR-J5W_-_G/MR-J5D_-_G_ servo amplifiers.
PDO	An abbreviation for Process Data Object. A collection of the application objects transmitted periodically between multiple CANopen nodes.
RWr	An abbreviation for a remote register of the link device. This refers to 16-bit (1-word) data input from a device station to the master station. (Not applicable for some local stations.)
RWw	An abbreviation for a remote register of the link device. This refers to 16-bit (1-word) data output from the master station to a device station. (Not applicable for some local stations.)
RX	An abbreviation for remote input of the link device. This refers to bit data input from a device station to the master station. (Not applicable for some local stations.)
RY	An abbreviation for remote output of the link device. This refers to bit data output from the master station to a device station. (Not applicable for some local stations.)
Safety CPU	A generic term for R08SFCPU, R16SFCPU, R32SFCPU, and R120SFCPU.
Safety station	A generic term for a station that performs safety communications and standard communications.
SDO	An abbreviation for Service Data Object. A message used to access the object entries inside the object dictionary of an optional CANopen node. Used for non-periodic transmission between stations.
SLMP	An abbreviation for Seamless Message Protocol. It is a protocol to access SLMP compatible devices from external devices such as personal computers and display devices, as well as from SLMP compatible modules (such as Ethernet-equipped modules or CC-Link IE TSN modules).
Software	A generic term for a firmware which configures the motion system. It consists of add-ons, baseSystem software, and boot software.

1 START AND STOP

This chapter describes start and stop methods of the positioning control for the Motion module.

1.1 Start

The Motion module operates the start trigger for each control, and starts the positioning control. The following table shows the start signals for each control. This section describes the start using positioning start signals and external command signals.

Control details		Start trigger
Major positioning control		• Turns ON the positioning start signal [Y10 to Y1F].*1 • Turns ON the external command signal (DI).
High-level positioning control		
Home position return control		
Manual control	JOG operation	Turns ON "[Cd.181] Forward run JOG start signal" or "[Cd.182] Reverse run JOG start signal".
	Inching operation	
	Manual pulse generator operation	Operates the manual pulse generator.

*1 The positioning start signal, whose axis No. exceeds the number of controlled axes, cannot be used.

In the control other than the manual control, the following start methods can be selected.

- Normal Start (☞ Page 146 Block start)
- Multiple axes simultaneous start (☞ Page 26 Multiple axes simultaneous start)

The positioning data, block start data, and condition data are used for the position specified at the control. The data that can be used varies depending on the start method.

Servo ON conditions

Setting of servo parameter

↓

PLC READY [Y0] ON

↓

All axis servo ON [Y1] ON

Starting conditions

To start the control, the following conditions must be satisfied.

The necessary start conditions must be incorporated in the program so that the control is not started when the conditions are not satisfied.

- Operation state

n: Axis No. - 1

Monitor item		Operation state	Buffer memory address
			Axis 1 to axis 16
[Md.26]	Axis operation status	"0: Standby" or "1: Stopped"	2409+100n

• Signal state

Signal name		Signal state		Device
I/O signal	PLC READY signal	ON	CPU module preparation completed	Y0
	READY signal	ON	Preparation completed	X0
	All axis servo ON	ON	All axis servo ON	Y1
	Synchronization flag*1	ON	The buffer memory can be accessed.	X1
	Axis stop signal	OFF	Axis stop signal is OFF	[Cd.180] Axis stop
	M code ON signal	OFF	M code ON signal is OFF	[Md.31] Status: b12
	Error detection signal	OFF	There is no error	[Md.31] Status: b13
	BUSY signal	OFF	BUSY signal is OFF	X10 to X1F*2
	Start complete signal	OFF	Start complete signal is OFF	[Md.31] Status: b14
External signal	Forced stop input signal	ON	There is no forced stop input	—
	Stop signal	OFF	Stop signal is OFF	—
	Upper limit signal (FLS)	ON	Within limit range	—
	Lower limit signal (RLS)	ON	Within limit range	—

*1 The interlock must be provided so that the buffer memory is accessed after Synchronization flag [X1] turns on. When no interlock is provided, an unexpected value may be read or written.

*2 The BUSY signal, whose axis No. exceeds the number of controlled axes, cannot be used.

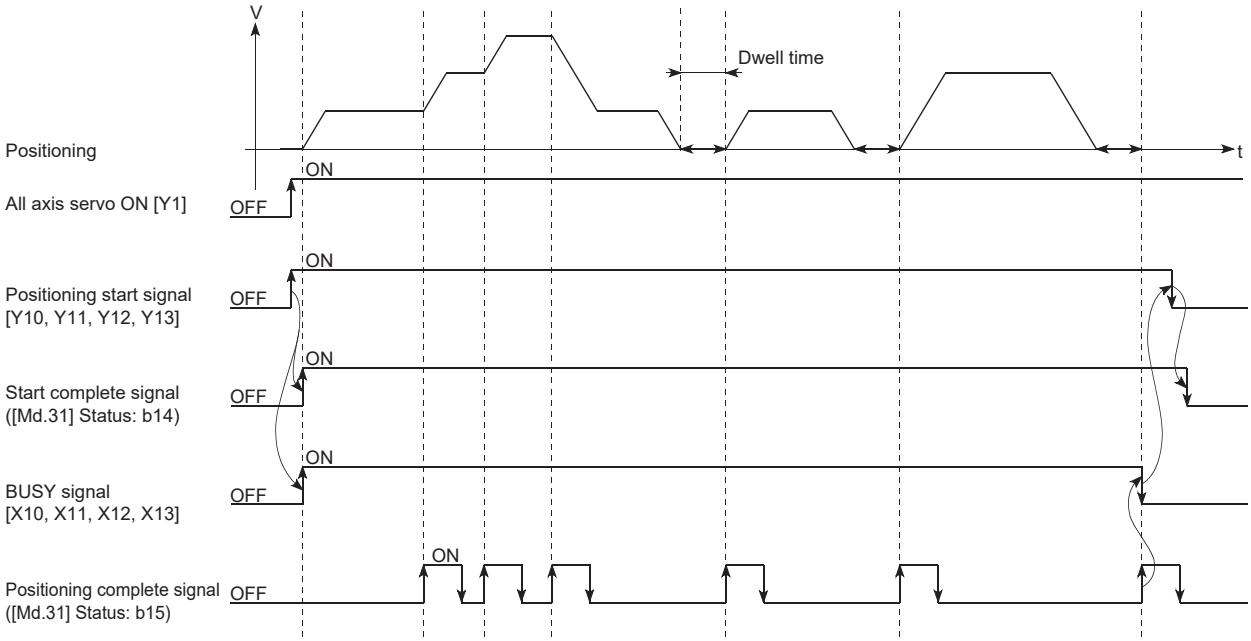
Start by the positioning start signal

The operation at starting by the positioning start signal is shown below.

- When the positioning start signal turns ON, the start complete signal ([Md.31] Status: b14) and BUSY signal turn ON, and the positioning operation starts. It can be seen that the axis is operating when the BUSY signal is ON.
- When the positioning start signal turns OFF, the start complete signal ([Md.31] Status: b14) also turns OFF. If the positioning start signal is ON even after positioning is completed, the start complete signal ([Md.31] Status: b14) will remain ON.
- If the positioning start signal turns ON again while the BUSY signal is ON, "Start during operation" (warning code: 0D00H) will occur.
- The process executed when the positioning operation is completed will differ by whether the next positioning control is executed.

Whether the next positioning control is executed	Processing details
Do not execute the positioning	• If dwell time is set, the system will wait for the set time to pass, and then positioning will be completed. • When positioning is completed, the BUSY signal will turn OFF and the positioning complete signal ([Md.31] Status: b15) will turn ON. However, when using speed control or when the positioning complete signal output time is "0", the signal will not turn ON. • When the time set in "[Pr.40] Positioning complete signal output time" is passed, the positioning complete signal ([Md.31] Status: b15) will turn OFF.
Execute the positioning	• If dwell time is set, the system will wait for the set time to pass. • When the set dwell time is passed, the next positioning will start.

■Operation example



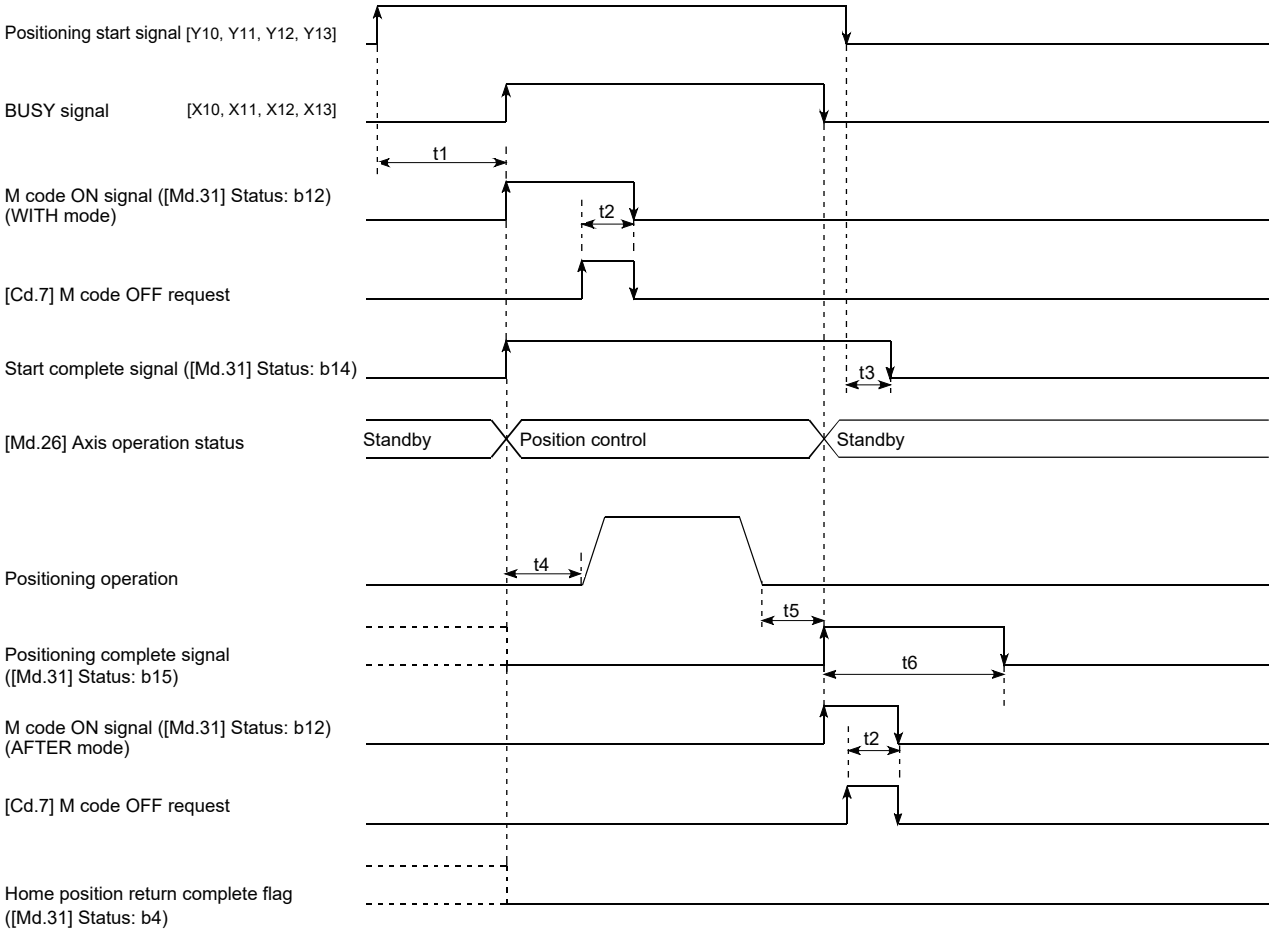
Point

The BUSY signal turns ON even when position control of movement amount 0 is executed. However, since the ON time is short, the ON status may not be detected in the program. (The ON status of the start complete signal ([Md.31] Status: b14), positioning complete signal ([Md.31] Status: b15) and M code ON signal ([Md.31] Status: b12) can be detected in the program.)

■Operation timing and processing time

The following shows details about the operation timing and time during position control.

• Operation example



Point

When the positioning start signal turns ON, if the "positioning complete signal" or "home position return complete flag" is already ON, the "positioning complete signal" or "home position return complete flag" will turn OFF when the positioning start signal turns ON.

• Normal timing time (Unit: [ms])

Operation cycle	t1*1	t2	t3	t4*2	t5	t6
0.25	0.25 to 0.69	0.00 to 0.25	0.00 to 0.25	0.80 to 0.90	0.00 to 0.25	Follows parameters
0.50	0.38 to 0.84	0.00 to 0.50	0.00 to 0.50	1.50 to 1.60	0.00 to 0.50	Follows parameters
1.00	0.60 to 1.50	0.00 to 1.00	0.00 to 1.00	3.00 to 3.10	0.00 to 1.00	Follows parameters
2.00	0.74 to 2.60	0.00 to 2.00	0.00 to 2.00	6.40 to 6.60	0.00 to 2.00	Follows parameters
4.00	0.77 to 4.50	0.00 to 4.00	0.00 to 4.00	13.50 to 13.70	0.00 to 4.00	Follows parameters

*1 The t1 timing time could be delayed by the operation state of other axes.

*2 The t4 timing time depends on the setting of the acceleration time, servo parameter, etc.

Start by the external command signal (DI)

When starting positioning control by inputting the external command signal (DI), the start command from the drive module or the start command from the link device can be directly input into the Motion module.

■Advance setting

Set the following data in advance.

• When using the start command from the drive unit

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.42]	External command function selection	0	Set to "0: External positioning start".	62+150n
[Pr.95]	External command signal selection	0	Set the external command signal (DI).	69+150n

Set the external command signal (DI) to be used in "[Pr.95] External command signal selection".

For details of the setting, refer to the following.

☞ Page 448 Basic Setting

• When using the start command from the link device

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.95]	External command signal selection	900	Set "900: Link device".	69+150n

Start signal	Relevant parameter	Positioning number to be started
External command signal (external positioning start)	[Pr.950] to [Pr.953]	The number set in "[Cd.3] Positioning start No."
External command signal (block No.7000 start)	[Pr.1020] to [Pr.1023]	7000
External command signal (block No.7001 start)	[Pr.1030] to [Pr.1033]	7001
External command signal (block No.7002 start)	[Pr.1040] to [Pr.1043]	7002
External command signal (block No.7003 start)	[Pr.1050] to [Pr.1053]	7003
External command signal (block No.7004 start)	[Pr.1060] to [Pr.1063]	7004

When the start command from the link device (block No.7000 to 7004) is executed, the block No. (7000 to 7004) is set in "[Cd.3] Positioning start No." by the Motion module.

Do not overwrite in "[Cd.3] Positioning start No." until the analysis is completed and the operation is started.

Refer to the following for details on the setting method.

☞ Page 325 Link Device External Signal Assignment Function

■Start method

Set "[Cd.3] Positioning start No." and enable "[Cd.8] External command valid" with a program. Then, turn ON the external command signal (DI).

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.3]	Positioning start No.	1 to 600	Set the positioning data No. to be started.	4300+100n
[Cd.8]	External command valid	1	Set to "1: Validates an external command.".	4305+100n

For details of the setting, refer to the following.

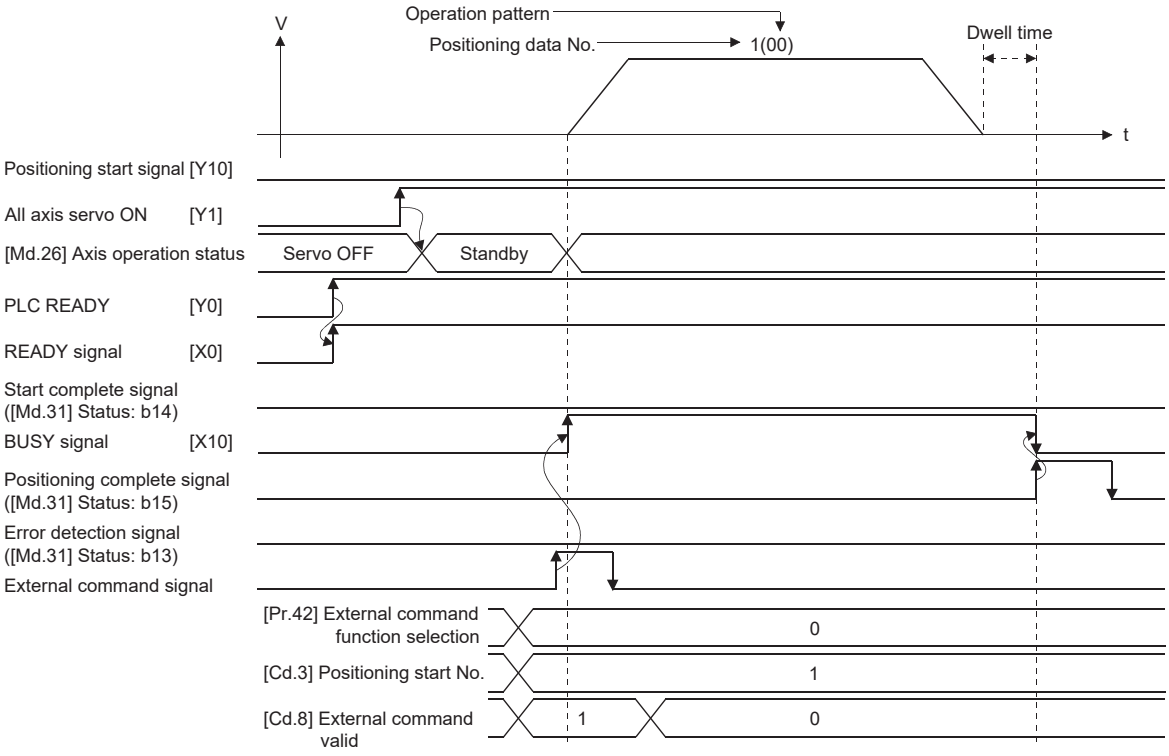
☞ Page 550 Control Data

■Restriction

When starting by inputting the external command signal (DI), the start complete signal ([Md.31] Status: b14) will not turn ON.

■Starting time chart

• Operation example



Multiple axes simultaneous start

The "multiple axes simultaneous start" starts outputting the command to the specified simultaneous starting axis at the same timing as the started axis. The maximum of four axes can be started simultaneously.

Control details

The multiple axes simultaneous start control is carried out by setting the simultaneous start setting data to the multiple axes simultaneous start control buffer memory of the axis control data, "9004" to "[Cd.3] Positioning start No." of the start axis, and then turning ON the positioning start signal.

Set the number of axes to be started simultaneously and axis No. in "[Cd.43] Simultaneous starting axis", and the start data No. of simultaneous starting axis (positioning data No. to be started simultaneously for each axis) in "[Cd.30] Simultaneous starting own axis start data No." and "[Cd.31] Simultaneous starting axis start data No.1" to "[Cd.33] Simultaneous starting axis start data No.3".

Restriction

- "Error before simultaneous start" (error code: 1A90H, 1A91H) will occur and all simultaneous starting axes will not start if the simultaneous starting axis start data No. in the axis control data of the started axis is not set, or is set outside the setting range.
- "Error before simultaneous start" (error code: 1A90H, 1A91H) will occur and all simultaneous starting axes will not start if either of the simultaneous starting axes is BUSY.
- "Error before simultaneous start" (error code: 1A90H, 1A91H) will occur and all simultaneous starting axes will not start if an error occurs during the analysis on the positioning data of the simultaneous starting axis.
- No error or warning will occur if only the start axis is the simultaneous starting axis.
- This function cannot be used with the sub function. (☞ Page 273 Pre-reading start function)

Procedure

The procedure for multiple axes simultaneous start control is shown below.

1. Set the following axis control data.

- [Cd.43] Simultaneous starting axis
- [Cd.30] Simultaneous starting own axis start data No.
- [Cd.31] Simultaneous starting axis start data No.1
- [Cd.32] Simultaneous starting axis start data No.2
- [Cd.33] Simultaneous starting axis start data No.3

2. Write "9004" in "[Cd. 3] Positioning start No.".

3. Turn ON the positioning start signal to be started.

Setting method

The following shows the setting of the data used to execute the multiple axes simultaneous start control with positioning start signals (The axis control data on the start axis is set).

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.3]	Positioning start No.	9004	Set the multiple axes simultaneous start control start No. "9004".	4300+100n
[Cd.43]	Simultaneous starting axis	Set the number of simultaneous starting axes and target axis.		4368+100n 4369+100n

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.30]	Simultaneous starting own axis start data No.	Set the simultaneous starting axis start data No. Set a "0" for the axis other than the simultaneous starting axes.		4340+100n
[Cd.31]	Simultaneous starting axis start data No.1			4341+100n
[Cd.32]	Simultaneous starting axis start data No.2			4342+100n
[Cd.33]	Simultaneous starting axis start data No.3			4343+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

Setting examples

The following shows the setting examples in which the axis 10 is used as the start axis and the axis 12 and axis 14 are used as the simultaneous starting axes.

Setting item		Setting value	Setting details	Buffer memory address (Axis 10)
[Cd.3]	Positioning start No.	9004	Set the multiple axes simultaneous start control start No. "9004".	5200
[Cd.43]	Simultaneous starting axis	03000D0BH	Set the axis 12 (0BH) to the simultaneous starting axis No.1, and the axis 14 (0DH) to the simultaneous starting axis No.2.	5268, 5269
[Cd.30]	Simultaneous starting own axis start data No.	100	The axis 10 starts the positioning data No.100.	5240
[Cd.31]	Simultaneous starting axis start data No.1	200	Immediately after the start of the axis 10, the axis 12 starts the axis 12 positioning data No.200.	5241
[Cd.32]	Simultaneous starting axis start data No.2	300	Immediately after the start of the axis 10, the axis 14 starts the axis 14 positioning data No.300.	5242
[Cd.33]	Simultaneous starting axis start data No.3	0	Will not start simultaneously.	5243

Point

The "multiple axes simultaneous start control" carries out an operation equivalent to the "simultaneous start" using the "block start data".

The setting of the "multiple axes simultaneous start control" is easier than that of the "simultaneous start" using the "block start data".

- Setting items for "simultaneous start" using "block start data": Positioning start data, block start data, condition data, and positioning data
- Setting items for "multiple axes simultaneous start control": Positioning data and axis control data

1.2 Stop

The axis stop signal or stop signal from external input signal is used to stop the control.

Create a program to turn ON the axis stop signal [Cd.180] as the stop program.

Each control is stopped in the following cases.

- When each control is completed normally
- When the Servo READY signal is turned OFF
- When a CPU module error occurs
- When the PLC READY signal [Y0] is turned OFF
- When an error occurs in the Motion module
- When control is intentionally stopped (Stop signal from CPU module turned ON, "Stop signal" of external input signal turned ON, etc.)

The stop process for the above cases is shown below.

(Excluding when each control is completed normally.)

Refer to the following for the stop process during speed control mode and torque control mode.

☞ Page 196 Speed-torque Control

Refer to the following for the stop process during test mode operation.

☞ Page 388 Stop operation of the test mode operation axes

Stop process

Stop cause		Stop axis	M code ON signal after stop	Axis operation status after stopping ([Md.26])
Forced stop	Forced stop input to the Motion module	All axes	No change	Servo OFF
Forced stop	Servo READY OFF • Servo amplifier power supply OFF	Each axis	No change	Servo amplifier has not been connected
	• Servo alarm			Error
	• Forced stop input to servo amplifier			Servo OFF
Fatal stop (Stop group 1)	Hardware stroke limit upper/lower limit error occurrence	Each axis	No change	Error
Emergency stop (Stop group 2)	Error occurs in a CPU module	All axes	No change	Error
	PLC READY [Y0] OFF		Turns OFF	
Relatively safe stop (Stop group 3)	Axis error detection (Error other than stop group 1 or 2)*1	Each axis	No change	Error
Intentional stop (Stop group 3)	"Axis stop signal" ON from a CPU module*2	Each axis	No change	Stopped (Standby)

*1 If an error occurs in a positioning data due to an invalid setting value, when the continuous positioning control uses multiple positioning data successively, it automatically decelerates at the previous positioning data. It does not stop rapidly even the setting value is rapid stop in stop group 3. If any of the following error occurs, the operation is performed up to the positioning data immediately before the positioning data where an error occurred, and then stops immediately.
No command speed (error code: 1B13H, 1B14H)
Outside linear movement amount range (error code: 1B15H, 1B16H)
Large arc error deviation (error code: 1B17H)
Software stroke limit + (error code: 1B18H, 1B19H)
Software stroke limit - (error code: 1B1AH, 1B1BH)
Sub point setting error (error code: 1B27H, 1B28H, 1B29H, 1B2AH, 1B37H)
End point setting error (error code: 1B2BH, 1B2CH)
Center point setting error (error code: 1B2DH, 1B2EH, 1B2FH)
Outside radius range (error code: 1B32H)
Illegal setting of ABS direction in unit of degree (error code: 1AA4H, 1AA5H)

*2 It is recommended to control the stop signal after checking the condition while the axis is BUSY, such as incorporating the fact that the BUSY signal is ON as the interlock condition. "Stop signal ON at start" (error code: 1A08H) can be prevented depending on the timing.

Stop cause		Stop process					
		Home position return control		Major positioning control	High-level positioning control	Manual control	
		Machine home position return control[*1]	Fast home position return control			JOG/ Inching operation	Manual pulse generator operation
Forced stop	Forced stop input to the Motion module	Immediate stop For the stop method of the servo amplifier, refer to each servo amplifier manual.					—
Forced stop	Servo READY OFF • Servo amplifier power supply OFF						
	• Servo alarm						
	• Forced stop input to servo amplifier						
Fatal stop (Stop group 1)	Hardware stroke limit upper/lower limit error occurrence	Deceleration stop/rapid stop (Select with "[Pr.37] Stop group 1 rapid stop selection".)					Deceleration stop
Emergency stop (Stop group 2)	Error occurs in a CPU module	Deceleration stop/rapid stop (Select with "[Pr.38] Stop group 2 rapid stop selection".)					Deceleration stop
	PLC READY [Y0] OFF						
Relatively safe stop (Stop group 3)	Axis error detection (Error other than stop group 1 or 2)[*2]	Deceleration stop/rapid stop (Select with "[Pr.39] Stop group 3 rapid stop selection".)					Deceleration stop
Intentional stop (Stop group 3)	"Axis stop signal" ON from a CPU module[*3]						

*1 When using the driver homing method, the stop processing follows the specifications of the servo amplifier.
For details, refer to the manual of the servo amplifier to use.
MR-J5(W)-G: MR-J5 User's Manual (Function)

*2 If an error occurs in a positioning data due to an invalid setting value, when the continuous positioning control uses multiple positioning data successively, it automatically decelerates at the previous positioning data. It does not stop rapidly even the setting value is rapid stop in stop group 3. If any of the following error occurs, the operation is performed up to the positioning data immediately before the positioning data where an error occurred, and then stops immediately.
No command speed (error code: 1B13H, 1B14H)
Outside linear movement amount range (error code: 1B15H, 1B16H)
Large arc error deviation (error code: 1B17H)
Software stroke limit + (error code: 1B18H, 1B19H)
Software stroke limit - (error code: 1B1AH, 1B1BH)
Sub point setting error (error code: 1B27H, 1B28H, 1B29H, 1B2AH, 1B37H)
End point setting error (error code: 1B2BH, 1B2CH)
Center point setting error (error code: 1B2DH, 1B2EH, 1B2FH)
Outside radius range (error code: 1B32H)
Illegal setting of ABS direction in unit of degree (error code: 1AA4H, 1AA5H)

*3 It is recommended to control the stop signal after checking the condition while the axis is BUSY, such as incorporating the fact that the BUSY signal is ON as the interlock condition. "Stop signal ON at start" (error code: 1A08H) can be prevented depending on the timing.

Point

Provide the emergency stop circuits outside the servo system to prevent cases where danger may result from abnormal operation of the overall system in the event of an external power supply fault or servo system failure.

Types of stop processes

The operation can be stopped with deceleration stop, rapid stop or immediate stop.

■Deceleration stop

The operation stops with "deceleration time 0 to 3" ([Pr.10], [Pr.28], [Pr.29], [Pr.30]). Which time from "deceleration time 0 to 3" to use for control is set in positioning data ([Da.4]).

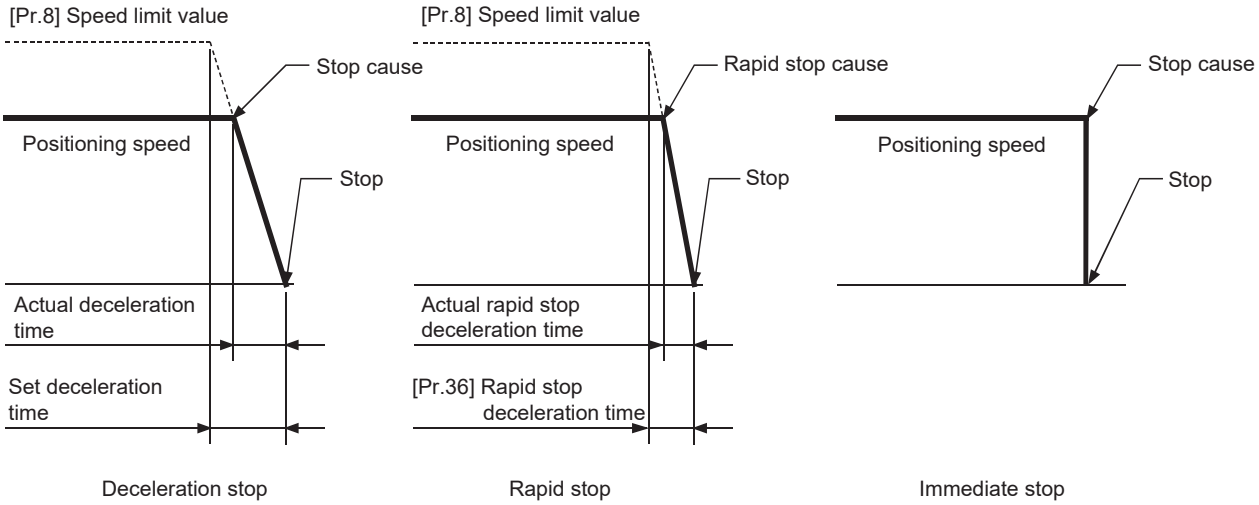
■Rapid stop

The operation stops with "[Pr.36] Rapid stop deceleration time".

■Immediate stop

The operation does not decelerate.

The Motion module immediately stops the command. For the stop method of the servo amplifier, refer to each servo amplifier manual.



Deceleration stop　　Rapid stop　　Immediate stop

Point

"Deceleration stop" and "rapid stop" are selected with the detailed parameter 2 "stop group 1 to 3 rapid stop selection". (The default setting is "deceleration stop".)

Order of priority for stop process

The order of priority for the Motion module stop process is as follows.

(Deceleration stop) < (Rapid stop) < (Immediate stop)

- If the deceleration stop command ON (stop signal ON) or deceleration stop cause occurs during deceleration to speed 0 (including automatic deceleration), operation changes depending on the setting of "[Cd.42] Stop command processing for deceleration stop selection". (☞ Page 277 Stop command processing for deceleration stop function)

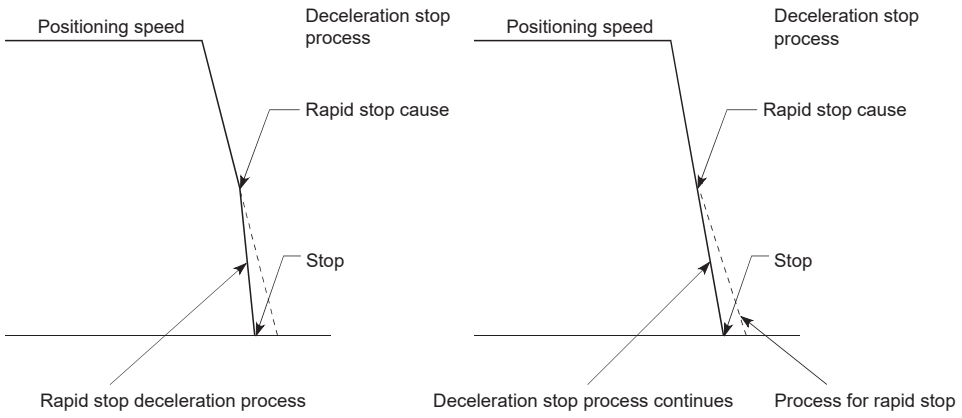
Positioning control during deceleration	Setting value of [Cd.42]	Processing details
Manual control	—	Independently of the [Cd.42] setting, a deceleration curve is re-processed from the speed at stop cause occurrence.
Home position return control*1, positioning control	0: Deceleration curve re-processing	A deceleration curve is re-processed from the speed at stop cause occurrence. (☞ Page 277 Deceleration curve re-processing)
	1: Deceleration curve continuation	The current deceleration curve is continued after stop cause occurrence. (☞ Page 277 Deceleration curve continuation)

*1 When using the driver homing method, the stop processing follows the specifications of the servo amplifier. For details, refer to the manual of the servo amplifier to use.
MR-J5(W)-G: 📖MR-J5 User's Manual (Function)

- If the stop signal designated for rapid stop turns ON or a stop cause occurs during deceleration, the rapid stop process will start from that point. However, if the rapid stop deceleration time is longer than the deceleration time, the deceleration stop process will be continued even if a rapid stop cause occurs during the deceleration stop process.

Example

The process when a rapid stop cause occurs during deceleration stop is shown below.



(a) When deceleration stop time > rapid stop deceleration time

(b) When deceleration stop time < rapid stop deceleration time

Inputting the stop signal during deceleration

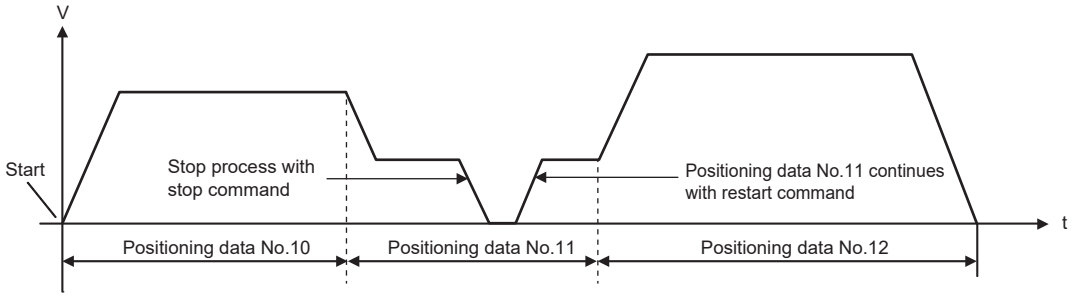
- Even if stop is input during deceleration (including automatic deceleration), the operation will stop at that deceleration speed.
- If stop is input during deceleration for home position return, the operation will stop at that deceleration speed. If input at the creep speed, the operation will stop immediately. When the driver home position return method is used, the stop process is performed according to the specification of the servo amplifier. For details, refer to the manual of the servo amplifier to be used. MR-J5(W)-G: 📖MR-J5 User's Manual (Function)
- If a stop cause, designated for rapid stop, occurs during deceleration, the rapid stop process will start from that point. The rapid stop process during deceleration is carried out only when the rapid stop time is shorter than the deceleration stop time.

1.3 Restart

When a stop factor occurs during position control and the operation stops, the positioning can be restarted from the stopped position to the position control end point by using the "restart command" ([Cd.6] Restart command). ("Restarting" is not possible when "continuous operation is interrupted.")
This instruction is efficient when performing the remaining positioning from the stopped position in the positioning control of incremental method such as INC linear 1. (Calculation of remaining distance is not required.)

Operation

After a deceleration stop by the stop command is completed, write "1: Restarts" to the "[Cd.6] Restart command" with "[Md.26] Axis operation status" is "stopped" and the positioning restarts.



Restriction

- Restarting can be executed only when "[Md.26] Axis operation status" is "stopped (the deceleration stop by stop command is completed)". If the axis operation is not "stopped", restarting is not possible. In this case, "Restart not possible" (warning code: 0D02H) will occur, and the process at that time will be continued.
- Do not execute restart while the stop command is ON. If restart is executed while stopped, "Stop signal ON at start" (error code: 1A08H) will occur, and "[Md.26] Axis operation status" will change to "Error". Thus, even if the error is reset, the operation cannot be restarted.
- Restarting can be executed even while the positioning start signal is ON. However, make sure that the positioning start signal does not change from OFF to ON while stopped.
- If the positioning start signal is changed from OFF to ON while "[Md.26] Axis operation status" is "stopped", the normal positioning (the positioning data set in "[Cd.3] Positioning start No.") is started.
- If positioning is ended with the continuous operation interrupt request, the operation cannot be restarted. If restart is requested, "Restart not possible" (warning code: 0D02H) will occur.
- When stopped with interpolation operation, write "1: Restarts" into "[Cd.6] Restart command" for the reference axis, and then restart.
- If PLC READY [Y0] is changed from OFF to ON while stopped, restarting is not possible. If restart is requested, "Restart not possible" (warning code: 0D02H) will occur.
- When the machine home position return and fast home position return is stopped, "Home position return restart not possible" (error code: 1A46H) will occur and the positioning cannot restart.
- If any of interpolation partner axes executes the positioning operation once after interpolation operation stop, "Restart not possible" (warning code: 0D02H) will occur and the positioning cannot restart.

Setting method

Set the following data to execute restart.

n: Axis No. - 1

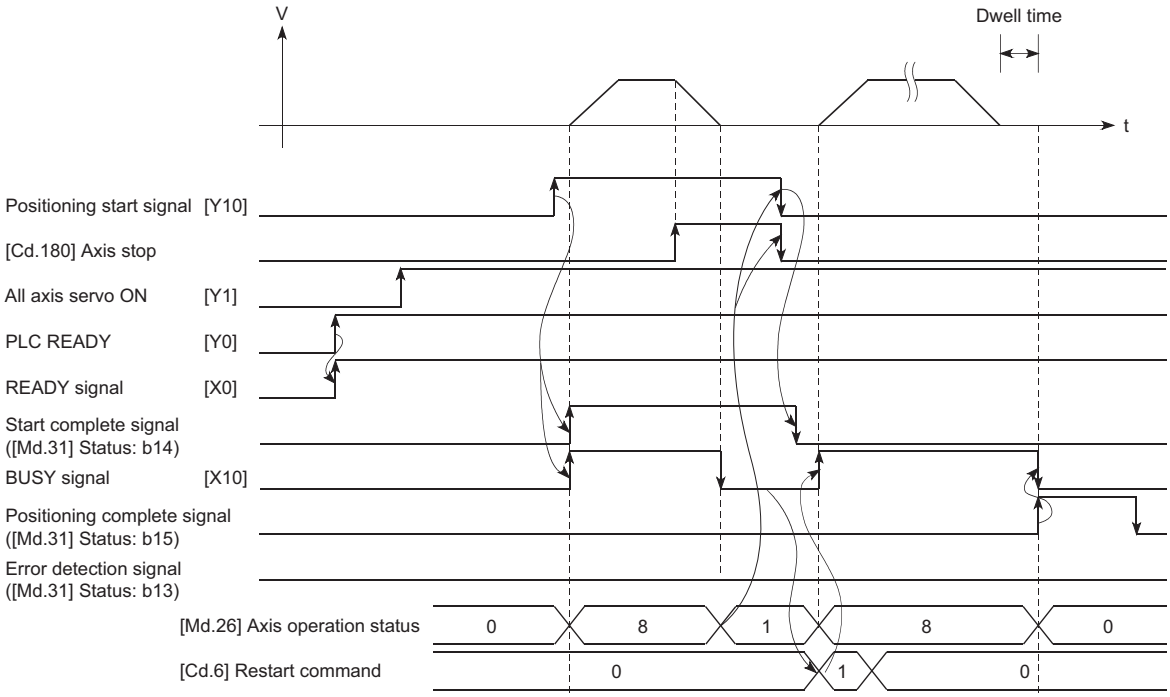
Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.6]	Restart command	1	Set "1: Restarts".	4303+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

Time chart for restarting

■Operation example



Program example

Refer to the following for the program example of restart.

☞ Page 636 Restart program

2 HOME POSITION RETURN CONTROL

The details and usage of "home position return control" are explained in this chapter.

2.1 Outline of Home Position Return Control

Two types of home position return control

In "home position return control", a position is established as the starting (or "home position") when carrying out positioning control, and positioning is carried out toward that starting point.
It is used to return a machine system at any position other than the home position to the home position when the Motion module issues a "home position return request" with the power turned ON or others, or after a positioning stop.
In the Motion module, the following two control types are defined as "home position return control", following the flow of the home position return. These two types of home position return control can be executed by setting the "home position return parameters", setting "Positioning start No.9001" and "positioning start No.9002" prepared beforehand in the Motion module to "[Cd.3] Positioning start No.", and turning ON the positioning start signal.

Home position return method	Home position return method operation details
Machine home position return (positioning start No.9001)	Executes the home position return operation to establish a machine home position. The following positioning control is executed based on the home position established by the home position return completion. The machine home position return is required when the machine home position has not been established (the current value monitor of the Motion module and the actual machine position are not matched) due to the power supply ON of the system, etc.
Fast home position return (positioning start No.9002)	Executes the positioning to the home position established by a machine home position return. The fast home position return is operated by specifying the positioning start No.9002, so that the positioning which returns to the home position can be executed without setting the positioning data.

The "machine home position return" above must be carried out in advance to execute the "fast home position return".

⚠CAUTION

- When using an absolute position system, execute a home position return always at the following cases: on starting up and when the controller or absolute position motor has been replaced. Check the home position return request signal using the program, etc. before performing the positioning control. Failure to observe this could lead to an accident such as a collision.

The address information stored in the Motion module cannot be guaranteed while the "home position return request flag" is ON.
The "home position return request flag" turns OFF and the "home position return complete flag" ([Md.31] Status: b4) turns ON if the machine home position return is executed and is completed normally.
The "home position return request flag" ([Md.31] Status: b3) must be turned ON in the Motion module, and a machine home position return must be executed in the following cases.

When not using an absolute position system

- This flag turns on in the following cases:

  - System's power supply on or reset
  - Servo amplifier power supply on
  - Machine home position return start (Unless a machine home position return is completed normally, the home position return request flag does not turn off.)
  - When "Electronic gear numerator (PA06)", "Electronic gear denominator (PA07)", "Linear encoder resolution setting - Numerator (PL02)", or "Linear encoder resolution setting - Denominator (PL03)" of the servo amplifier is changed
  - When the drive unit object "HomeOffset (607CH)" is changed

- This flag turns off by the completion of machine home position return.

When using an absolute position system

• This flag turns on in the following cases:

- When not executing a machine home position return even once after the system starts
- Machine home position return start (Unless a machine home position return is completed normally, the home position return request flag does not turn off.)
- When an absolute position data in the Motion module is erased due to a memory error, etc. (occurrence of "Home position return data incorrect" (warning code: 0D3CH))
- When the "Travel direction selection (PA14)" of servo parameter is changed
- The servo alarm "Absolute position erased" (alarm No.: 25) occurs. ([Md.108] Servo status1: b14 ON) (☞ Page 523 Axis monitor data)
- The servo warning "Absolute position counter warning" (warning No.: E3) occurs. ([Md.108] Servo status1: b14 ON) (☞ Page 523 Axis monitor data)
- When "Electronic gear numerator (PA06)", "Electronic gear denominator (PA07)", "Linear encoder resolution setting - Numerator (PL02)", or "Linear encoder resolution setting - Denominator (PL03)" of the servo amplifier is changed
- When the drive unit object "HomeOffset (607CH)" is changed
- When a change of the servo amplifier or motor encoder is detected
- When a virtual servo amplifier is connected and MR-J5(W)-G was not the servo amplifier connected at the previous home position establishment

• This flag turns off by the completion of machine home position return.

When a home position return is not required

Control can be carried out ignoring the "home position return request flag" ([Md.31] Status: b3) in systems that do not require a home position return.

In this case, the "home position return parameters ([Pr.43] to [Pr.55])" must all be set to their initial values or a value at which an error does not occur.

Wiring the proximity dog

When using the proximity dog signal, wire the signal terminals corresponding to the proximity dog of the device to be used as follows.

Refer to the following for how to set the input logic of the proximity dog signal.

☞ Page 318 Input logic setting method for external input signals

■External input signal of the servo amplifier

Refer to the manual of the servo amplifier to be used for details on signal input availability and wiring.

Refer to the following for settings of servo parameters when using the external input signal.

☞ Page 317 External Input Signal Select Function

■External input signal via CPU (buffer memory of the Motion module)

Refer to the manual of the input module to be used for wiring.

■Link device

Refer to the manual of the device station to be used for wiring.

Home position return sub functions

Refer to "Combination of Main Functions and Sub Functions" in the following manual for details on "sub functions" that can be combined with home position return control.

📖MELSEC iQ-R Motion Module User's Manual (Startup)

Also refer to the following for details on each sub function.

☞ Page 226 CONTROL SUB FUNCTIONS

[Remarks]

The following two sub functions are only related to machine home position return.

○: Combination possible, △: Restricted, ×: Combination not possible

Sub function name	Machine home position return	Fast home position return
Home position return retry function	△*1*2	×
Home position shift function	○*1	×

*1 When the driver home position return method is used, available functions depend on the specification of the servo amplifier. Confirm the specification of the servo amplifier.
For details, refer to the manual of the servo amplifier to use.
MR-J5(W)-G: 📖MR-J5 User's Manual (Function)

*2 The Motion module executes the home position return request to the servo amplifier regardless of the status of the proximity dog signal or workpiece position. Depending on the specification of the home position return performed with the servo amplifier, the workpiece may need to be moved before the proximity dog due to the positional relationship between them. Also, depending on the specification of the servo amplifier, the JOG operation cannot be used for moving the workpiece before the proximity dog. Confirm the specification of the servo amplifier for operation methods.

2.2 Machine Home Position Return

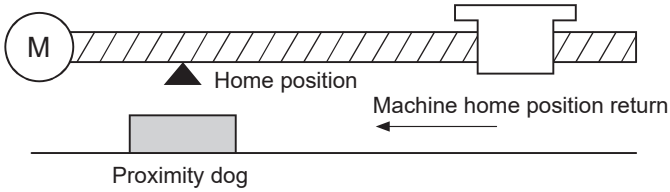
Outline of the machine home position return operation

Machine home position return operation

In a machine home position return, a home position is established.

None of the address information stored in the Motion module, CPU module, or servo amplifier is used at this time.

The position mechanically established after the machine home position return is regarded as the "home position" to be the starting point for positioning control.



Machine home position return method

The method by which the machine home position is established (method for judging the home position and machine home position return completion) is designated in the machine home position return according to the configuration and application of the positioning method.

The following table shows the methods that can be used for this home position return method. (The home position return method is one of the items set in the home position return parameters. It is set in "[Pr.43] Home position return method" of the basic parameters for home position return.)

[Pr.43] Home position return method	Operation details
Driver home position return method	The servo amplifier is switched to the home position return mode and the home position return set in the servo amplifier starts. After the home position return is completed, the servo amplifier is returned to the previous control mode.

The following shows the signals used for machine home position return.

[Pr.43] Home position return method	Signals required for control
Driver home position return method	• Proximity dog • Zero signal • Upper/lower limit Confirm to the home position return specification of the servo amplifier for the signals required for control.

Driver home position return method

The home position return is executed based on the positioning pattern set on the driver (servo amplifier) side (hereafter called the "driver side").

The following shows the procedure.

1. Set the home position return parameters of the servo amplifier.*1
2. The "machine home position return" is started.
3. The operation starts according to the speed and direction set in the servo amplifier.
4. The "home position" is established and the machine stops.
5. If "a" is set as "[Pr.45] Home position address", "a" will be stored as the current position in "[Md.20] Command position value" and "[Md.21] Machine feed value" which are monitoring the position.
6. The machine home position return is completed.

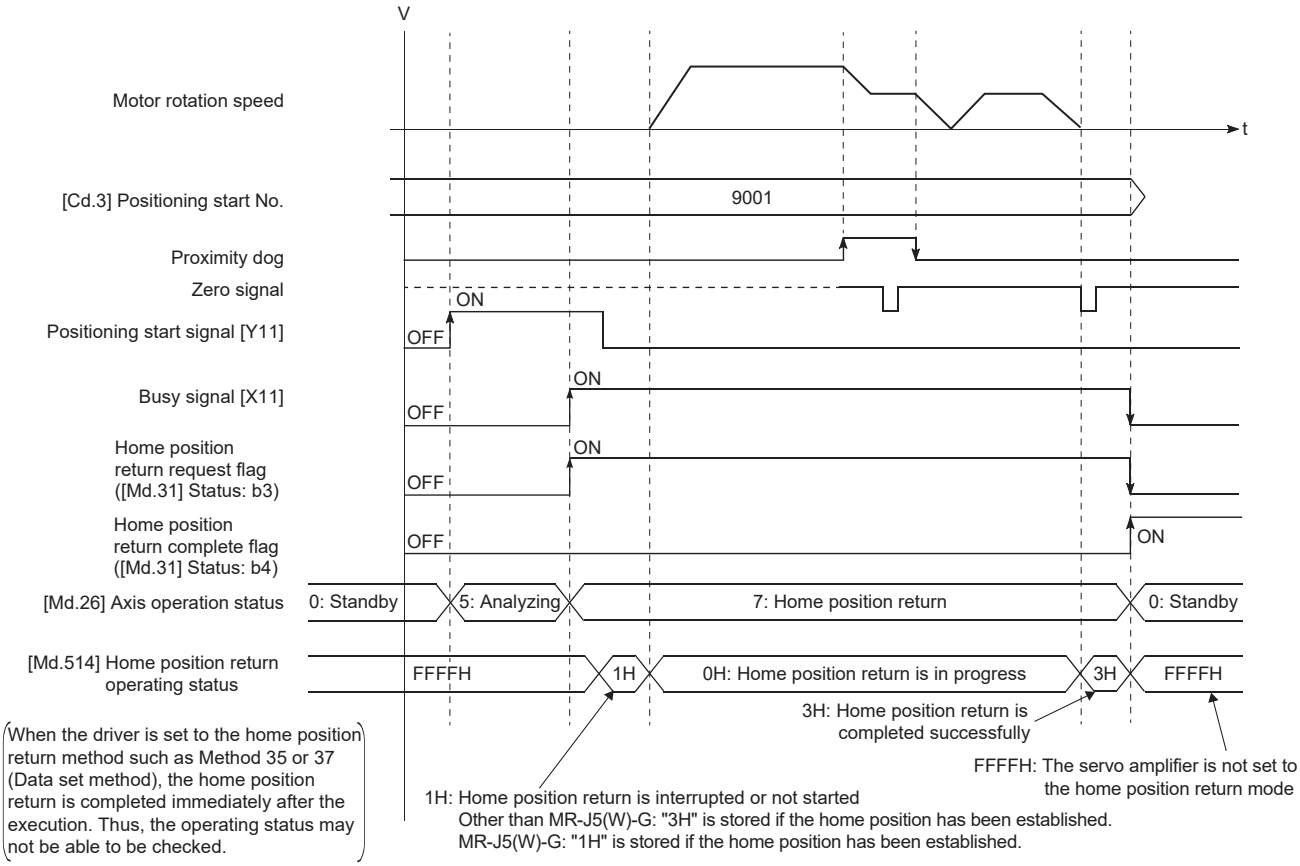
*1 Change the setting as necessary by using the servo transient transmission function. For the setting change method, refer to the manual of the servo amplifier.
MR-J5(W)-G: MR-J5-G/MR-J5W-G User's Manual (Parameters)

Point

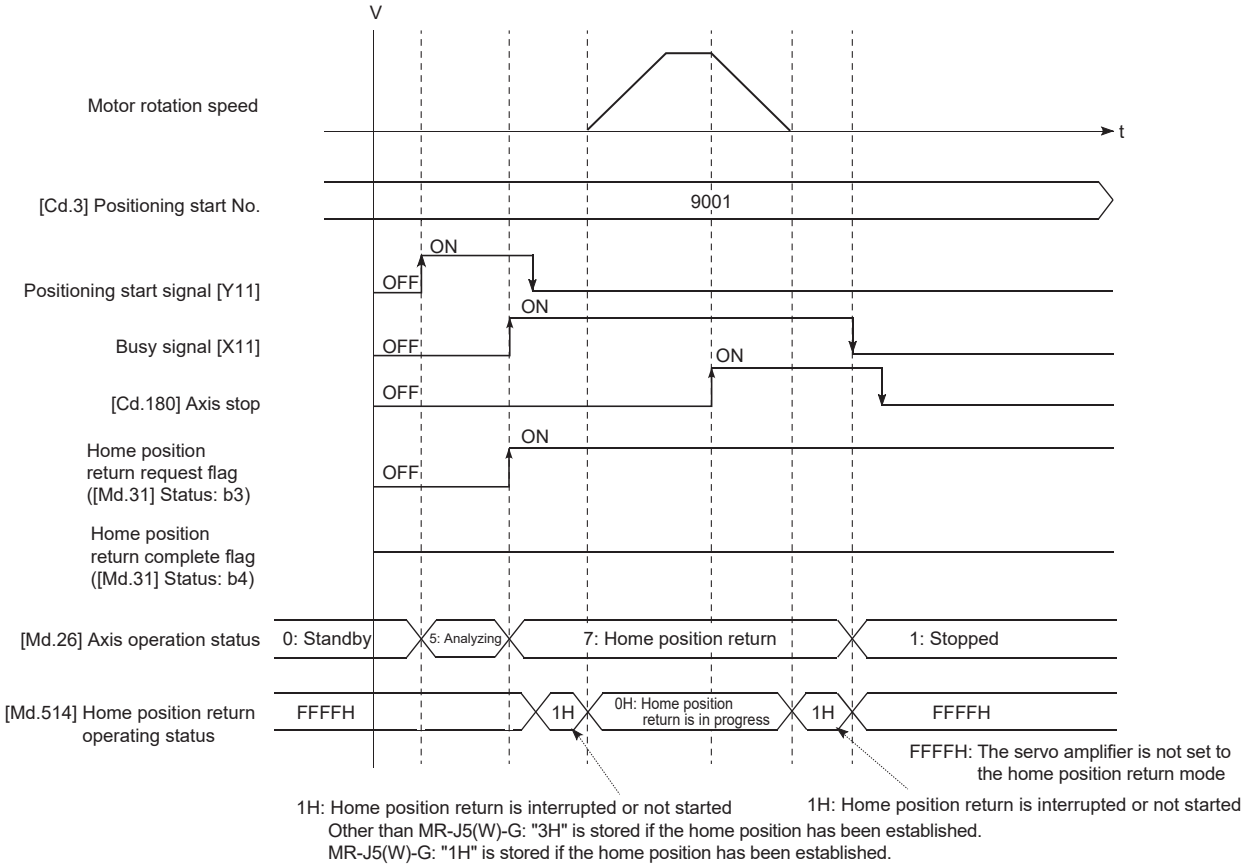
The method for establishing a "home position" by a driver home position return method differs according to the setting of the servo amplifier. For details, refer to the manual of the servo amplifier.

Operation chart

1. The machine home position return is started.
2. The command position value is continuously updated by follow up processing during the home position return.
3. The home position return complete flag ([Md.31] Status: b4) turns from OFF to ON and the home position return request flag ([Md.31] Status: b3) turns from ON to OFF.



When the machine home position return is stopped



Parameter setting required after the driver home position return method

Refer to the following.

☞ Page 420 Setting items for home position return parameters

Start of the driver home position return method

Set "9001" in "[Cd.3] Positioning start No.", and start the axis.

The control mode of the servo amplifier is set to "Home mode".

If Zero speed is not ON ([Md.119] Servo status 2: b3 is not ON) at start for the MR-J5(W)-G, the home position return operation does not start until Zero speed turns ON. Even in this case, "7: Home position return" is set in "[Md.26] Axis operation status".

When the home position return starts/completes and the control mode of the servo amplifier does not change within 1 second, "Control mode switching error" (error code: 1F04H) occurs.

Axis stop of the driver home position return method

When "[Cd.180] Axis stop" is turned ON during the home position return, the "HALT" signal is sent to the servo amplifier. If the servo amplifier which does not support the "HALT" signal is used, the axis is not stopped by this signal. Use the forced stop signal instead. Refer to the manual of the servo amplifier for support information on the HALT signal and forced stop signal.

The MR-J5(W)-G supports the HALT signal.

For MR-J5(W)-G: 📖MR-J5 User's Manual (Function)

Backlash compensation after the driver home position return method

When "[Pr.11] Backlash compensation amount" is set in the Motion module, whether the backlash compensation is necessary or not is judged from "[Pr.44] Home position return direction" of the Motion module in the axis operation such as positioning after the driver home position return. When the positioning is executed in the same direction as "[Pr.44] Home position return direction", the backlash compensation is not executed. However, when the positioning is executed in the reverse direction against "[Pr.44] Home position return direction", the backlash compensation is executed.
Note that the home position return is executed based on the home position return direction of the driver side parameter during the driver home position return. Therefore, set the same direction to "[Pr.44] Home position return direction" of the Motion module and the last home position return direction of the driver side.

Restrictions

- The home position return cannot be started with the Motion module during servo-off. Thus, the servo amplifier home position return method, Method 35 and 37 (Data set method), cannot be executed during servo-off.
- When the home position return is used during synchronous control, the output axis performs the following operations based on the type of the servo input axis.

[Pr.300] Servo input axis type	Output axis operation during synchronous control
1: Command position value 3: Servo command value	Continues synchronous control after home position return completion.
2: Actual position value 4: Feedback value	Synchronizes with the input axis until home position return completion, following which servo alarm "AL.031.1_Servo motor speed error" or "AL.035.1_Command frequency error" may occur and synchronous control may not be performed.

- If "[Pr.300] Servo input axis type" is set to "2: Actual position value" or "4: Feedback value" and "[Pr.301] Servo input axis smoothing time constant" or "[Pr.302] Servo input axis phase compensation advance time" is set to a value other than "0", "Input axis speed display over" (warning code: 0E42H) may occur.

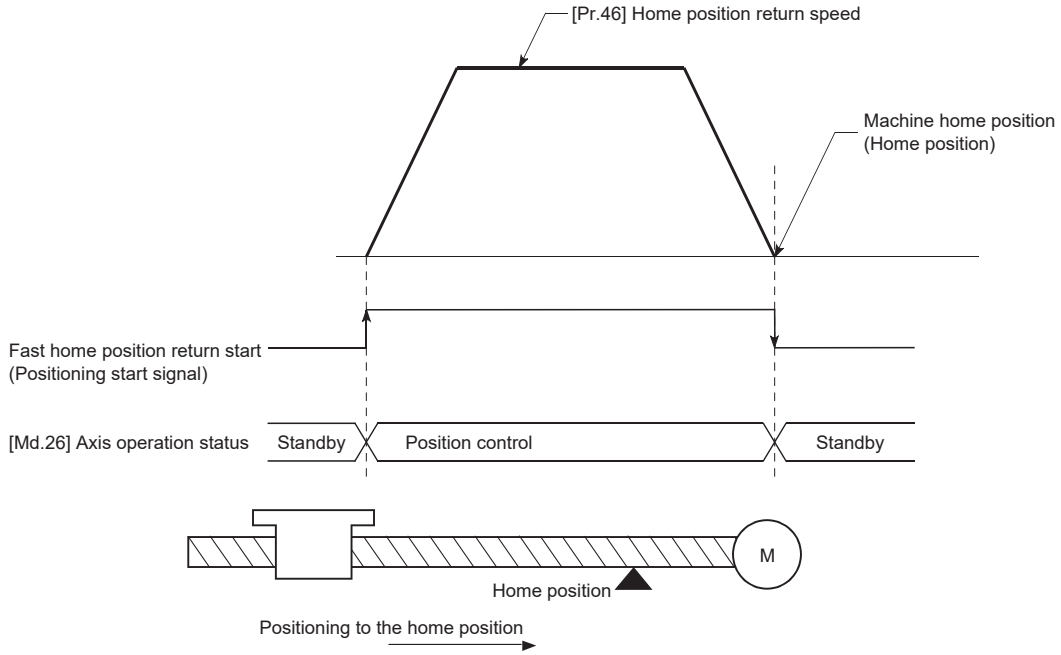
2.3 Fast Home Position Return

Outline of the fast home position return operation

Fast home position return operation

After establishing home position by a machine home position return, positioning control to the home position is executed without using a proximity dog or a zero signal.

The following shows the operation during a basic fast home position return start.

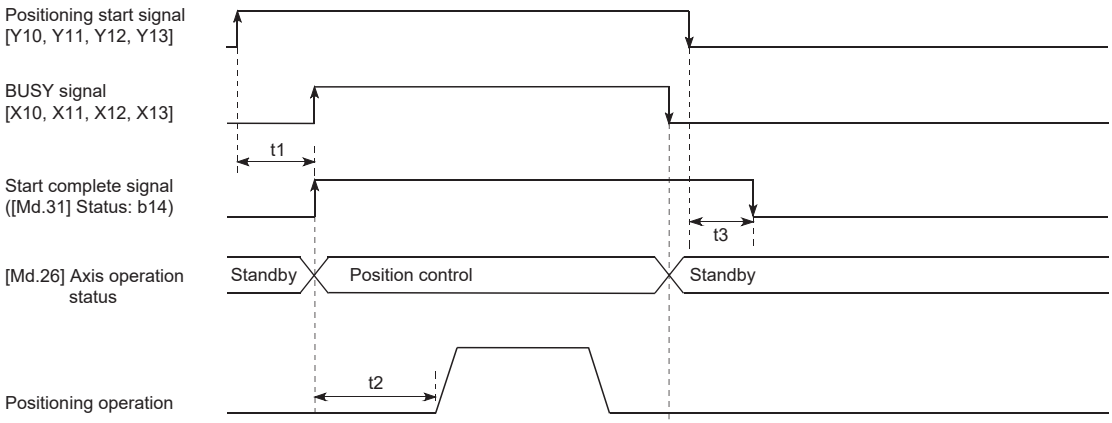


1. The fast home position return is started.
2. Positioning control to the home position established by a machine home position return begins at speed set in "[Pr.46] Home position return speed".
3. The fast home position return is completed.

Operation timing and processing time

The following shows details about the operation timing and time during fast home position return.

■Operation example



- Normal timing time (Unit: [ms])

Operation cycle	t1*1	t2*2	t3
0.25	0.25 to 0.69	1.12 to 1.54	0.00 to 0.25
0.50	0.38 to 0.84	1.57 to 1.61	0.00 to 0.50
1.00	0.60 to 1.50	3.58 to 3.84	0.00 to 1.00
2.00	0.74 to 2.60	7.56 to 7.59	0.00 to 2.00
4.00	0.77 to 4.50	14.81 to 15.33	0.00 to 4.00

*1 The t1 timing time could be delayed by the operation state of other axes.

*2 The t2 timing time depends on the setting of the acceleration time, servo parameter, etc.

Operating restrictions

- The fast home position return can only be executed after the home position is established by executing the machine home position return. If not, "Home position return request ON" (error code: 1A45H) will occur. (Home position return request flag ([Md.31] Status: b3) must be turned OFF).
- If the fraction pulse is cleared to zero using current value changing or fixed-feed control, execute the fast home position return and an error will occur by a cleared amount.
- When unlimited length feed is executed by speed control and the machine feed value overflows or underflows once, the fast home position return cannot be executed normally.
- The home position return complete flag ([Md.31] Status: b4) is not turned ON.
- The axis operation status during fast home position return is "in position control".

3 MAJOR POSITIONING CONTROL

The details and usage of the major positioning controls (control functions using the "positioning data") are explained in this chapter.

The major positioning controls include such controls as "positioning control" in which positioning is carried out to a designated position using the address information, "speed control" in which a rotating object is controlled at a constant speed, "speed-position switching control" in which the operation is shifted from "speed control" to "position control" and "position-speed switching control" in which the operation is shifted from "position control" to "speed control".

Execute the required settings to match each control.

3.1 Outline of Major Positioning Controls

"Major positioning control" is carried out using the "positioning data" stored in the Motion module.

The basic controls such as position control and speed control are executed by setting the required items in this "positioning data", and then starting that positioning data.

The control method for the "major positioning controls" is set in setting item "[Da.2] Control method" of the positioning data.

Control defined as a "major positioning control" carries out the following types of control according to the "[Da.2] Control method" setting. However, the position loop is included for commanding to servo amplifier in the speed control set in "[Da.2] Control method". Use the "speed-torque control" to execute the speed control not including position loop. (☞ Page 196 Speed-torque Control)

Major positioning control			[Da.2] Control method	Details
Position control	Linear control	1-axis linear control	ABS Linear 1 INC Linear 1	Positioning of the designated 1 axis is carried out from the start address (current stop position) to the designated position.
		2-axis linear interpolation control*1	ABS Linear 2 INC Linear 2	Using the designated 2 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position.
		3-axis linear interpolation control*1	ABS Linear 3 INC Linear 3	Using the designated 3 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position.
		4-axis linear interpolation control*1	ABS Linear 4 INC Linear 4	Using the designated 4 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position.
	Fixed-feed control	1-axis fixed-feed control	Fixed-feed 1	Positioning of the designated 1 axis is carried out for a designated movement amount from the start address (current stop position). ("[Md.20] Command position value" is set to "0" at the start.)
		2-axis fixed-feed control*1	Fixed-feed 2	Using the designated 2 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position). ("[Md.20] Command position value" is set to "0" at the start.)
		3-axis fixed-feed control*1	Fixed-feed 3	Using the designated 3 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position). ("[Md.20] Command position value" is set to "0" at the start.)
		4-axis fixed-feed control*1	Fixed-feed 4	Using the designated 4 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position). ("[Md.20] Command position value" is set to "0" at the start.)
	2-axis circular interpolation control*1	Sub point designation	ABS Circular sub INC Circular sub	Using the designated 2 axes, positioning is carried out in an arc path to a position designated from the start point address (current stop position).
		Center point designation	ABS Circular right ABS Circular left INC Circular right INC Circular left	
	3-axis helical interpolation control*1	Sub point designation	ABS helical sub INC helical sub	Using two axes of the three axes, the circular interpolation control is carried out. The remaining axis is used for the positioning of the helical, tangent line, or normal line control to follow the circular interpolation control.
		Center point designation	ABS helical right ABS helical left INC helical right INC helical left	

Major positioning control		[Da.2] Control method	Details
Speed control	1-axis speed control	Forward run speed 1 Reverse run speed 1	The speed control of the designated 1 axis is carried out.
	2-axis speed control*1	Forward run speed 2 Reverse run speed 2	The speed control of the designated 2 axes is carried out.
	3-axis speed control*1	Forward run speed 3 Reverse run speed 3	The speed control of the designated 3 axes is carried out.
	4-axis speed control*1	Forward run speed 4 Reverse run speed 4	The speed control of the designated 4 axes is carried out.
Speed-position switching control		Forward run speed/ position Reverse run speed/ position	The control is continued as position control (positioning for the designated address or movement amount) by turning ON the "speed-position switching signal" after first carrying out speed control.
Position-speed switching control		Forward run position/ speed Reverse run position/ speed	The control is continued as speed control by turning ON the "position-speed switching signal" after first carrying out position control.
Other control	NOP instruction	NOP	A nonexecutable control method. When this instruction is set, the operation is transferred to the next data operation, and the instruction is not executed.
	Current value changing	Current value changing	"[Md.20] Command position value" is changed to an address set in the positioning data. This can be carried out by either of the following 2 methods. ("[Md.21] Machine feed value" cannot be changed.) • Current value changing using the control method • Current value changing using the current value changing start No. (No.9003)
	JUMP instruction	JUMP instruction	An unconditional or conditional JUMP is carried out to a designated positioning data No.
	LOOP	LOOP	A repeat control is carried out by repeat LOOP to LEND.
	LEND	LEND	Control is returned to the top of the repeat control by repeat LOOP to LEND. After the repeat operation is completed specified times, the next positioning data is run.

*1 Control is carried out so that linear and arc paths are drawn using a motor set in two or more axes directions. This kind of control is called "interpolation control". (☞ Page 59 Interpolation control)

Data required for major positioning control

The following table shows an outline of the "positioning data" configuration and setting details required to carry out the "major positioning controls".

Setting item			Setting details
Positioning data	[Da.1]	Operation pattern	Set the method by which the continuous positioning data (Ex: positioning data No.1, No.2, No.3) will be controlled. (☞ Page 46 Operation patterns of major positioning controls)
	[Da.2]	Control method	Set the control method defined as a "major positioning control". (☞ Page 43 Outline of Major Positioning Controls)
	[Da.3]	Acceleration time No.	Select and set the acceleration time at control start. (Select one of the four values set in [Pr.9], [Pr.25], [Pr.26], and [Pr.27] for the acceleration time.)
	[Da.4]	Deceleration time No.	Select and set the deceleration time at control stop. (Select one of the four values set in [Pr.10], [Pr.28], [Pr.29], and [Pr.30] for the deceleration time.)
	[Da.6]	Positioning address/movement amount	Set the target value during position control. (☞ Page 53 Designating the positioning address)
	[Da.7]	Arc address	Set the sub point or center point address during 2-axis circular interpolation control or 3-axis helical interpolation control.
	[Da.8]	Command speed	Set the speed during the control execution.
	[Da.9]	Dwell time/JUMP destination positioning data No.	The time between the command pulse output is completed to the positioning completed signal is turned ON. Set it for absorbing the delay of the mechanical system to the instruction, such as the delay of the servo system (deviation).
	[Da.10]	M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches	Set this item when carrying out sub work (clamp and drill stops, tool replacement, etc.) corresponding to the code No. related to the positioning data execution.
	[Da.20]	Axis to be interpolated No.1	Set an axis to be interpolated during the 2- to 4-axis interpolation operation. (☞ Page 59 Interpolation control)
	[Da.21]	Axis to be interpolated No.2	
	[Da.22]	Axis to be interpolated No.3	
	[Da.27]	M code ON signal output timing	Set the M code ON signal output timing to each positioning data.
	[Da.28]	ABS direction in degrees	Set the ABS direction in degrees to each positioning data.
	[Da.29]	Interpolation speed designation method	Set the interpolation speed designation method to each positioning data.

The settings and setting requirement for the setting details of [Da.1] to [Da.10], [Da.20] to [Da.22] and [Da.27] to [Da.29] differ according to "[Da.2] Control method". Refer to the following for details.

☞ Page 63 Setting the Positioning Data

Major positioning control sub functions

Refer to "Combination of Main Functions and Sub Functions" in the following manual for details on "sub functions" that can be combined with the major positioning control.

📖MELSEC iQ-R Motion Module User's Manual (Startup)

Also refer to the following for details on each sub function.

☞ Page 226 CONTROL SUB FUNCTIONS

Point

600 positioning data (positioning data No.1 to 600) items can be set per axis.

Operation patterns of major positioning controls

In "major positioning control" (high-level positioning control), "[Da.1] Operation pattern" can be set to designate whether to continue executing positioning data after the started positioning data. The "operation pattern" includes the following 3 types.

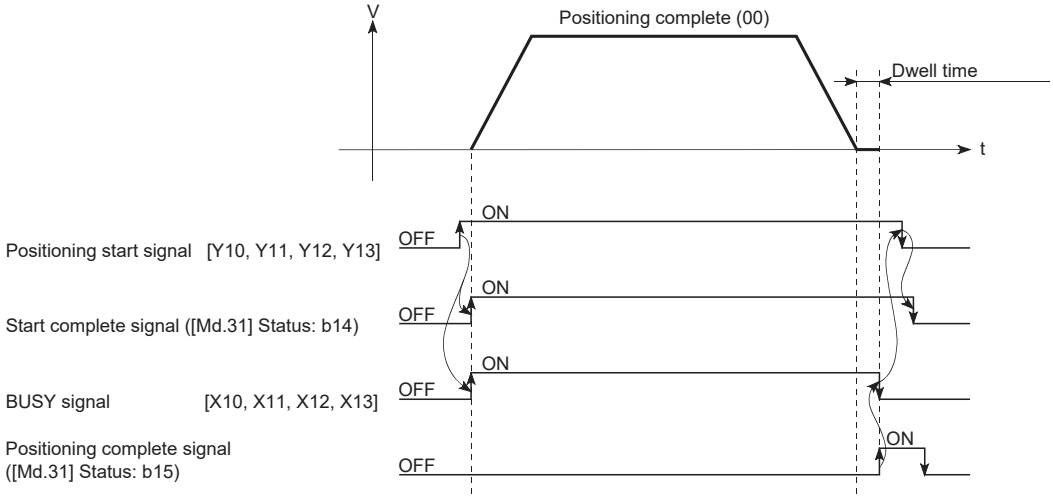
Positioning control	Operation pattern
Positioning complete	Independent positioning control (operation pattern: 00)
Positioning continue	Continuous positioning control (operation pattern: 01)
	Continuous path control (operation pattern: 11)

Independent positioning control (Positioning complete)

This control is set when executing only one designated data item of positioning. If a dwell time is designated, the positioning completes after the designated time elapses.

This data (operation pattern [00] data) becomes the end of block data when carrying out block positioning. (The positioning stops after this data is executed.)

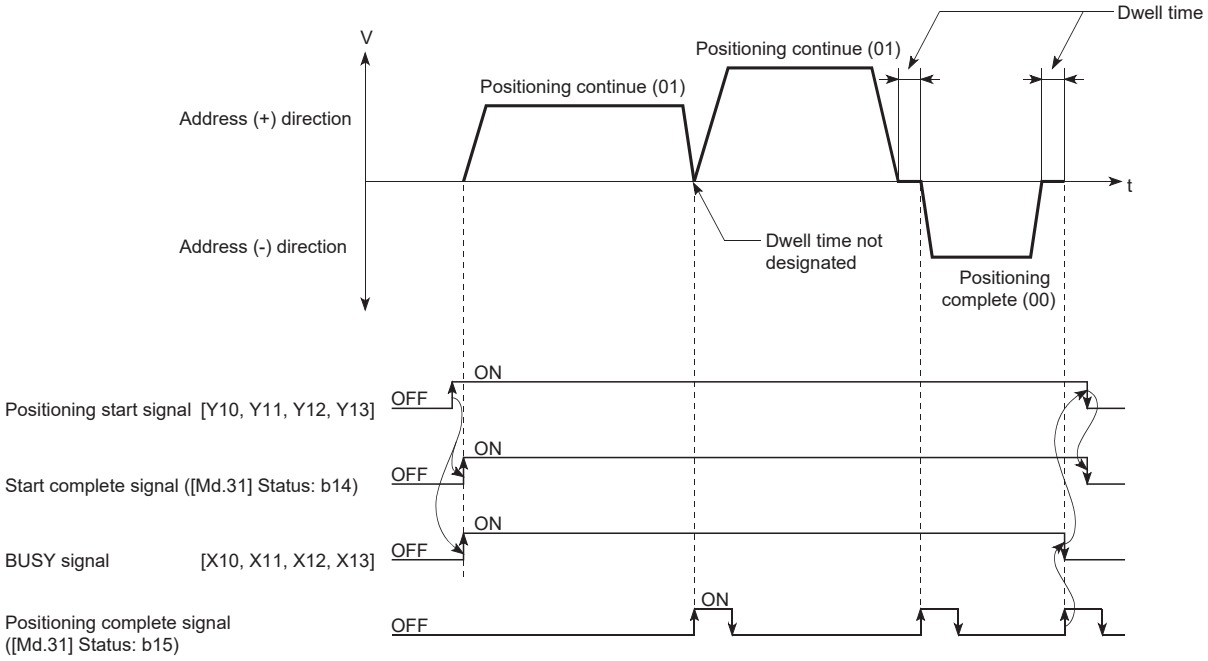
■Operation example



Continuous positioning control

- The machine always automatically decelerates each time the positioning is completed. Acceleration is then carried out after the Motion module command speed reaches 0 to carry out the next positioning data operation. If a dwell time is designated, the acceleration is carried out after the designated time elapses.
- In operation by continuous positioning control (operation pattern "01"), the next positioning No. is automatically executed. Always set operation pattern "00" in the last positioning data to complete the positioning. If the operation pattern is set to positioning continue ("01" or "11"), the operation will continue until operation pattern "00" is found. If the operation pattern "00" cannot be found, the operation may be carried out until the positioning data No.600. If the operation pattern of the positioning data No.600 is not completed, the operation will be started again from the positioning data No.1.

■Operation example

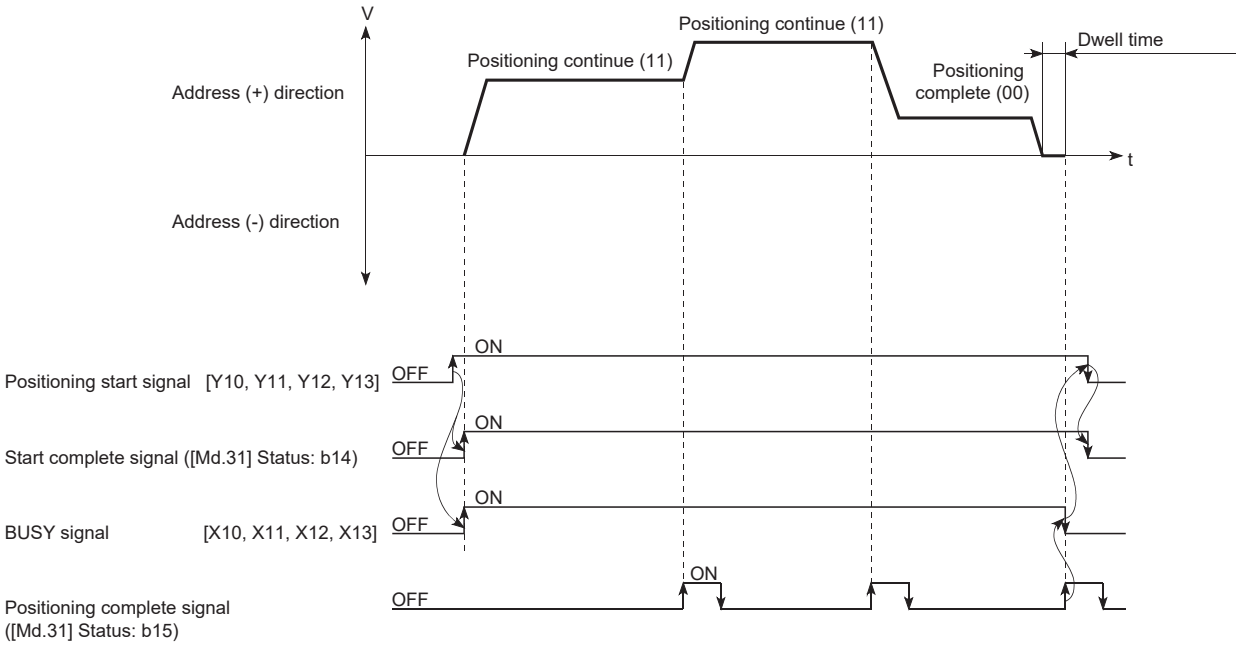


Continuous path control

■Continuous path control

- The speed is changed without deceleration stop between the command speed of the "positioning data No. currently being executed" and the speed of the "positioning data No. to carry out the next operation". The speed is not changed if the current speed and the next speed are equal.
- The speed used in the previous positioning operation is continued when the command speed is set to "-1".
- Dwell time is ignored, even if it is set.
- The next positioning No. is executed automatically in operations by continuous path control (operation pattern "11"). Always complete the positioning by setting operation pattern "00" in the last positioning data. If the operation pattern is set to positioning continue ("01" or "11"), the operation will continue until operation pattern "00" is found. If the operation pattern "00" cannot be found, the operation may be carried out until the positioning data No.600. If the operation pattern of the positioning data No.600 is not complete, the operation will be started again from the positioning data No.1.
- The speed switching includes the "front-loading speed switching mode" in which the speed is changed at the end of the current positioning side, and the "standard speed switching mode" in which the speed is at the start of the next positioning side. (☞ Page 465 [Pr.19] Speed switching mode)
- In the continuous path control, the positioning may be completed before the set address/movement amount and the current data may be switched to the "positioning data that will be run next". This is because a preference is given to the positioning at a command speed. In actuality, the positioning is completed before the set address/movement amount by an amount of remaining distance at speeds less than the command speed. The remaining distance ($\Delta 1$) at speeds less than the command speed is $0 \leq \Delta 1 \leq$ (distance moved in operation cycle at a speed at the time of completion of the positioning). The remaining distance ($\Delta 1$) is output at the next positioning data No.

■Operation example



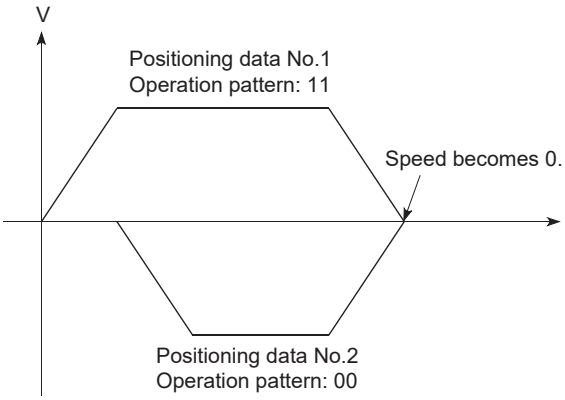
Point

In the continuous path control, a speed variation will not occur using the near-pass function when the positioning data No. is switched.
(☞ Page 237 Near pass function)

■Deceleration stop conditions during continuous path control

Deceleration stops are not carried out in continuous path control, but the machine will carry out a deceleration stop to speed "0" in the following 3 cases.

- When the operation pattern of the positioning data currently being executed is "continuous path control: 11", and the movement direction of the positioning data currently being executed differs from that of the next positioning data. (Only for 1-axis positioning control (Refer to the next point.))

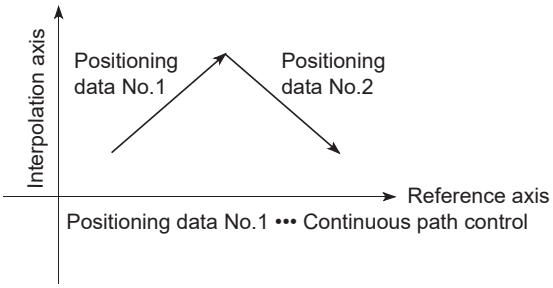


- During operation by step operation. (☞ Page 281 Step function)
- When there is an error in the positioning data to carry out the next operation.

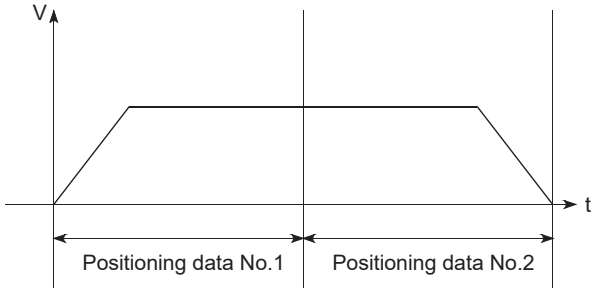
Point

- The movement direction is not checked during interpolation operations. Thus, automatic deceleration to a stop will not be carried out even if the movement direction is changed (See the figures below). Because of this, the interpolation axis may rapidly reverse direction. To avoid this rapid direction reversal in the interpolation axis, set the pass point to continuous positioning control "01" instead of setting it to continuous path control "11".

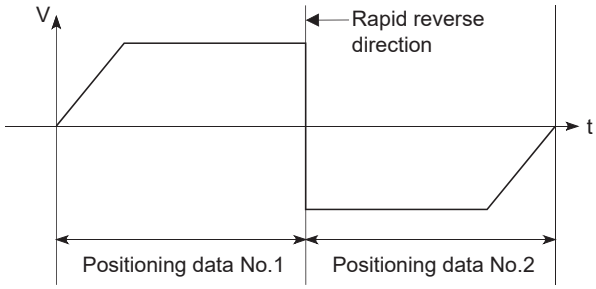
[Positioning by interpolation]



[Reference axis operation]



[Interpolation axis operation]

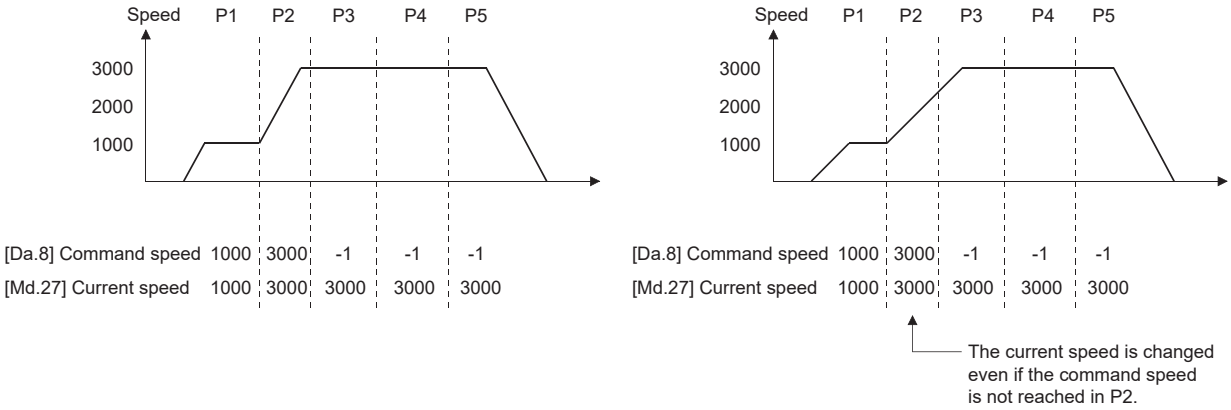


- When a "0" is set in "[Da.6] Positioning address/movement amount" of the continuous path control positioning data, the command speed is reduced to 0 in an operation cycle. When a "0" is set in "[Da.6] Positioning address/movement amount" to increase the number of speed change points in the future, change "[Da.2] Control method" to the "NOP" to make the control nonexecutable. (☞ Page 136 NOP instruction)
- In the continuous path control positioning data, assure a movement distance so that the execution time with that data is 100ms or longer, or lower the command speed.

■Speed handling

- Continuous path control command speeds are set with each positioning data. The Motion module carries out the positioning at the speed designated with each positioning data.
- The command speed can be set to "-1" in continuous path control. The control will be carried out at the speed used in the previous positioning data No. if the command speed is set to "-1". The "current speed" will be displayed in the command speed when the positioning data is set with an engineering tool. The current speed is the speed of the positioning control being executed currently.
- The speed does not need to be set in each positioning data when carrying out uniform speed control if "-1" is set beforehand in the command speed.
- If the speed is changed or the override function is executed, in the previous positioning data when "-1" is set in the command speed, the operation can be continued at the new speed.
- "No command speed" (error code: 1B12H to 1B14H) occurs and positioning cannot be started if "-1" is set in the command speed of the first positioning data at start.

[Relation between the command speed and current speed]



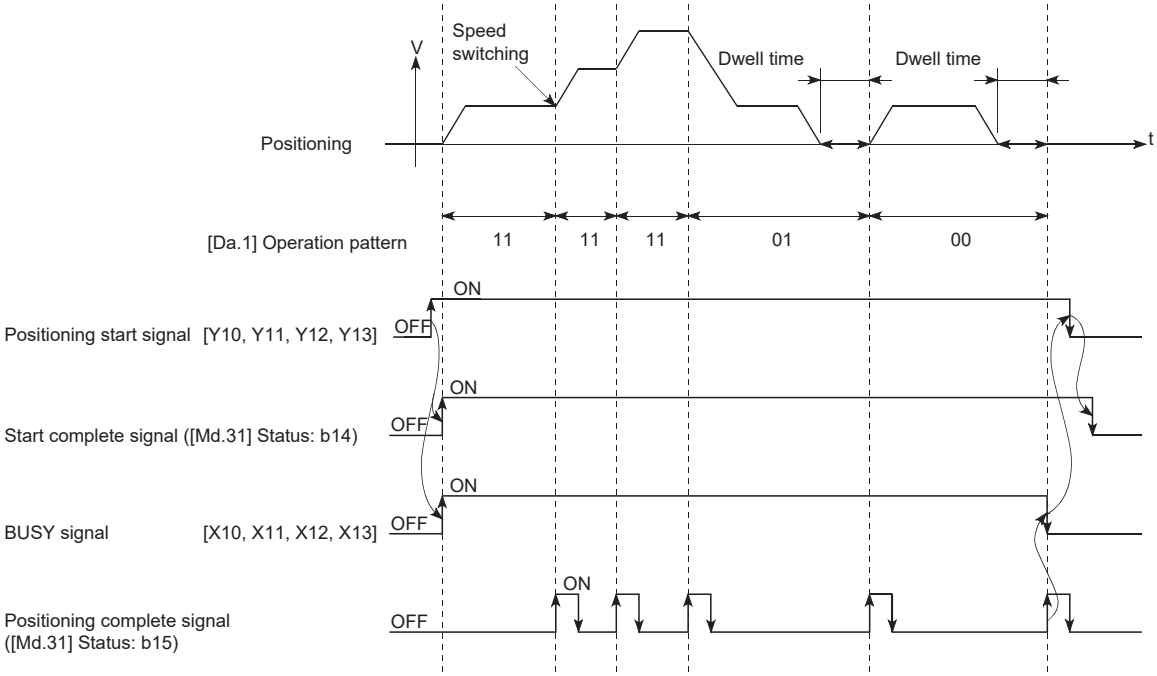
Point

- In the continuous path control, a speed variation will not occur using the near-pass function when the positioning data No. is switched. (☞ Page 237 Near pass function)
- The Motion module holds the command speed set with the positioning data, and the latest value of the speed set with the speed change request as "[Md.27] Current speed". It controls the operation at the "current speed" when "-1" is set in the command speed. (Depending on the relation between the movement amount and the speed, the speed command may not reach the command speed value, but even then the current speed will be updated.)
- When the address for speed change is identified beforehand, generate and execute the positioning data for speed change by the continuous path control to carry out the speed change without requesting the speed change with a program.

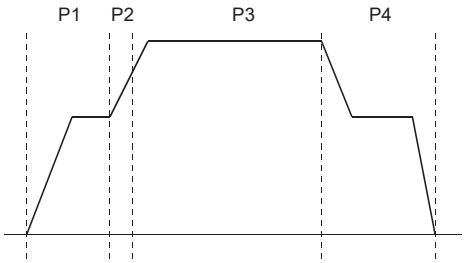
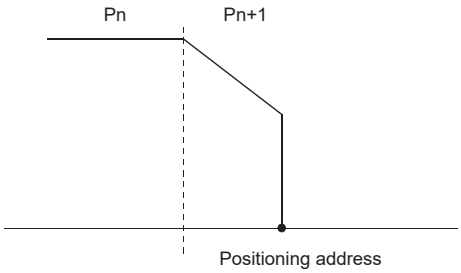
■Speed switching (Standard speed switching mode: Switch the speed when executing the next positioning data.) (☞ Page 465 [Pr.19] Speed switching mode)

- If the respective command speeds differ in the "positioning data currently being executed" and the "positioning data to carry out the next operation", the machine will accelerate or decelerate after reaching the positioning point set in the "positioning data currently being executed" and the speed will change over to the speed set in the "positioning data to carry out the next operation".
- The parameters used in acceleration/deceleration to the command speed set in the "positioning data to carry out the next operation" are those of the positioning data to carry out acceleration/deceleration. Speed switching will not be carried out if the command speeds are the same.

Ex.



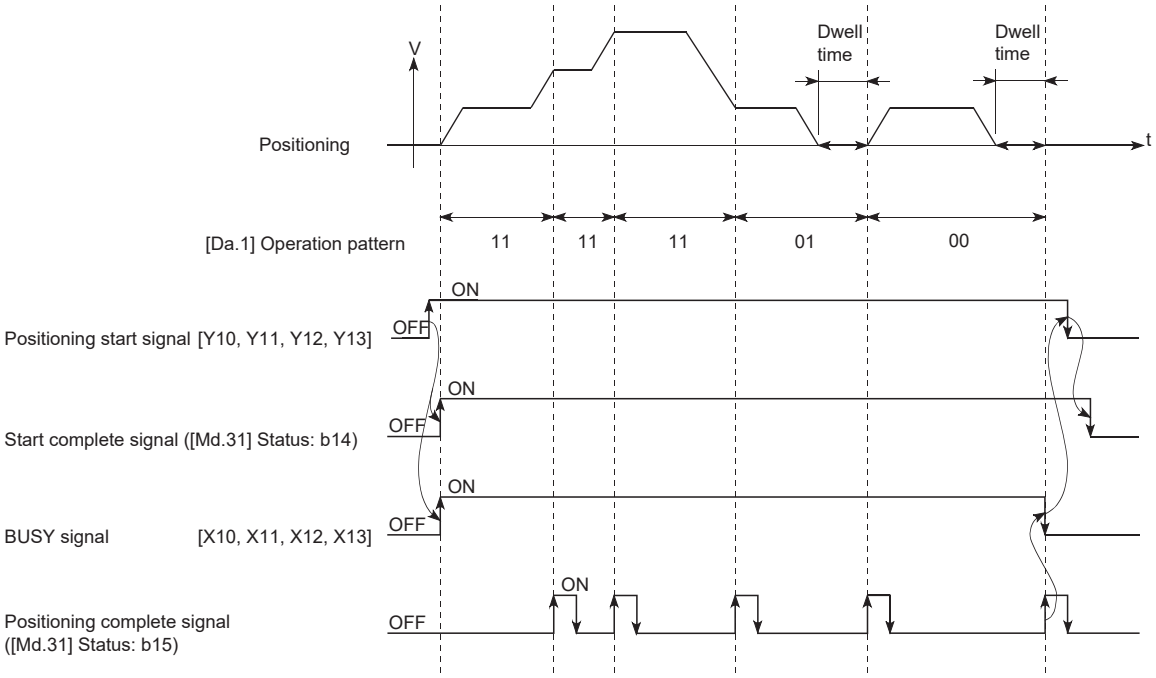
- If the movement amount is small in regard to the target speed, the current speed may not reach the target speed even if acceleration/deceleration is carried out. In this case, the machine is accelerated/decelerated to approach the target speed. If the movement amount will be exceeded when automatic deceleration is required (Ex. Operation patterns "00", "01", etc.), the machine will immediately stop at the designated positioning address, and "Insufficient movement amount" (warning code: 0D58H) will occur.

[When the speed cannot change over in P2]	[When the movement amount is small during automatic deceleration]
For the following relation of the speed P1 = P4, P2 = P3, P1 < P2 	The movement amount required to carry out the automatic deceleration cannot be secured, so the machine immediately stops in a speed ≠ 0 status. 

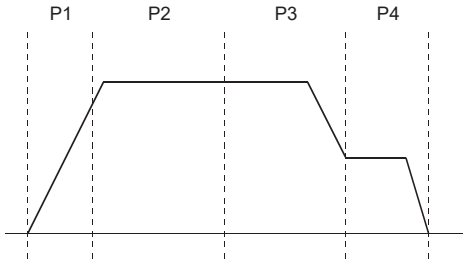
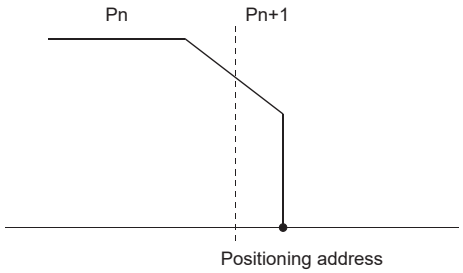
■Speed switching (Front-loading speed switching mode: The speed switches at the end of the positioning data currently being executed.) (☞ Page 465 [Pr.19] Speed switching mode)

- If the respective command speeds differ in the "positioning data currently being executed" and the "positioning data to carry out the next operation", the speed will change over to the speed set in the "positioning data to carry out the next operation" at the end of the "positioning data currently being executed".
- The parameters used in acceleration/deceleration to the command speed set in the "positioning data to carry out the next operation" are those of the positioning data to carry out acceleration/deceleration. Speed switching will not be carried out if the command speeds are the same.

Ex.



- If the movement amount is small in regard to the target speed, the current speed may not reach the target speed even if acceleration/deceleration is carried out. In this case, the machine is accelerated/decelerated to approach the target speed. If the movement amount will be exceeded when automatic deceleration is required (Ex. Operation patterns "00", "01", etc.), the machine will immediately stop at the designated positioning address, and "Insufficient movement amount" (warning code: 0D58H) will occur.

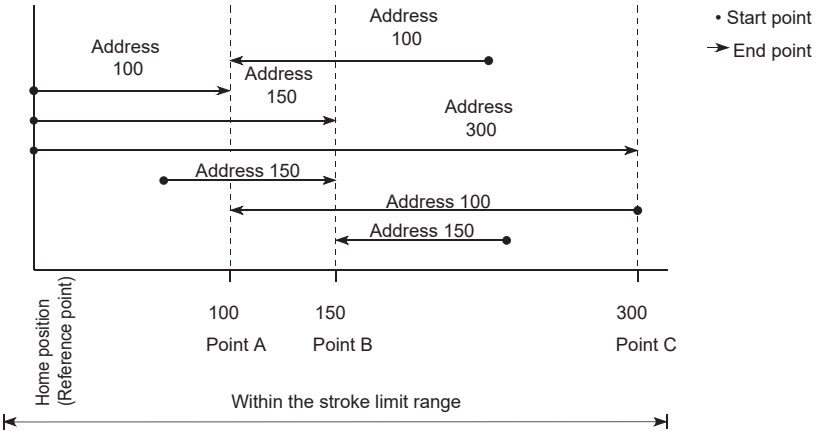
[When the speed cannot change over to the P2 speed in P1]	[When the movement amount is small during automatic deceleration]
For the following relation of the speed P1 = P4, P2 = P3, P1 < P2 	The movement amount required to carry out the automatic deceleration cannot be secured, so the machine immediately stops in a speed ≠ 0 status. 

Designating the positioning address

The following shows the two methods for commanding the position in control using positioning data.

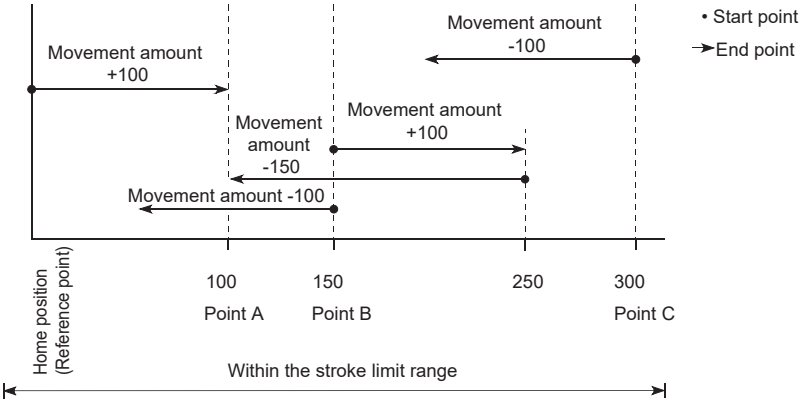
Absolute system

Positioning is carried out to a designated position (absolute address) having the home position as a reference. This address is regarded as the positioning address. (The start point can be anywhere.)



Incremental system

The position where the machine is currently stopped is regarded as the start point, and positioning is carried out for a designated movement amount in a designated movement direction.



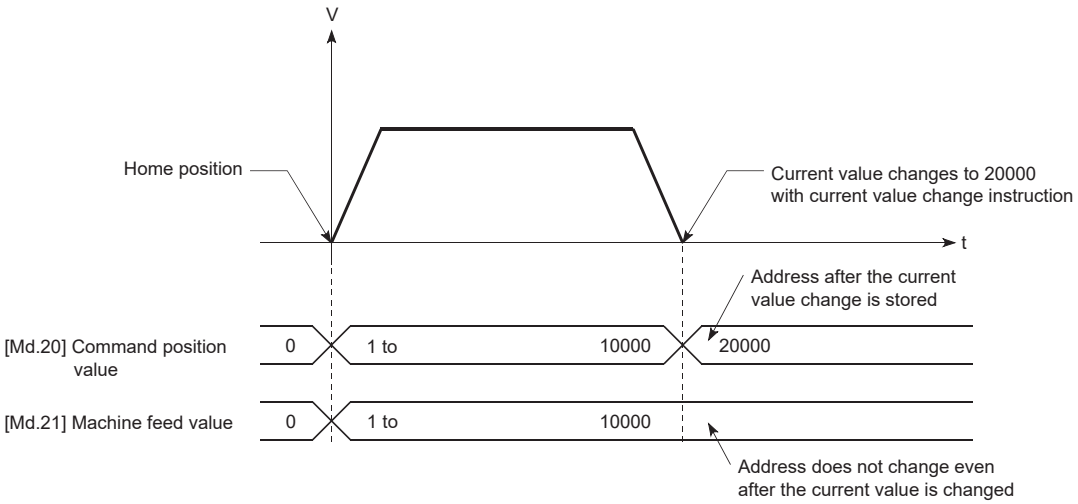
Confirming the current value

Values showing the current value

The following two types of addresses are used as values to show the position in the Motion module.
These addresses ("command position value" and "machine feed value") are stored in the monitor data area, and used in monitoring the current value display, etc.

Command position value	Machine feed value
• This is the value stored in "[Md.20] Command position value". • This value has an address established with a "machine home position return" as a reference, but the address can be changed by changing the current value to a new value.	• This is the value stored in "[Md.21] Machine feed value". • This value always has an address established with a "machine home position return" as a reference. The address cannot be changed, even if the current value is changed to a new value.

The "command position value" and "machine feed value" are used in monitoring the current value display, etc.



Restriction

Operation cycle error will occur in the current value refresh cycle when the stored "command position value" and "machine feed value" are used in the control.

Monitoring the current value

The "command position value" and "machine feed value" are stored in the following buffer memory addresses, and can be read using a "DFROM(P) instruction" or "DMOV(P) instruction" from the CPU module.
n: Axis No. - 1

Monitor item		Buffer memory address
		Axis 1 to axis 16
[Md.20]	Command position value	2400+100n 2401+100n
[Md.21]	Machine feed value	2402+100n 2403+100n

Program example

The following shows the program example that stores the command position value of the axis 1 in the specified device.



Classification	Label name	Description
Module label	RD78GS_1.stnAxMntr_D[0].dCommandPosition_D	Axis 1 Command position value
Global label, local label	Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. The following table shows an example for the local label.	

	Label Name	Data Type		Class
1	dCommandPositionValue	Double Word [Signed]	...	VAR
2	bCommandPositionValueReadReq	Bit	...	VAR
3			...	

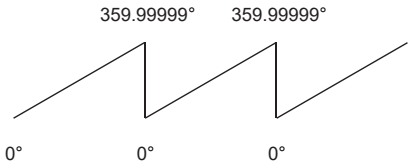
Control unit "degree" handling

When the control unit is set to "degree", the following items differ from when other control units are set.

Command position value and machine feed value addresses

The address of "[Md.20] Command position value" becomes a ring address from 0 to 359.99999°. The address of "[Md.21] Machine feed value" will become a cumulative value. (They will not have a ring structure for values between 0 and 359.99999°.)

However, "[Md.21] Machine feed value" is restored with cumulating the machine feed value before the power supply OFF (the rounded value within the range of 0 to 359.99999°) to the movement amount during the power supply OFF at the communication start with servo amplifier after the power supply ON or CPU module reset.

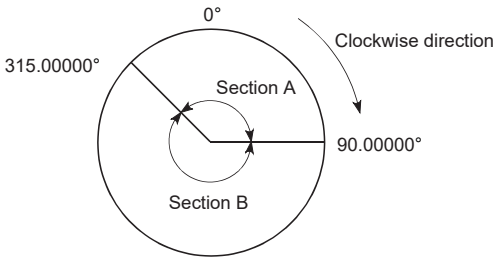


Software stroke limit valid/invalid setting

With the control unit set to "degree", the software stroke limit upper and lower limit values are 0° to 359.99999°.

■Setting to validate software stroke limit

To validate the software stroke limit, set the software stroke limit lower limit value and the upper limit value in a clockwise direction.



- To set the movement range A, set as follows.

Software stroke limit lower limit value	315.00000°
Software stroke limit upper limit value	90.00000°

- To set the movement range B, set as follows.

Software stroke limit lower limit value	90.00000°
Software stroke limit upper limit value	315.00000°

■Setting to invalidate software stroke limit

To invalidate the software stroke limit, set the software stroke limit lower limit value equal to the software stroke limit upper limit value.

The control can be carried out irrespective of the setting of the software stroke limit.

Point

- When the upper/lower limit value of the axis which set the software stroke limit as valid are changed, perform the machine home position return after that.
- When the software stroke limit is set as valid in the incremental data system, perform the machine home position return after power supply on.

Positioning control method when the control unit is set to "degree"

■Absolute system (When the software stroke limit is invalid)

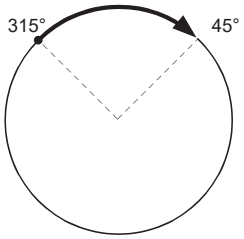
Positioning is carried out in the nearest direction to the designated address, using the current value as a reference. (This is called "shortcut control".)

Ex.

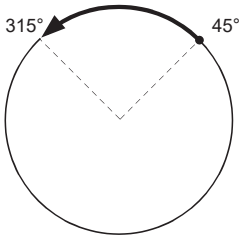
1) Positioning is carried out in a clockwise direction when the current value is moved from 315° to 45°.

2) Positioning is carried out in a counterclockwise direction when the current value is moved from 45° to 315°.

(1) Moved from 315° to 45°



(2) Moved from 45° to 315°



To designate the positioning direction (not carrying out the shortcut control), the shortcut control is invalidated and positioning in a designated direction is carried out by "[Cd.40] ABS direction in degrees".

This function can be performed only when the software stroke limit is invalid. When the software stroke limit is valid, "Illegal setting of ABS direction in unit of degree" (error code: 1AA5H) occurs and positioning is not started.

To designate the movement direction in the ABS control, a "1" or "2" is written to "[Cd.40] ABS direction in degrees" of the buffer memory (initial value: 0).

The value written to "[Cd.40] ABS direction in degrees" becomes valid only when the positioning control is started.

In the continuous positioning control and continuous path control, the operation is continued with the setting set at the time of start even if the setting is changed during the operation.

n: Axis No. - 1

Name	Function	Buffer memory address	Initial value
		Axis 1 to axis 16	
[Cd.40] ABS direction in degrees	The ABS movement direction in the unit of degree is designated. 0: Shortcut (direction setting invalid) 1: ABS clockwise 2: ABS counterclockwise	4350+100n	0

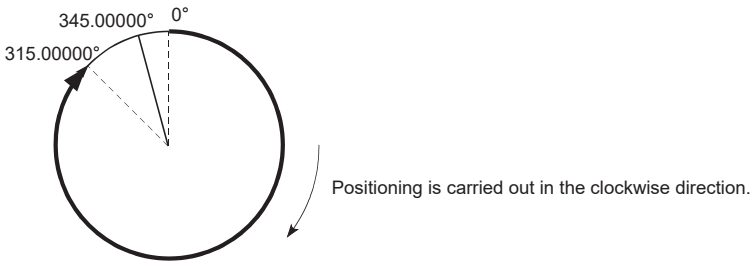
■Absolute system (When the software stroke limit is valid)

The positioning is carried out in a clockwise/counterclockwise direction depending on the software stroke limit range setting method.

Because of this, positioning with "shortcut control" may not be possible.

Ex.

When the current value is moved from 0° to 315°, positioning is carried out in the clockwise direction if the software stroke limit lower limit value is 0° and the upper limit value is 345°.



Point

Positioning addresses are within a range of 0° to 359.99999°.

Use the incremental system to carry out positioning of one rotation or more.

■Incremental system

Positioning is carried out for a designated movement amount in a designated movement direction when in the incremental system of positioning.

The movement direction is determined by the sign (+, -) of the movement amount.

For a positive (+) movement direction	Clockwise
For a negative (-) movement direction	Counterclockwise

Point

Positioning of 360 or more can be carried out with the incremental system.

At this time, set as shown below to invalidate the software stroke limit.

[Software stroke limit upper limit value = Software stroke limit lower limit value]

Set the value within the setting range (0° to 359.99999°).

Interpolation control

Meaning of interpolation control

In "2-axis linear interpolation control", "3-axis linear interpolation control", "4-axis linear interpolation control", "2-axis fixed-feed control", "3-axis fixed-feed control", "4-axis fixed-feed control", "2-axis speed control", "3-axis speed control", "4-axis speed control", "2-axis circular interpolation control", and "3-axis helical interpolation control", each control is performed so that linear and arc paths are drawn using a motor set in two to four axis directions. This kind of control is called "interpolation control".

In interpolation control, the axis in which the control method is set is defined as the "reference axis", and the other axis is defined as the "interpolation axis".

The Motion module controls the "reference axis" following the positioning data set in the "reference axis", and controls the "interpolation axis" corresponding to the reference axis control so that a linear or arc path is drawn.

The following table shows the reference axis and interpolation axis combinations.

—: Setting not required (Use the initial value or a value within the setting range.)

Interpolation control set in "[Da.2] Control method"	Axis definition	
	Reference axis	Interpolation axis
2-axis linear interpolation control 2-axis fixed-feed control 2-axis circular interpolation control 2-axis speed control	4-axis module: Any of axes 1 to 4 8-axis module: Any of axes 1 to 8 16-axis module: Any of axes 1 to 16	"Axis to be interpolated No.1" set in reference axis
3-axis linear interpolation control 3-axis fixed-feed control 3-axis speed control		"Axis to be interpolated No.1" and "Axis to be interpolated No.2" set in reference axis
4-axis linear interpolation control 4-axis fixed-feed control 4-axis speed control		"Axis to be interpolated No.1", "Axis to be interpolated No.2" and "Axis to be interpolated No.3" set in reference axis

The combinations of axes available for the 3-axis helical interpolation control are the same as the ones for the "3-axis linear interpolation control", "3-axis fixed-feed control", and "3-axis speed control". The following table shows the combinations of the reference axis, circular interpolation axis, and linear interpolation axis for the 3-axis helical interpolation control.

Interpolation control set in "[Da.2] Control method"	Axis definition		
	Reference axis	Circular interpolation axis	Linear interpolation axis
3-axis helical interpolation control	4-axis module: Any of axes 1 to 4 8-axis module: Any of axes 1 to 8 16-axis module: Any of axes 1 to 16	"Axis to be interpolated No.1" set in reference axis	"Axis to be interpolated No.2" set in reference axis

Setting positioning data

When carrying out interpolation control, the same positioning data Nos. are set for the "reference axis" and the "interpolation axis". The following table shows the "positioning data" setting items for the reference axis and interpolation axis.

◎: Setting always required, ○: Set according to requirements (Set to "—" when not used.), △: Setting restrictions exist

—: Setting not required (Use the initial value or a value within the setting range.)

Setting item			Reference axis setting item	Interpolation axis setting item
Same positioning data Nos	[Da.1]	Operation pattern	◎	—
	[Da.2]	Control method	◎ Linear 2, 3, 4 Fixed-feed 2, 3, 4 Circular sub, Circular right, Circular left Helical sub, Helical right, Helical left Forward run speed 2, 3, 4 Reverse run speed 2, 3, 4	—
	[Da.3]	Acceleration time No.	◎	—
	[Da.4]	Deceleration time No.	◎	—
	[Da.6]	Positioning address/movement amount	△ (Forward run speed 2, 3, and 4. Reverse run speed 2, 3, and 4 not required.)	△ (Forward run speed 2, 3, and 4. Reverse run speed 2, 3, and 4 not required.)
	[Da.7]	Arc address	△ (Only during circular sub, circular right, circular left, helical sub, helical right, and helical left.)	△ (Only during circular sub, circular right, circular left, helical sub, helical right, and helical left.)
	[Da.8]	Command speed	◎	△ (Only during forward run speed 2, 3, 4 and reverse run speed 2, 3, 4).
	[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
	[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	— Set the number of pitch for the linear interpolation axis only during helical sub, helical right, and helical left.
	[Da.20]	Axis to be interpolated No.1	○*1	—
	[Da.21]	Axis to be interpolated No.2	○*1	—
	[Da.22]	Axis to be interpolated No.3	○*1	—
	[Da.27]	M code ON signal output timing	○	—
	[Da.28]	ABS direction in degrees	○	—
	[Da.29]	Interpolation speed designation method	△	—

*1 The axis No. is set to axis to be interpolated No.1 for 2-axis linear interpolation, to axis to be interpolated No.1 and No.2 for 3-axis linear interpolation, and to axis to be interpolated No.1 to No.3 for 4-axis linear interpolation.
If the self-axis is set, "Illegal interpolation description command" (error code: 1B22H) will occur. The axes that are not used are not required.

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Starting the interpolation control

The positioning data Nos. of the reference axis (axis in which interpolation control was set in "[Da.2] Control method") are started when starting the interpolation control. (Starting of the interpolation axis is not required.)

The following errors or warnings will occur and the positioning will not start if both reference axis and the interpolation axis are started.

- Reference axis: Interpolation while interpolation axis BUSY (error code: 1A98H)
- Interpolation axis: Control method setting error (error code: 1B24H), start during operation (warning code: 0D00H).

Interpolation control continuous positioning

When carrying out interpolation control in which "continuous positioning control" and "continuous path control" are designated in the operation pattern, the positioning method for all positioning data from the started positioning data to the positioning data in which "positioning complete" is set must be set to interpolation control.

The number of the interpolation axes and axes to be interpolated cannot be changed from the intermediate positioning data. When the number of the interpolation axes and axes to be interpolated are changed, "Control method setting error" (error code: 1B25H) will occur and the positioning will stop.

Speed during interpolation control

Either the "composite speed" or "reference axis speed" can be designated as the speed during interpolation control. ([Pr.20] Interpolation speed designation method)

Only the "Reference axis speed" can be designated in the following interpolation control.

When a "composite speed" is set and positioning is started, "Interpolation mode error" (error code: 1A9AH) occurs, and the system will not start.

- 4-axis linear interpolation
- 2-axis speed control
- 3-axis speed control
- 4-axis speed control

Cautions

- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis speed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated are suppressed by the command speed ratio.
- If the reference axis exceeds "[Pr.8] Speed limit value" during 2-axis circular interpolation control, the reference axis is controlled with the speed limit value. (The speed limit does not function on the interpolation axis side.)
- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis linear interpolation control or 2- to 4-axis fixed-feed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated are suppressed by the movement amount ratio.
- In the 3-axis helical interpolation control, the composite speed of the circular interpolation axis or the speed of the linear interpolation axis is controlled not to exceed "[Pr.8] Speed limit value". (However, when the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, such as when the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches") set in the linear interpolation axis is less, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".)
- In 2- to 4-axis interpolation, you cannot change the combination of interpolated axes midway through operation.

Point

When the "reference axis speed" is set during interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed "[Pr.8] Speed limit value".

Limits to interpolation control

There are limits to the interpolation control that can be executed and speed ([Pr.20] Interpolation speed designation method) that can be set, depending on "[Pr.1] Unit setting" of the reference axis and interpolation axis. (For example, 2-axis circular interpolation control cannot be executed if the reference axis and interpolation axis units differ.)

The following table shows the interpolation control and speed designation limits.

○: Setting possible, ×: Setting not possible

Interpolation control set in "[Da.2] Control method"	[Pr.20] Interpolation speed designation method	[Pr.1] Unit setting*1	
		Reference axis and interpolation axis units are the same, or a combination of "mm" and "inch"*2	Reference axis and interpolation axis units differ*2
Linear 2 (ABS, INC) Fixed-feed 2	Composite speed	○	×
	Reference axis speed	○	○
Circular sub (ABS, INC) Circular right (ABS, INC) Circular left (ABS, INC)	Composite speed	○*3	×
	Reference axis speed	×	×
Linear 3 (ABS, INC) Fixed-feed 3	Composite speed	○	×
	Reference axis speed	○	○
Linear 4 (ABS, INC) Fixed-feed 4	Composite speed	×	×
	Reference axis speed	○	○
2 to 4-axis speed control	Composite speed	×	×
	Reference axis speed	○	○
Helical sub (ABS, INC) Helical right (ABS, INC) Helical left (ABS, INC)	Composite speed	○*3	○*4
	Reference axis speed	×	×

*1 "mm" and "inch" unit mix possible.
When "mm" and "inch" are mixed, convert as follows for the positioning.
If interpolation control units are "mm", positioning is controlled by calculating position commands from the address, travel value, positioning speed and electronic gear, which have been converted to "mm" using the formula: inch setting value × 25.4 = mm setting value.
If interpolation control units are "inch", positioning is controlled by calculating position commands from the address, travel value, positioning speed and electronic gear, which have been converted to "inch" using the formula: mm setting value/25.4 = inch setting value.

*2 The unit set in the reference axis will be used for the speed unit during control if the units differ or if "mm" and "inch" are combined.

*3 "degree" setting not possible.
"Circular interpolation not possible" (error code: 1A9FH) will occur and the positioning control does not start if 2-axis circular interpolation control and 3-axis helical interpolation control is set when the unit is "degree".
The machine will carry out a deceleration stop if "degree" is set during positioning control.

*4 Only linear interpolation axis can use a unit different from that of the reference axis.

Axis operation status during interpolation control

"Interpolation" will be stored in "[Md.26] Axis operation status" during interpolation control. "Standby" will be stored when the interpolation operation is terminated. Both the reference axis and interpolation axis will carry out a deceleration stop if an error occurs during control, and "Error" will be stored in the operation status.

3.2 Setting the Positioning Data

Relation between each control and positioning data

The setting requirements and details for the setting items of the positioning data to be set differ according to "[Da.2] Control method".

The following table shows the positioning data setting items corresponding to the different types of control.

(In this section, it is assumed that the positioning data setting is carried out using an engineering tool.)

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur at start.)

△: Setting limited

—: Setting not required (Use the initial value or a value within the setting range.)

Positioning data			Position control				1 to 4 axis speed control
			1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control	
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	◎	◎	◎	◎	◎
		Continuous positioning control	◎	◎	◎	◎	×
		Continuous path control	◎	×	◎	◎	×
[Da.2]	Control method		Linear 1 Linear 2 Linear 3 Linear 4 *1	Fixed-feed 1 Fixed-feed 2 Fixed-feed 3 Fixed-feed 4	Circular sub Circular right Circular left *1	Helical sub Helical right Helical left *1	Forward run speed 1 Reverse run speed 1 Forward run speed 2 Reverse run speed 2 Forward run speed 3 Reverse run speed 3 Forward run speed 4 Reverse run speed 4
[Da.3]	Acceleration time No.		◎	◎	◎	◎	◎
[Da.4]	Deceleration time No.		◎	◎	◎	◎	◎
[Da.6]	Positioning address/movement amount		◎	◎	◎	◎	—
[Da.7]	Arc address		—	—	◎	◎	—
[Da.8]	Command speed		◎	◎	◎	◎	◎
[Da.9]	Dwell time/JUMP destination positioning data No.		○	○	○	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches		○	○	○	○*2	○
[Da.20]	Axis to be interpolated No.1		◎: 2 axes, 3 axes, 4 axes, —: 1 axis			◎	◎: 2 axes, 3 axes, 4 axes, —: 1 axis
[Da.21]	Axis to be interpolated No.2		◎: 3 axes, 4 axes, —: 1 axis, 2 axes			◎	◎: 3 axes, 4 axes, —: 1 axis, 2 axes
[Da.22]	Axis to be interpolated No.3		◎: 4 axes, —: 1 axis, 2 axes, 3 axes			—	◎: 4 axes, —: 1 axis, 2 axes, 3 axes
[Da.27]	M code ON signal output timing		○	○	○	○	○
[Da.28]	ABS direction in degrees		○	○	○	○	○
[Da.29]	Interpolation speed designation method		△	△	△	△	△

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

*2 Set an M code for the reference axis and set the number of pitches for the linear interpolation axis.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur at start.)

—: Setting not required (Use the initial value or a value within the setting range.)

Positioning data			Speed-position switching control	Position-speed switching control
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	◎	◎
		Continuous positioning control	◎	×
		Continuous path control	×	×
[Da.2]	Control method		Forward run speed/position Reverse run speed/position *1	Forward run position/speed Reverse run position/speed
[Da.3]	Acceleration time No.		◎	◎
[Da.4]	Deceleration time No.		◎	◎
[Da.6]	Positioning address/movement amount		◎	◎
[Da.7]	Arc address		—	—
[Da.8]	Command speed		◎	◎
[Da.9]	Dwell time/JUMP destination positioning data No.		○	○
[Da.10]	M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches		○	○
[Da.20]	Axis to be interpolated No.1		—	—
[Da.21]	Axis to be interpolated No.2		—	—
[Da.22]	Axis to be interpolated No.3		—	—
[Da.27]	M code ON signal output timing		○	○
[Da.28]	ABS direction in degrees		—	—
[Da.29]	Interpolation speed designation method		—	—

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur at start.)

—: Setting not required (Use the initial value or a value within the setting range.)

Positioning data			Other control				
			NOP instruction	Current value changing	JUMP instruction	LOOP	LEND
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	—	◎	—	—	—
		Continuous positioning control	—	◎	—	—	—
		Continuous path control	—	×	—	—	—
[Da.2]	Control method		NOP	Current value changing	JUMP instruction	LOOP	LEND
[Da.3]	Acceleration time No.		—	—	—	—	—
[Da.4]	Deceleration time No.		—	—	—	—	—
[Da.6]	Positioning address/movement amount		—	New address	—	—	—
[Da.7]	Arc address		—	—	—	—	—
[Da.8]	Command speed		—	—	—	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.		—	—	JUMP destination positioning data No.	—	—
[Da.10]	M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches		—	○	JUMP condition data No.	Number of LOOP to LEND repetitions	—
[Da.20]	Axis to be interpolated No.1		—	—	—	—	—
[Da.21]	Axis to be interpolated No.2		—	—	—	—	—
[Da.22]	Axis to be interpolated No.3		—	—	—	—	—
[Da.27]	M code ON signal output timing		—	○	—	—	—
[Da.28]	ABS direction in degrees		—	—	—	—	—
[Da.29]	Interpolation speed designation method		—	—	—	—	—

Point

It is recommended that the "positioning data" be set whenever possible with an engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

1-axis linear control

In "1-axis linear control" ("[Da.2] Control method" = ABS linear 1, INC linear 1), one motor is used to carry out position control in a set axis direction.

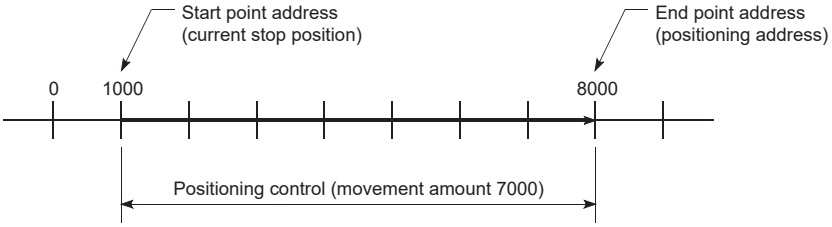
1-axis linear control (ABS linear 1)

■Operation chart

In absolute system 1-axis linear control, positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount".

Ex.

When the start point address (current stop position) is 1000, and the end point address (positioning address) is 8000, positioning is carried out in the positive direction for a movement amount of 7000 (8000 - 1000)



■Setting positioning data

When using 1-axis linear control (ABS linear 1), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set ABS linear 1.)
[Da.3]	Acceleration time No.	◎
[Da.4]	Deceleration time No.	◎
[Da.6]	Positioning address/movement amount	◎
[Da.7]	Arc address	—
[Da.8]	Command speed	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	○
[Da.29]	Interpolation speed designation method	△

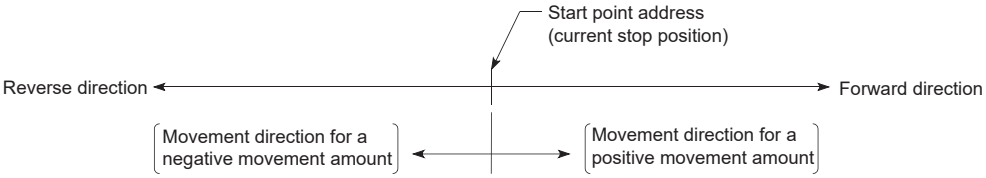
Refer to the following for information on the setting details.

☞ Page 489 Positioning data

1-axis linear control (INC linear 1)

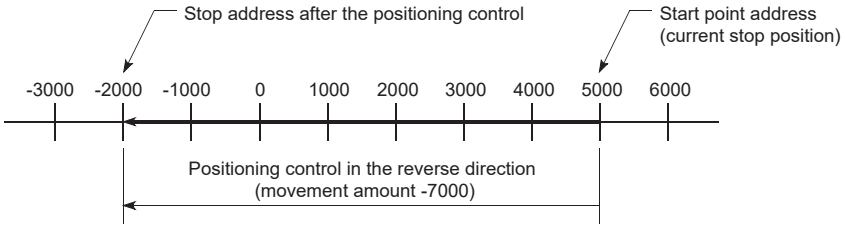
■Operation chart

In incremental system 1-axis linear control, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.



Ex.

When the start point address is 5000, and the movement amount is -7000, positioning is carried out to the -2000 position.



■Setting positioning data

When using 1-axis linear control (INC linear 1), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set INC linear 1.)
[Da.3]	Acceleration time No.	◎
[Da.4]	Deceleration time No.	◎
[Da.6]	Positioning address/movement amount	◎
[Da.7]	Arc address	—
[Da.8]	Command speed	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	○
[Da.29]	Interpolation speed designation method	△

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

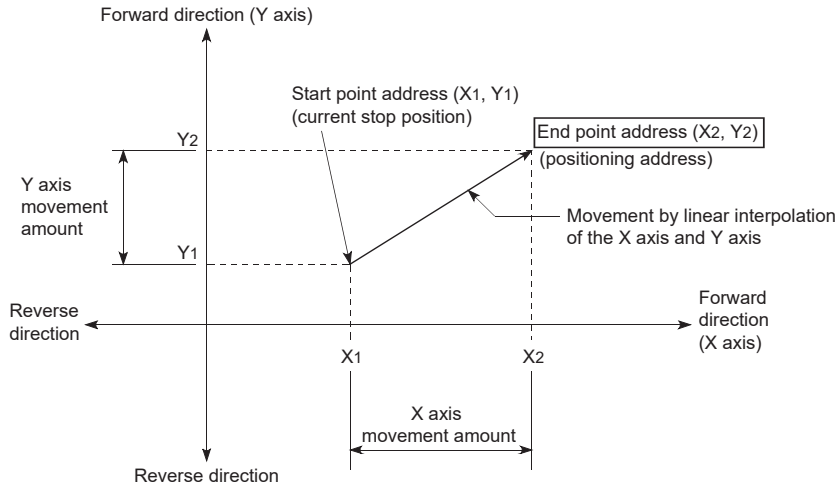
2-axis linear interpolation control

In "2-axis linear interpolation control" ("[Da.2] Control method" = ABS linear 2, INC linear 2), two motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 59 Interpolation control for details on interpolation control.)

2-axis linear interpolation control (ABS linear 2)

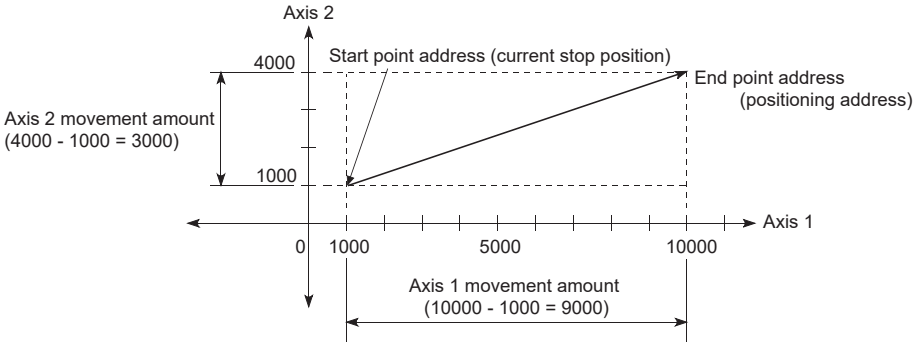
■Operation chart

In absolute system 2-axis linear interpolation control, the designated 2 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount".



Ex.

When the start point address (current stop position) is (1000, 1000) and the end point address (positioning address) is (10000, 4000), positioning is carried out as follows.



■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

- If the movement amount of each axis exceeds "1073741824 (= 2^{30})" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", "Outside linear movement amount range" (error code: 1B15H, 1B16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".)

■Setting positioning data

When using 2-axis linear interpolation control (ABS linear 2), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set ABS linear 2.)	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Restriction

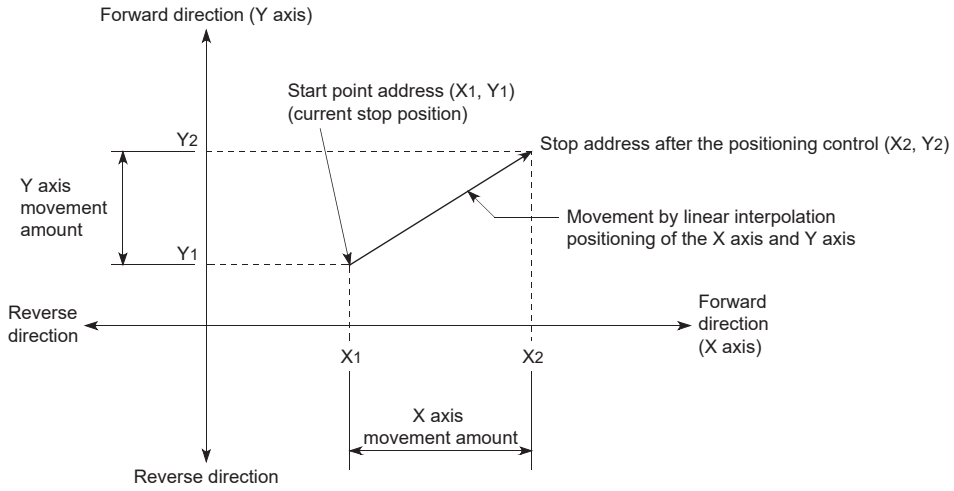
When the "reference axis speed" is set during 2-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed "[Pr.8] Speed limit value".

2-axis linear interpolation control (INC linear 2)

■Operation chart

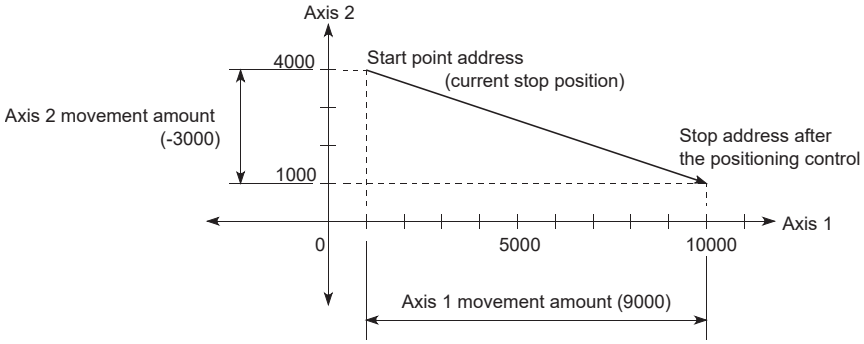
In incremental system 2-axis linear interpolation control, the designated 2 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

- Positive movement amount: Positioning control to forward direction (Address increase direction)
- Negative movement amount: Positioning control to reverse direction (Address decrease direction)



Ex.

When the axis 1 movement amount is 9000 and the axis 2 movement amount is -3000, positioning address (10000, 4000) is carried out as follows.



■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

- If the movement amount of each axis exceeds "1073741824 (= 2^{30})" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", "Outside linear movement amount range" (error code: 1B15H, 1B16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".)

■Setting positioning data

When using 2-axis linear interpolation control (INC linear 2), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set INC linear 2.)	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Restriction

When the "reference axis speed" is set during 2-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed "[Pr.8] Speed limit value".

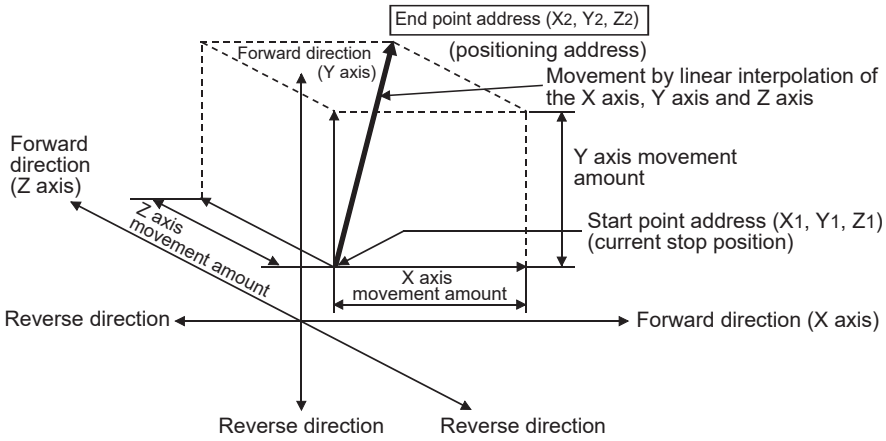
3-axis linear interpolation control

In "3-axis linear interpolation control" ("[Da.2] Control method" = ABS linear 3, INC linear 3), three motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis.
(Refer to ☞ Page 59 Interpolation control for details on interpolation control.)

3-axis linear interpolation control (ABS linear 3)

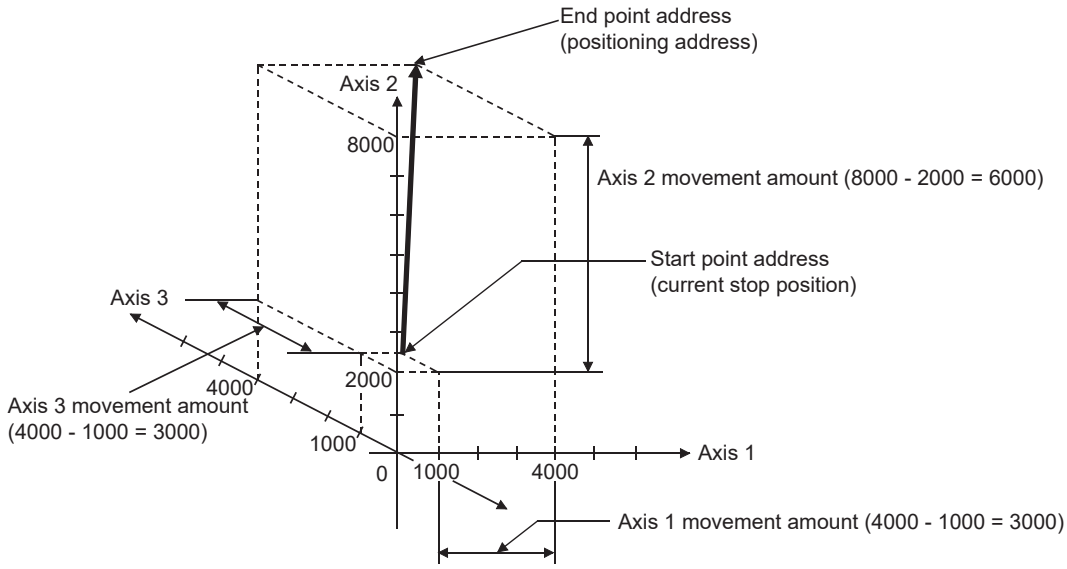
■Operation chart

In the absolute system 3-axis linear interpolation control, the designated 3 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount".



Ex.

When the start point address (current stop position) is (1000, 2000, 1000) and the end point address (positioning address) is (4000, 8000, 4000), positioning is carried out as follows.



■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

- If the movement amount of each axis exceeds "1073741824 (= 2^{30})" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", "Outside linear movement amount range" (error code: 1B15H, 1B16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".)

■Setting positioning data

When using 3-axis linear interpolation control (ABS linear 3), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set ABS linear 3.)	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	◎	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Restriction

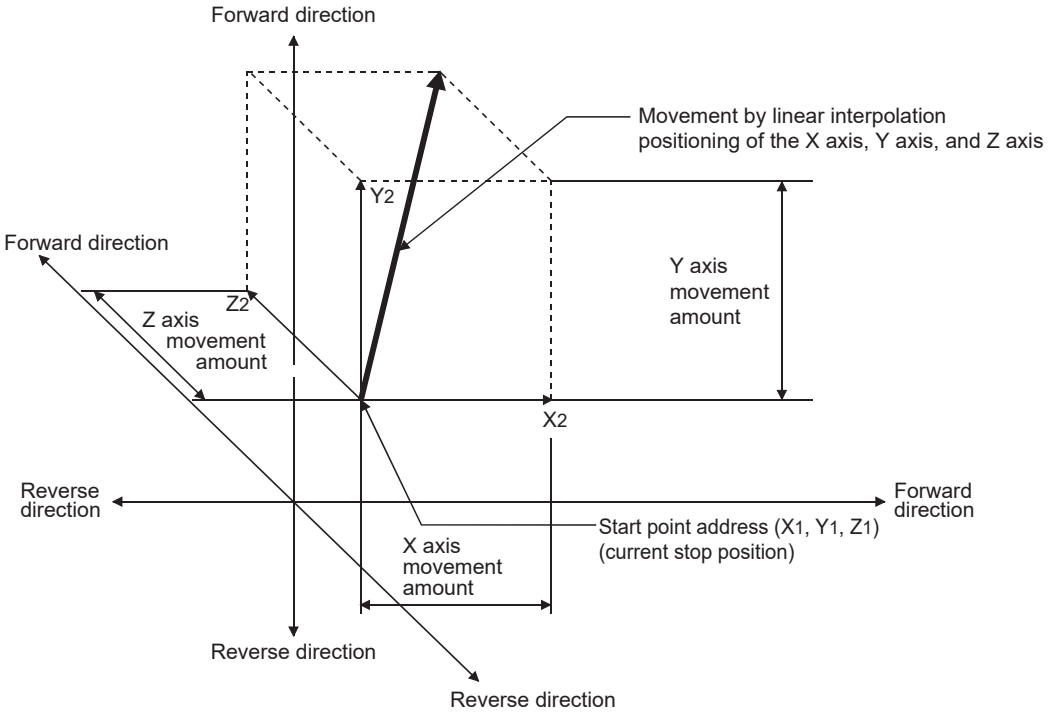
- When the "reference axis speed" is set during 3-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed "[Pr.8] Speed limit value".
- Refer to ☞ Page 59 Interpolation control for the reference axis and interpolation axis combinations.

3-axis linear interpolation control (INC linear 3)

■Operation chart

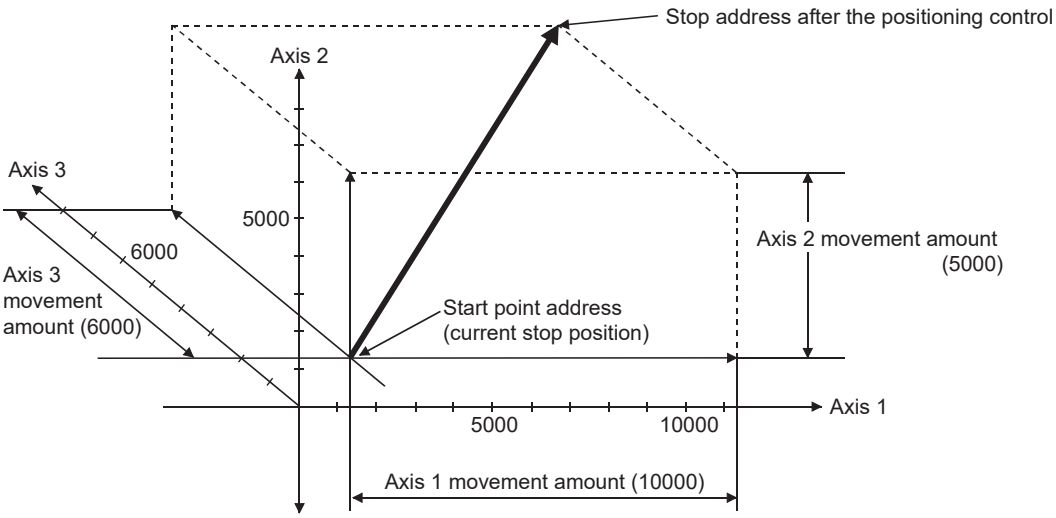
In the incremental system 3-axis linear interpolation control, the designated 3 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

- Positive movement amount: Positioning control to forward direction (Address increase direction)
- Negative movement amount: Positioning control to reverse direction (Address decrease direction)



Ex.

When the axis 1 movement amount is 10000, the axis 2 movement amount is 5000 and the axis 3 movement amount is 6000, positioning is carried out as follows.



■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

- If the movement amount of each axis exceeds "1073741824 (= 2^{30})" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", "Outside linear movement amount range" (error code: 1B15H, 1B16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".)

■Setting positioning data

When using 3-axis linear interpolation control (INC linear 3), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set INC linear 3.)	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	◎	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Restriction

- When the "reference axis speed" is set during 3-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed "[Pr.8] Speed limit value".
- Refer to ☞ Page 59 Interpolation control for the reference axis and interpolation axis combinations.

4-axis linear interpolation control

In "4-axis linear interpolation control" ("[Da.2] Control method" = ABS linear 4, INC linear 4), four motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 59 Interpolation control for details on interpolation control.)

4-axis linear interpolation control (ABS linear 4)

In the absolute system 4-axis linear interpolation control, the designated 4 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount".

■Setting positioning data

When using 4-axis linear interpolation control (ABS linear 4), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set ABS linear 4.)	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	◎	—
[Da.22]	Axis to be interpolated No.3	◎	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Restriction

- When the "reference axis speed" is set during 4-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed "[Pr.8] Speed limit value".
- Refer to ☞ Page 59 Interpolation control for the reference axis and interpolation axis combinations.

4-axis linear interpolation control (INC linear 4)

In the incremental system 4-axis linear interpolation control, the designated 4 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

■Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning operation.

- If the movement amount of each axis exceeds "1073741824 (= 2^{30})", "Outside linear movement amount range" (error code: 1B15H, 1B16H) occurs at a positioning start. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".)

■Setting positioning data

When using 4-axis linear interpolation control (INC linear 4), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set INC linear 4.)	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	◎	—
[Da.22]	Axis to be interpolated No.3	◎	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Restriction

- When the "reference axis speed" is set during 4-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed "[Pr.8] Speed limit value".
- Refer to ☞ Page 59 Interpolation control for the reference axis and interpolation axis combinations.

Fixed-feed control

In "fixed-feed control" ("[Da.2] Control method" = fixed-feed 1, fixed-feed 2, fixed-feed 3, fixed-feed 4), the motor of the specified axis is used to carry out fixed-feed control in a set axis direction.
In fixed-feed control, any remainder of below control accuracy is rounded down to convert the movement amount designated in the positioning data into the command value to servo amplifier.

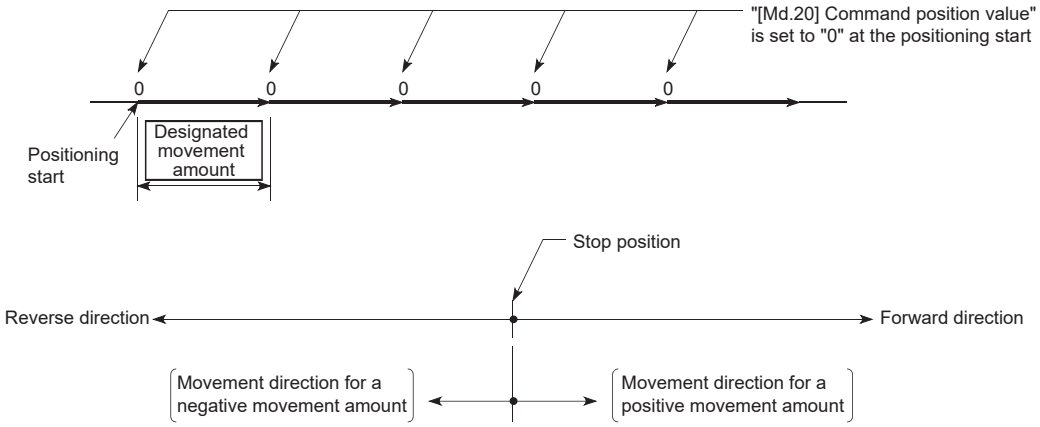
Operation chart

In fixed-feed control, the address ([Md.20] Command position value) of the current stop position (start point address) is set to "0". Positioning is then carried out to a position at the end of the movement amount set in "[Da.6] Positioning address/ movement amount". The movement direction is determined by the movement amount sign.

- Positive movement amount: Positioning control to forward direction (Address increase direction)
- Negative movement amount: Positioning control to reverse direction (Address decrease direction)

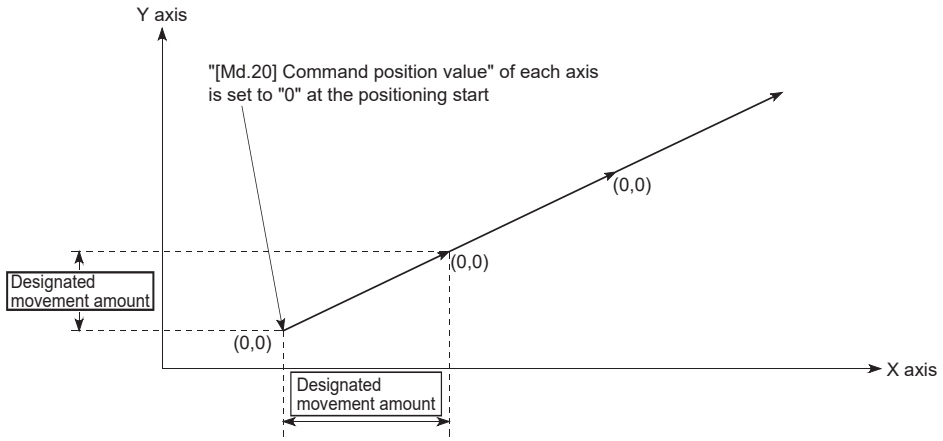
Ex.

1-axis fixed-feed control



Ex.

2-axis fixed-feed control



■Restrictions

- "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur and the operation cannot start if "continuous path control" is set in "[Da.1] Operation pattern". ("Continuous path control" cannot be set in fixed-feed control.)
- "Fixed-feed" cannot be set in "[Da.2] Control method" in the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No.1 is "continuous path control", fixed-feed control cannot be set in positioning data No.2.) "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- In 2- or 3-axis fixed-feed control, if the movement amount of each axis exceeds "1073741824 (= 2^{30})" when "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method", "Outside linear movement amount range" (error code: 1B15H, 1B16H) occurs at a positioning start and the positioning cannot be started. (The maximum movement amount that can be set in "[Da.6] Positioning address/movement amount" is "1073741824 (= 2^{30})".)
- In 4-axis fixed-feed control, set "1: Reference axis speed" in "[Pr.20] Interpolation speed designation method". If "0: Composite speed" is set, "Interpolation mode error" (error code: 1A9AH) occurs and the positioning cannot be started.

Setting positioning data

When using fixed-feed control (fixed-feed 1), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	—*1	—
[Da.21]	Axis to be interpolated No.2	—*1	—
[Da.22]	Axis to be interpolated No.3	—*1	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

*1 To use the 2- to 4-axis fixed-feed control (interpolation), it is required to set the axis used as the interpolation axis.

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Point

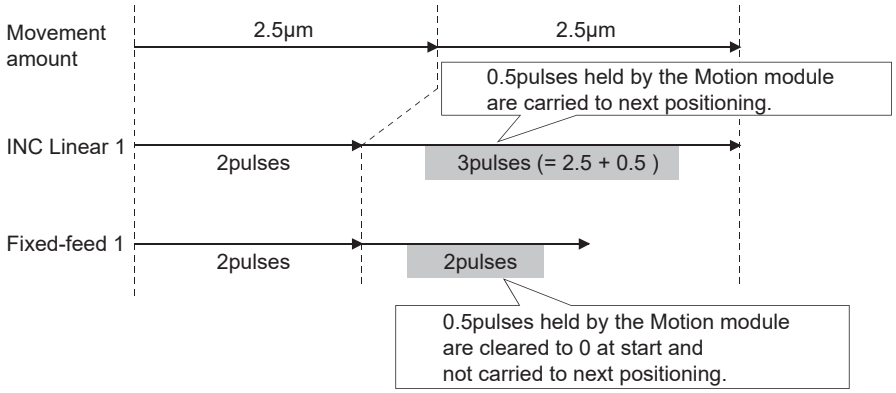
When the movement amount is converted to the actual number of command pulses, a fraction appears after the decimal point, according to the movement amount per pulse. This fraction is normally retained in the Motion module and reflected at the next positioning.

For the fixed-feed control, since the movement distance is maintained constant (= the command number of pulses is maintained constant), the control is carried out after the fraction pulse is cleared to zero at start.

[Accumulation/cutoff for fractional pulses]

When movement amount per pulse is 1.0 [μm] and movement for 2.5 [μm] is executed two times

→ Conversion to command pulses: 2.5 [μm]/1.0 = 2.5 [pulse]



When the "reference axis speed" is set in 2- to 4-axis fixed-feed control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed "[Pr.8] Speed limit value".

Refer to the following for the combination of the reference axis and the interpolation axis.

☞ Page 59 Interpolation control

2-axis circular interpolation control with sub point designation

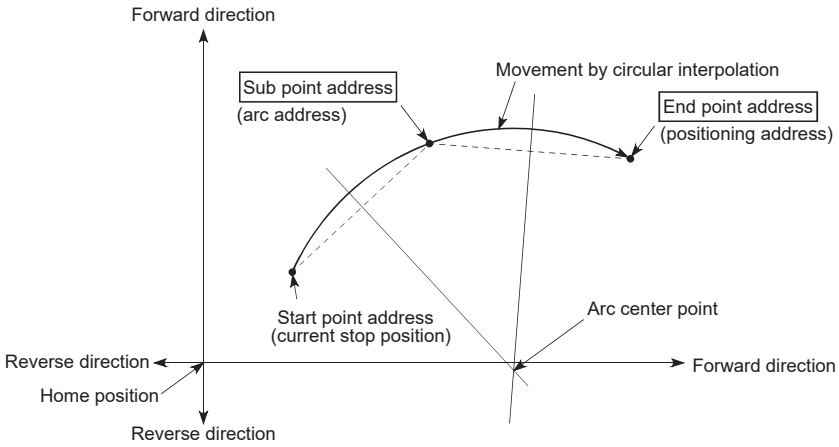
In "2-axis circular interpolation control" ("[Da.2] Control method" = ABS circular sub, INC circular sub), two motors are used to carry out position control in an arc path passing through designated sub points, while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 59 Interpolation control for details on interpolation control.)

2-axis circular interpolation control with sub point designation (ABS circular sub)

■Operation chart

In the absolute system, 2-axis circular interpolation control with sub point designation, positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount", in an arc path that passes through the sub point address set in "[Da.7] Arc address".

The resulting control path is an arc having as its center the intersection point of perpendicular bisectors of a straight line between the start point address (current stop position) and sub point address (arc address), and a straight line between the sub point address (arc address) and end point address (positioning address).



■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis ("mm" and "inch" combinations are possible)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	"Outside radius range" (error code: 1B32H) occurs at the start of the positioning.
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"Sub point setting error" (error code: 1B37H) occurs at the start of the positioning.
Start point address = End point address	"End point setting error" (error code: 1B2BH)
Start point address = Sub point address	"Sub point setting error" (error code: 1B27H)
End point address = Sub point address	"Sub point setting error" (error code: 1B28H)
When the start point address, sub point address, and end point address are on a straight line	"Sub point setting error" (error code: 1B29H)

■Setting positioning data

When using 2-axis circular interpolation control with sub point designation (ABS circular sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set ABS circular sub.)	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	◎	◎
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Restriction

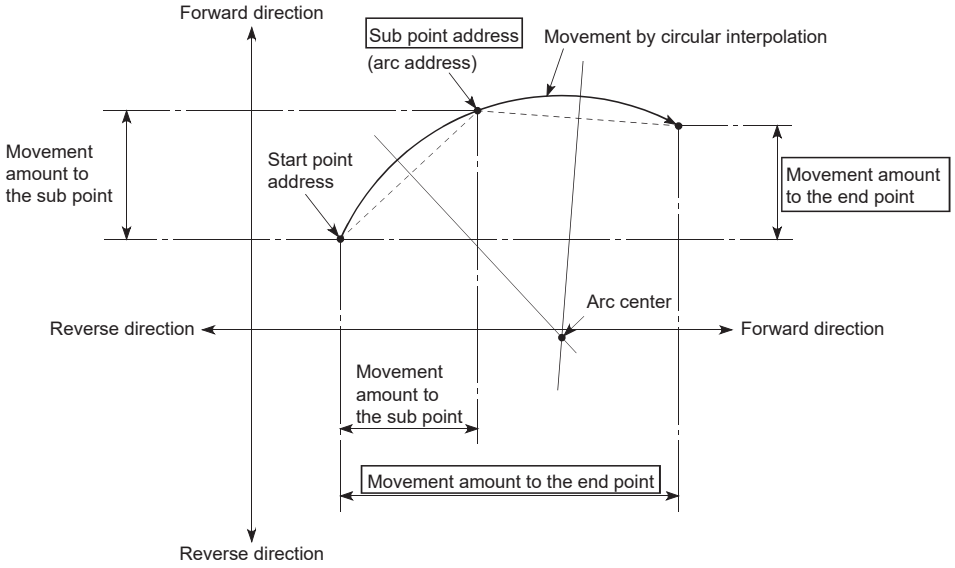
Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Motion module.)

2-axis circular interpolation control with sub point designation (INC circular sub)

■Operation chart

In the incremental system, 2-axis circular interpolation control with sub point designation, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/ movement amount" in an arc path that passes through the sub point address set in "[Da.7] Arc address". The movement direction depends on the sign (+ or -) of the movement amount.

The resulting control path is an arc having as its center the intersection point of perpendicular bisectors of the straight line between the start point address (current stop position) and sub point address (arc address) calculated from the movement amount to the sub point, and a straight line between the sub point address (arc address) and end point address (positioning address) calculated from the movement amount to the end point.



■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis ("mm" and "inch" combinations are possible)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	"Outside radius range" (error code: 1B32H) occurs at the start of the positioning.
When the sub point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"Sub point setting error" (error code: 1B2AH)
When the end point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"End point setting error" (error code: 1B2CH)
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"Sub point setting error" (error code: 1B37H) occurs at the start of the positioning.
Start point address = End point address	"End point setting error" (error code: 1B2BH)
Start point address = Sub point address	"Sub point setting error" (error code: 1B27H)
End point address = Sub point address	"Sub point setting error" (error code: 1B28H)
When the start point address, sub point address, and end point address are on a straight line	"Sub point setting error" (error code: 1B29H)

■Setting positioning data

When using 2-axis circular interpolation control with sub point designation (INC circular sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set INC circular sub.)	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	◎	◎
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

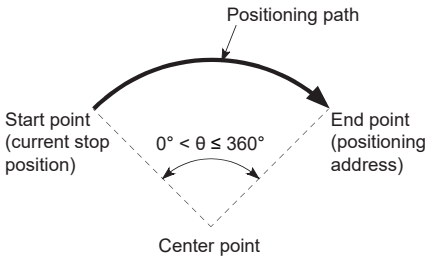
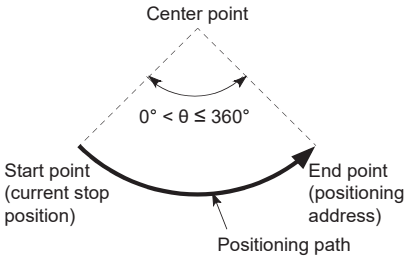
Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Motion module.)

2-axis circular interpolation control with center point designation

In "2-axis circular interpolation control" ("[Da.2] Control method" = ABS circular right, INC circular right, ABS circular left, INC circular left), two motors are used to carry out position control in an arc path having an arc address as a center point, while carrying out interpolation for the axis directions set in each axis. (Refer to ☞ Page 59 Interpolation control for details on interpolation control.)

The following table shows the rotation directions, arc center angles that can be controlled, and positioning paths for the different control methods.

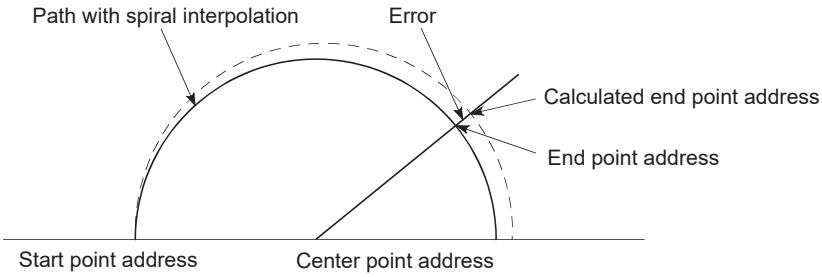
Control method	Rotation direction	Arc center angle that can be controlled	Positioning path
ABS circular right	Clockwise	0° < θ ≤ 360°	
INC circular right			
ABS circular left	Counterclockwise		
INC circular left			

Circular interpolation error compensation

In 2-axis circular interpolation control with center point designation, the arc path calculated from the start point address and center point address may deviate from the position of the end point address set in "[Da.6] Positioning address/movement amount". (Refer to ☞ Page 474 [Pr.41] Allowable circular interpolation error width.)

■Calculated error ≤ "[Pr.41] Allowable circular interpolation error width"

2-axis circular interpolation control to the set end point address is carried out while the error compensation is carried out. (This is called "spiral interpolation".)



In 2-axis circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point. Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

Start point radius > End point radius	As compared with the speed without error, the speed becomes slower as end point address is reached.
Start point radius < End point radius	As compared with the speed without error, the speed becomes faster as end point address is reached.

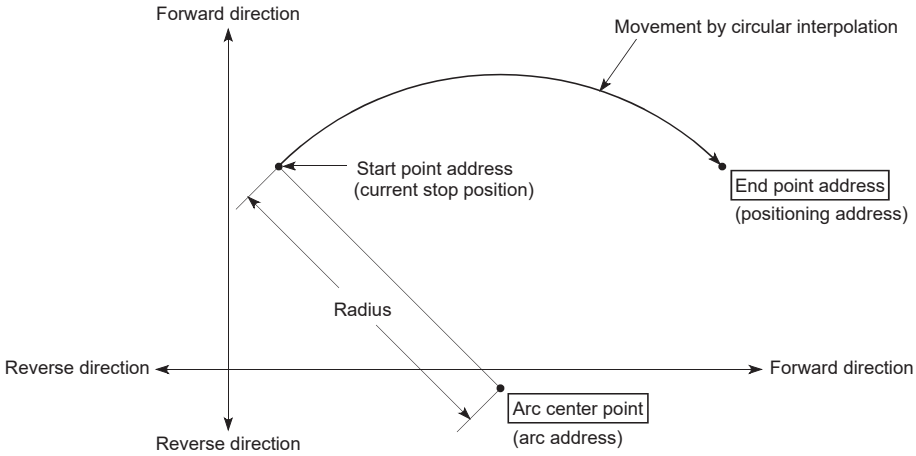
■Calculated error > "[Pr.41] Allowable circular interpolation error width"

At the positioning start, "Large arc error deviation" (error code: 1B17H) will occur and the control will not start. The machine will immediately stop if the error is detected during positioning control.

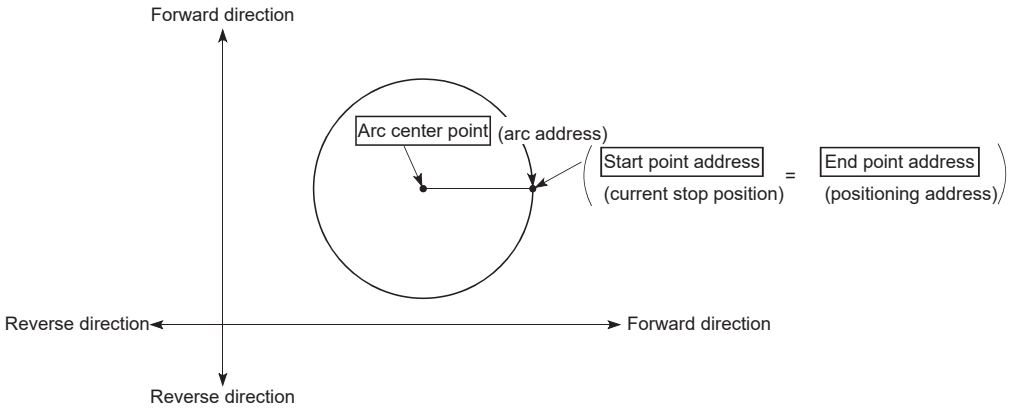
2-axis circular interpolation control with center point designation (ABS circular)

■Operation chart

In the absolute system, 2-axis circular interpolation control with center point designation positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount", in an arc path having as its center the address (arc address) of the center point set in "[Da.7] Arc address".



Positioning of a complete round with a radius from the start point address to the arc center point can be carried out by setting the end point address (positioning address) to the same address as the start point address.



In 2-axis circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point. Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

Start point radius > End point radius	As compared with the speed without error, the speed becomes slower as end point address is reached.
Start point radius < End point radius	As compared with the speed without error, the speed becomes faster as end point address is reached.

■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis ("mm" and "inch" combinations are possible)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	"Outside radius range" (error code: 1B32H) occurs at the start of the positioning.
When the start point address is the same as the center point address	"Center point setting error" (error code: 1B2DH)
When the end point address is the same as the center point address	"Center point setting error" (error code: 1B2EH)
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"Center point setting error" (error code: 1B2FH)

■Setting positioning data

When using 2-axis circular interpolation control with center point designation (ABS circular right, ABS circular left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set ABS circular right or ABS circular left.)	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	◎	◎
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

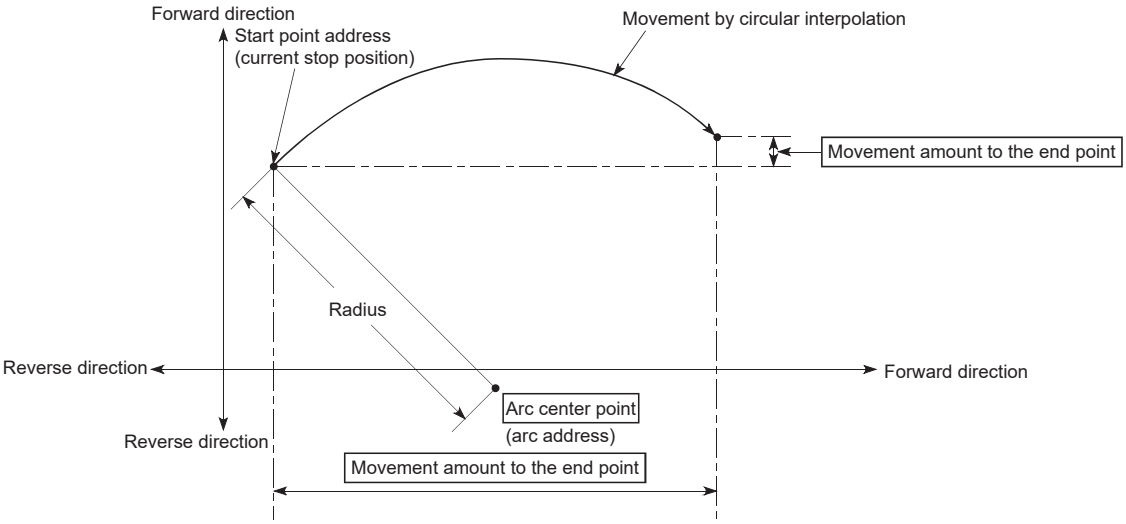
Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Motion module.)

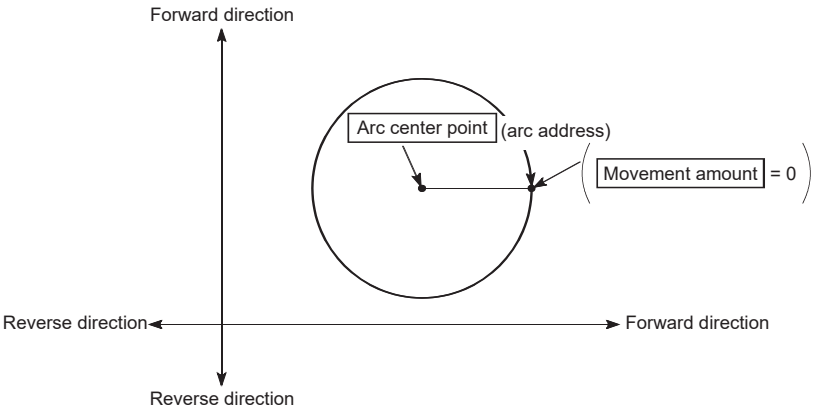
2-axis circular interpolation control with center point designation (INC circular)

■Operation chart

In the incremental system, 2-axis circular interpolation control with center point designation, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/ movement amount", in an arc path having as its center the address (arc address) of the center point set in "[Da.7] Arc address".



Positioning of a complete round with a radius of the distance from the start point address to the arc center point can be carried out by setting the movement amount to "0".



In 2-axis circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point. Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

Start point radius > End point radius	As compared with the speed without error, the speed becomes slower as end point address is reached.
Start point radius < End point radius	As compared with the speed without error, the speed becomes faster as end point address is reached.

■Restrictions

2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "[Pr.1] Unit setting"
- When the units set in "[Pr.1] Unit setting" are different for the reference axis and interpolation axis ("mm" and "inch" combinations are possible)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	"Outside radius range" (error code: 1B32H) occurs at the start of the positioning.
When the end point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"End point setting error" (error code: 1B2CH)
When the start point address is the same as the center point address	"Center point setting error" (error code: 1B2DH)
When the end point address is the same as the center point address	"Center point setting error" (error code: 1B2EH)
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"Center point setting error" (error code: 1B2FH)

■Setting positioning data

When using 2-axis circular interpolation control with center point designation (INC circular right, INC circular left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎ (Set INC circular right or INC circular left.)	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	◎	◎
[Da.7]	Arc address	◎	◎
[Da.8]	Command speed	◎	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	◎	—
[Da.21]	Axis to be interpolated No.2	—	—
[Da.22]	Axis to be interpolated No.3	—	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

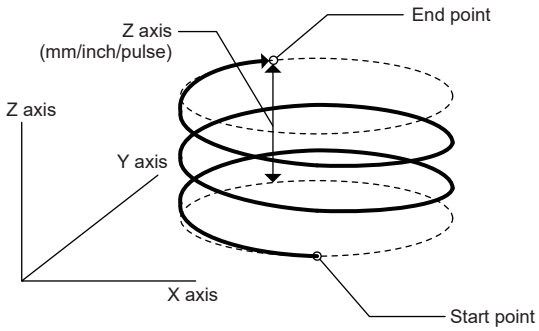
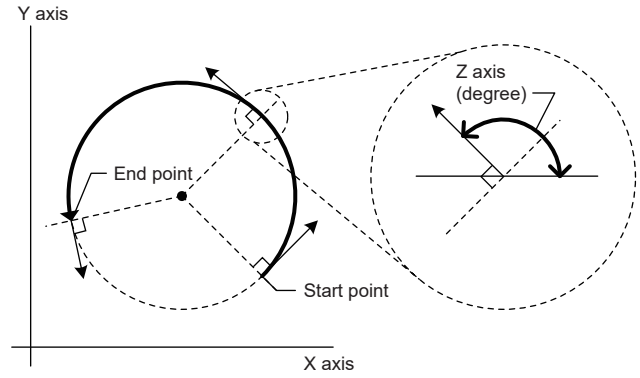
Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Motion module.)

3-axis helical interpolation control with sub point designation

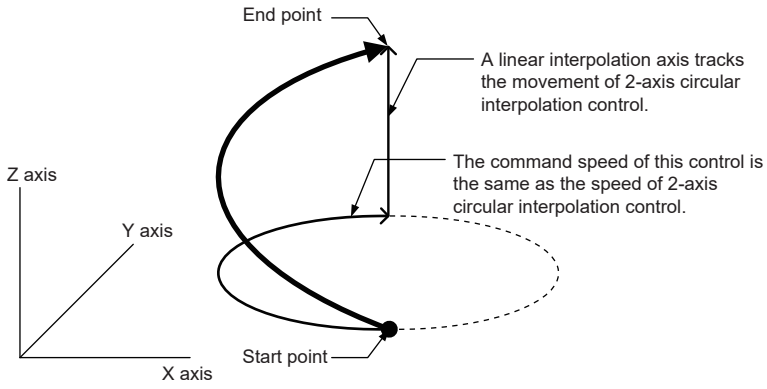
In "3-axis helical interpolation control" ("[Da.2] Control method" = ABS helical sub, INC helical sub), three motors are used to carry out the circular interpolation control of 2 axes. The remaining axis is used for "helical control" or "tangent control and normal line control".

X axis: Reference axis, Y axis: Circular interpolation axis, Z axis: Linear interpolation axis

Control details	Control overview	Positioning path
Helical control		Draws a helical path by following the linear interpolation axis (linear control) to the 2-axis circular interpolation control. ■Unit setting • Reference axis: mm/inch, pulse • Circular interpolation axis: The same as the reference axis • Linear interpolation axis: mm/inch, pulse
Tangent control/ Normal line control		Keeps the direction of the workpiece against the center point of the 2-axis circular interpolation control by following the value of the linear interpolation axis (degree) to the 2-axis circular interpolation control. The figure shown on the left is an example in which the direction of the workpiece is kept to the direction of the tangent or normal line. ■Unit setting • Reference axis: mm/inch, pulse • Circular interpolation axis: The same as the reference axis • Linear interpolation axis: degree

Speed of the 3-axis helical interpolation control

The 2-axis circular interpolation control (Reference axis—Composite speed of the circular interpolation axis) is the target of the command speed of the 3-axis helical interpolation control.

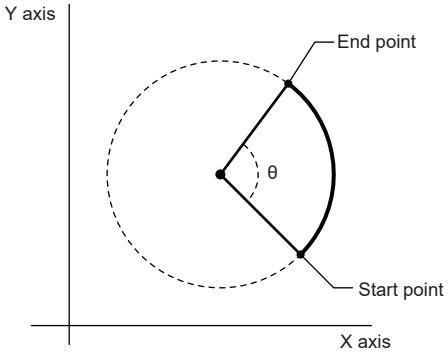


Point

- When the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".
- When "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method" or "1: Composite speed" is set in "[Da.29] Interpolation speed designation method", the command speed of ABS3/INC3 is the composite speed of the three axes (X axis—Y axis—Z axis). The command speed of the 3-axis helical interpolation control is the composite speed of the two axes (X axis—Y axis). When the continuous path control is performed using ABS3/INC3 and the 3-axis helical interpolation control, the movement speed of the workpiece may change at the positioning data switching; therefore, adjust the command speed not to shake the workpiece.

Rotation angle of circular interpolation axis (X axis-Y axis)

The rotation angle of the circular interpolation axis in the 3-axis helical interpolation control is as follows.



Number of pitch	Control of the circular interpolation axis
0	θ°
1	360° + θ°
2	720° + θ°
⋮	⋮
n	360° × n + θ°
⋮	⋮
999	360° × 999 + θ°

Restriction

When "degree" is set to "[Pr.1] Unit setting", the positioning range of the absolute system is 0 to 359.99999°. If the rotation angle is 360° or larger in the circular interpolation axis (X axis—Y axis), the tangent control and normal line control cannot be performed because 360° or larger angle cannot be set for "[Da.6] Positioning address/movement amount" of the linear interpolation axis (Z axis: degree). To perform the tangent control or normal line control with the rotation of 360° or larger angle, use the incremental system.

Rotation direction when the linear interpolation axis (Z axis) is set in degrees

When "degree" is set to "[Pr.1] Unit setting" for the linear interpolation axis, the rotation direction is determined depending on the axis control data in "[Cd.40] ABS direction in degrees" of the reference axis. To set a rotation direction for each positioning data, set "[Da.28] ABS direction in degrees" of each positioning data.

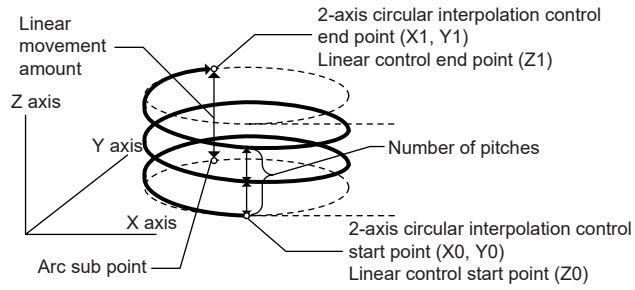
3-axis helical interpolation control with sub point designation (ABS helical sub)

■Operation chart

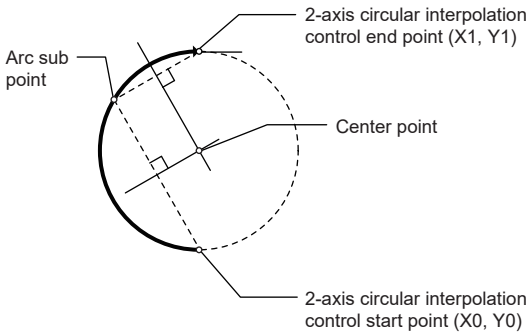
In the absolute system and 3-axis helical interpolation control with sub point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position indicated with the arc end point address (X1 and Y1) and the linear interpolation axis end point address (Z1) set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches" of the linear interpolation axis while the circular interpolation through the sub point address (sub point address) set in "[Da.7] Arc address" is performed.

The resulting path is an arc whose center is the intersection point of the perpendicular bisectors of a straight line between the start point address (current stop position) and sub point address (arc address) and a straight line between the sub point address (arc address) and end point address (positioning address).

Operation chart



Top view of the circular interpolation



■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

In the following case, an error occurs and the positioning will not start. During the positioning control, the operation stops immediately at the detection of the error.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	"Outside radius range" (error code: 1B32H) occurs at the start of the positioning.
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"Sub point setting error" (error code: 1B37H) occurs at the start of the positioning.
Start point address = End point address	"End point setting error" (error code: 1B2BH)
Start point address = Sub point address	"Sub point setting error" (error code: 1B27H)
End point address = Sub point address	"Sub point setting error" (error code: 1B28H)
When the start point address, sub point address, and end point address are on a straight line	"Sub point setting error" (error code: 1B29H)

■Positioning data to be set

When using 3-axis helical interpolation control with sub point designation (ABS helical sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting requirement of reference axis	Setting requirement of circular interpolation axis*1	Setting requirement of linear interpolation axis*2
[Da.1]	Operation pattern	◎	—	—
[Da.2]	Control method	◎(Set ABS helical sub.)	—	—
[Da.3]	Acceleration time No.	◎	—	—
[Da.4]	Deceleration time No.	◎	—	—
[Da.6]	Positioning address/movement amount	◎	◎	◎
[Da.7]	Arc address	◎	◎	—
[Da.8]	Command speed	◎	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—	◎*3
[Da.20]	Axis to be interpolated No.1	◎	—	—
[Da.21]	Axis to be interpolated No.2	◎	—	—
[Da.22]	Axis to be interpolated No.3	—	—	—
[Da.27]	M code ON signal output timing	○	—	—
[Da.28]	ABS direction in degrees	○	—	—
[Da.29]	Interpolation speed designation method	△	—	—

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3 Set the number of pitches for the linear interpolation axis.

Refer to the following for the setting details.

☞ Page 489 Positioning data

Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Motion module.)

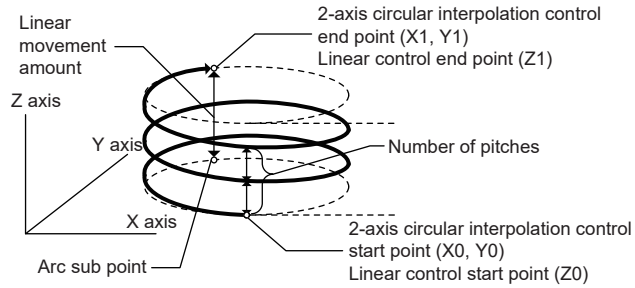
3-axis helical interpolation control with sub point designation (INC helical sub)

■Operation chart

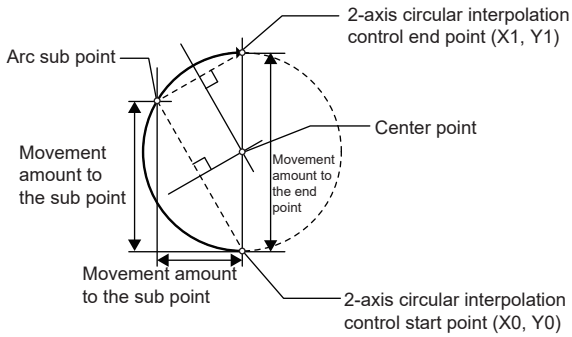
In the incremental system and 3-axis helical interpolation control with sub point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position (X1, Y1, Z1) for the movement amount set in "[Da.6] Positioning address/ movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear interpolation axis while the circular interpolation through the sub point address (sub point address) set in "[Da.7] Arc address" is performed. The movement direction is determined by the sign of the movement amount.

The resulting path is an arc whose center is the intersection point of the perpendicular bisectors of a straight line between the start point address (current stop position) and the sub point address (arc address) calculated from the movement amount to the sub point, and a straight line between the sub point address (arc address) and the end point address (positioning address) calculated from the movement amount to the end point.

Operation chart



Top view of the circular interpolation



■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	"Outside radius range" (error code: 1B32H) occurs at the start of the positioning.
When the sub point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"Sub point setting error" (error code: 1B2AH) occurs at the start of the positioning.
When the end point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"End point setting error" (error code: 1B2CH) occurs at the start of the positioning.
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"Sub point setting error" (error code: 1B37H) occurs at the start of the positioning.
Start point address = End point address	"End point setting error" (error code: 1B2BH)
Start point address = Sub point address	"Sub point setting error" (error code: 1B27H)
End point address = Sub point address	"Sub point setting error" (error code: 1B28H)
When the start point address, sub point address, and end point address are on a straight line	"Sub point setting error" (error code: 1B29H)

■Positioning data to be set

When using the 3-axis helical interpolation control with sub point designation (INC helical sub), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting requirement of reference axis	Setting requirement of circular interpolation axis*1	Setting requirement of linear interpolation axis*2
[Da.1]	Operation pattern	◎	—	—
[Da.2]	Control method	◎(Set INC helical sub.)	—	—
[Da.3]	Acceleration time No.	◎	—	—
[Da.4]	Deceleration time No.	◎	—	—
[Da.6]	Positioning address/movement amount	◎	◎	◎
[Da.7]	Arc address	◎	◎	—
[Da.8]	Command speed	◎	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—	◎*3
[Da.20]	Axis to be interpolated No.1	◎	—	—
[Da.21]	Axis to be interpolated No.2	◎	—	—
[Da.22]	Axis to be interpolated No.3	—	—	—
[Da.27]	M code ON signal output timing	○	—	—
[Da.28]	ABS direction in degrees	○	—	—
[Da.29]	Interpolation speed designation method	△	—	—

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3 Set the number of pitches for the linear interpolation axis.

Refer to the following for the setting details.

☞ Page 489 Positioning data

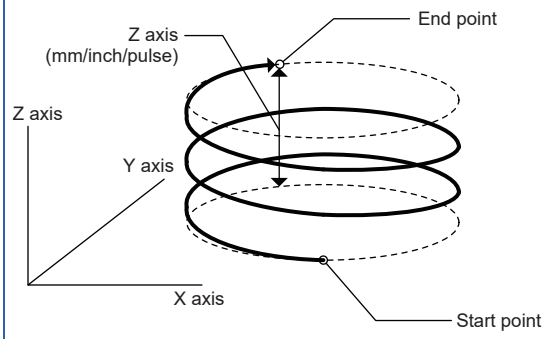
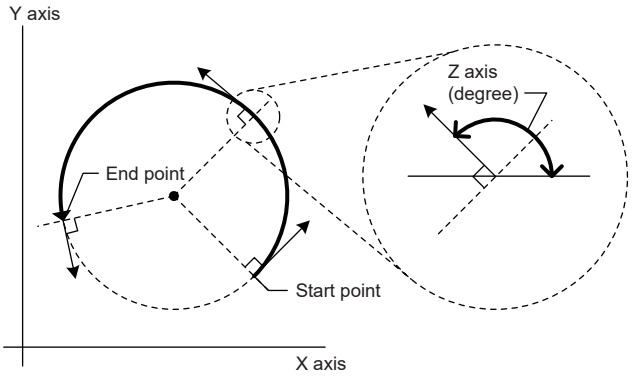
Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Motion module.)

3-axis helical interpolation control with center point designation

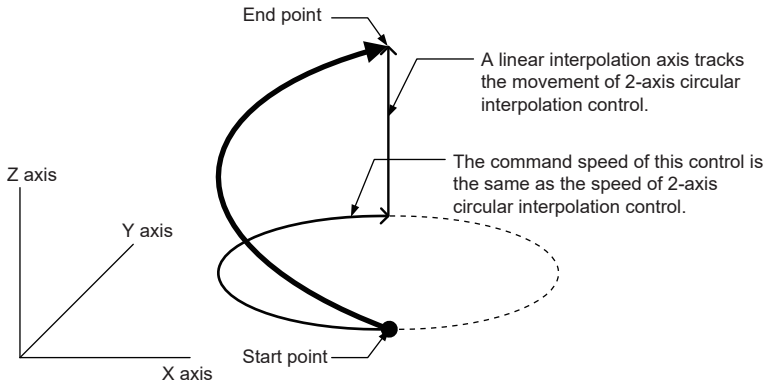
In "3-axis helical interpolation control" ("[Da.2] Control method" = ABS helical right, INC helical right, ABS helical left, INC helical left), three motors are used to carry out the circular interpolation control of 2 axes. The remaining axis is used for "helical control" or "tangent control and normal line control".

X axis: Reference axis, Y axis: Circular interpolation axis, Z axis: Linear interpolation axis

Control details	Control overview	Positioning path
Helical control		Draws a helical path by following the linear interpolation axis (linear control) to the 2-axis circular interpolation control. ■Unit setting • Reference axis: mm/inch, pulse • Circular interpolation axis: The same as the reference axis • Linear interpolation axis: mm/inch, pulse
Tangent control/ Normal line control		Keeps the direction of the workpiece against the center point of the 2-axis circular interpolation control by following the value of the linear interpolation axis (degree) to the 2-axis circular interpolation control. The figure shown on the left is an example in which the direction of the workpiece is kept to the direction of the tangent or normal line. ■Unit setting • Reference axis: mm/inch, pulse • Circular interpolation axis: The same as the reference axis • Linear interpolation axis: degree

Speed of the 3-axis helical interpolation control

The 2-axis circular interpolation control (Reference axis—Composite speed of the circular interpolation axis) is the target of the command speed of the 3-axis helical interpolation control.



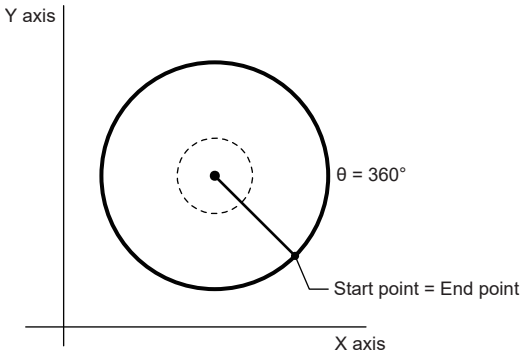
Point

- When the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".
- When "0: Composite speed" is set in "[Pr.20] Interpolation speed designation method" or "1: Composite speed" is set in "[Da.29] Interpolation speed designation method", the command speed of ABS3/INC3 is the composite speed of the three axes (X axis—Y axis—Z axis). The command speed of the 3-axis helical interpolation control is the composite speed of the two axes (X axis—Y axis). When the continuous path control is performed using ABS3/INC3 and the 3-axis helical interpolation control, the movement speed of the workpiece may change at the positioning data switching; therefore, adjust the command speed not to shake the workpiece.

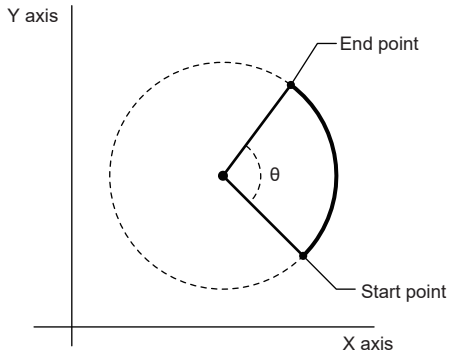
Rotation angle of circular interpolation axis (X axis-Y axis)

The rotation angle of the circular interpolation axis in the 3-axis helical interpolation control is as follows.

True circle



Other than the true circle



Number of pitch	Control of the circular interpolation axis	
	True circle	Other than the true circle
0	360°	θ°
1		360° + θ°
2	720°	720° + θ°
⋮	⋮	⋮
n	360°×n	360° × n + θ°
⋮	⋮	⋮
999	360°×999	360° × 999 + θ°

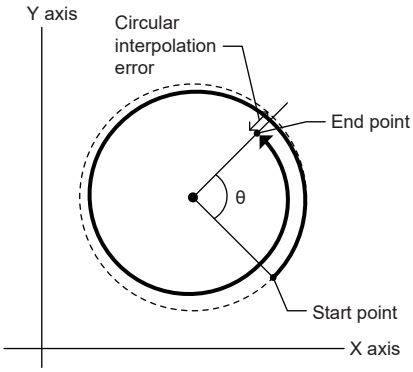
The setting of the true circle is available only when "Start point = End point" is set for the 3-axis helical interpolation (ABS/INC, center point).

Restriction

When "degree" is set to "[Pr.1] Unit setting", the positioning range of the absolute system is 0 to 359.99999°. If the rotation angle is 360° or larger in the circular interpolation axis (X axis—Y axis), the tangent control and normal line control cannot be performed because 360° or larger angle cannot be set for "[Da.6] Positioning address/movement amount" of the linear interpolation axis (Z axis: degree). To perform the tangent control or normal line control with the rotation of 360° or larger angle, use the incremental system.

Error compensation of the circular interpolation axis

In the 3-axis helical interpolation control with center point designation, as well as the 2-axis circular interpolation control, "[Pr.41] Allowable circular interpolation error width" is enabled. When a circular interpolation error occurs, the path of the 2-axis circular interpolation control (X axis—Y axis) becomes spiral as shown below.



Rotation direction when the linear interpolation axis (Z axis) is set in degrees

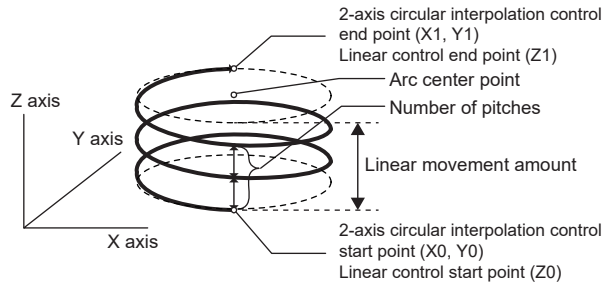
When "degree" is set to "[Pr.1] Unit setting" for the linear interpolation axis, the rotation direction is determined depending on the axis control data in "[Cd.40] ABS direction in degrees" of the reference axis. To set a rotation direction for each positioning data, set "[Da.28] ABS direction in degrees" of each positioning data.

3-axis helical interpolation control with center point designation (ABS helical right, ABS helical left)

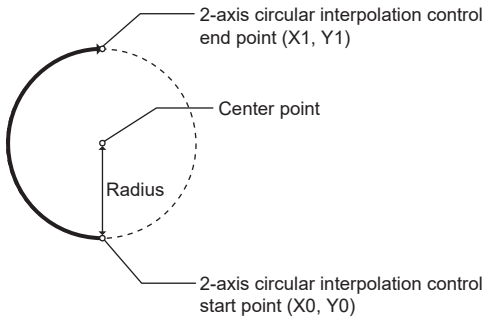
■Operation chart

In the absolute system and 3-axis helical interpolation control with center point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position indicated with the arc end point address (X1 and Y1) and the linear interpolation axis end point address (Z1) set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches" of the linear interpolation axis while the circular interpolation of the circle whose center is the center point address (arc address) set in "[Da.7] Arc address" is performed.

Operation chart

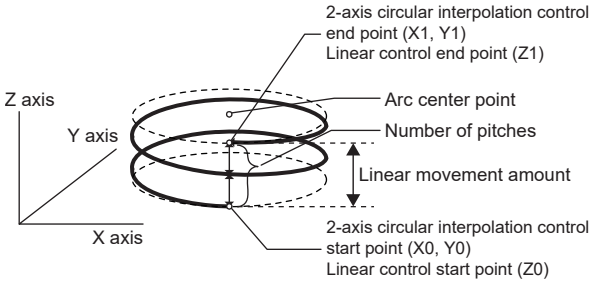


Top view of the circular interpolation

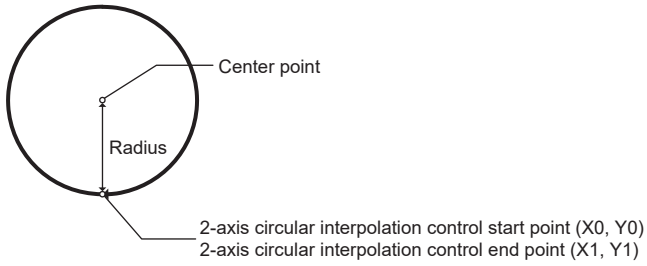


If the end point address (positioning address) of the circular interpolation axis is set to be the same as the start point address, the positioning of a true circle whose radius is from the start point address to the center point of the arc can be performed.

Operation chart



Top view of the circular interpolation



■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

In the following case, an error occurs and the positioning will not start. During the positioning control, the operation stops immediately at the detection of the error.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	"Outside radius range" (error code: 1B32H) occurs at the start of the positioning.
Start point address = Center point address	"Center point setting error" (error code: 1B2DH)
End point address = Center point address	"Center point setting error" (error code: 1B2EH)
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"Center point setting error" (error code: 1B2FH)

■Positioning data to be set

When using the 3-axis helical interpolation control with center point designation (ABS helical right, ABS helical left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting requirement of reference axis	Setting requirement of circular interpolation axis[*1]	Setting requirement of linear interpolation axis[*2]
[Da.1]	Operation pattern	◎	—	—
[Da.2]	Control method	◎(Set ABS helical right or ABS helical left.)	—	—
[Da.3]	Acceleration time No.	◎	—	—
[Da.4]	Deceleration time No.	◎	—	—
[Da.6]	Positioning address/movement amount	◎	◎	◎
[Da.7]	Arc address	◎	◎	—
[Da.8]	Command speed	◎	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—	◎[*3]
[Da.20]	Axis to be interpolated No.1	◎	—	—
[Da.21]	Axis to be interpolated No.2	◎	—	—
[Da.22]	Axis to be interpolated No.3	—	—	—
[Da.27]	M code ON signal output timing	○	—	—
[Da.28]	ABS direction in degrees	○	—	—
[Da.29]	Interpolation speed designation method	△	—	—

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3 Set the number of pitches for the linear interpolation axis.

Refer to the following for the setting details.

☞ Page 489 Positioning data

Restriction

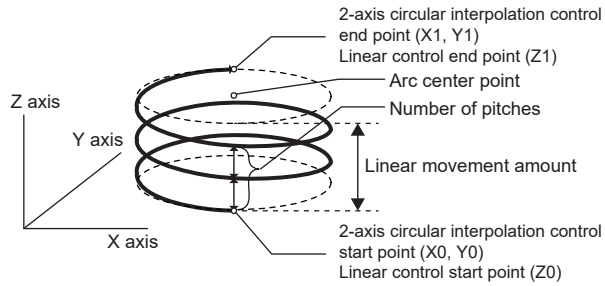
Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Motion module.)

3-axis helical interpolation control with center point designation (INC helical right, INC helical left)

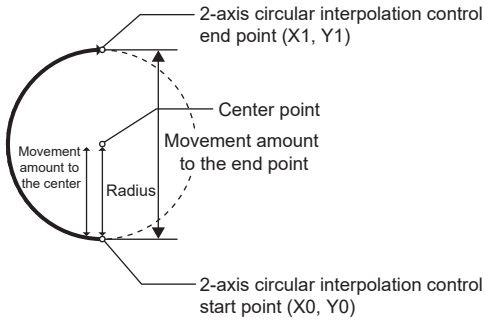
■Operation chart

In the incremental system and 3-axis helical interpolation control with center point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position (X1, Y1, Z1) for the movement amount set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/ Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear interpolation axis while the circular interpolation of the circle whose center is the center point address (arc address) set in "[Da.7] Arc address" is performed.

Operation chart

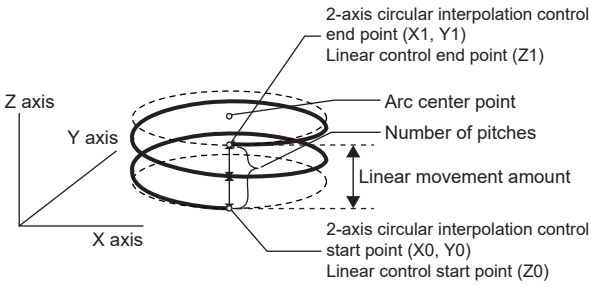


Top view of the circular interpolation

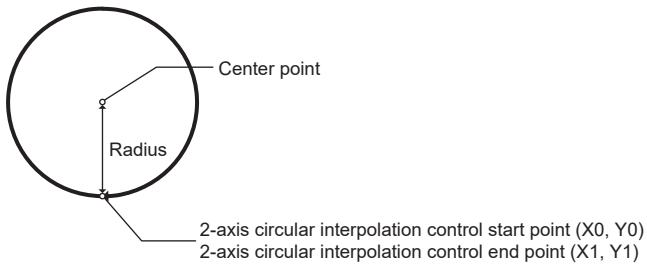


If "0" is set for the movement amount of the circular interpolation axis, the positioning of a true circle whose radius is from the start point address to the center point address of the arc can be performed.

Operation chart



Top view of the circular interpolation



■Restrictions

In the following cases, the 3-axis helical interpolation control cannot be set.

- When "degree" is set in "[Pr.1] Unit setting" of the reference axis and circular interpolation axis
- When the units set in "[Pr.1] Unit setting" are different between the reference axis and circular interpolation axis (The combination of "mm" and "inch" is possible.)
- When "reference axis speed" is set in "[Pr.20] Interpolation speed designation method"
- When the value out of the range of "0 to 999" is set in the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches")

In the following case, an error occurs and the positioning will not start. During the positioning control, the operation stops immediately at the detection of the error.

Error cause	Error code
When the radius exceeds 536870912 (= 2^{29}) (The maximum radius for which the 2-axis circular interpolation control is possible is 536870912 (= 2^{29}).)	"Outside radius range" (error code: 1B32H) occurs at the start of the positioning.
When the end point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"End point setting error" (error code: 1B2CH) occurs at the start of the positioning.
Start point address = Center point address	"Center point setting error" (error code: 1B2DH)
End point address = Center point address	"Center point setting error" (error code: 1B2EH)
When the center point address is out of the range of -2147483648 (-2^{31}) to 2147483647 (2^{31}-1)	"Center point setting error" (error code: 1B2FH)

■Positioning data to be set

When using the 3-axis helical interpolation control with center point designation (INC helical right, INC helical left), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting requirement of reference axis	Setting requirement of circular interpolation axis*1	Setting requirement of linear interpolation axis*2
[Da.1]	Operation pattern	◎	—	—
[Da.2]	Control method	◎(Set INC helical right or INC helical left.)	—	—
[Da.3]	Acceleration time No.	◎	—	—
[Da.4]	Deceleration time No.	◎	—	—
[Da.6]	Positioning address/movement amount	◎	◎	◎
[Da.7]	Arc address	◎	◎	—
[Da.8]	Command speed	◎	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.	○	—	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—	◎*3
[Da.20]	Axis to be interpolated No.1	◎	—	—
[Da.21]	Axis to be interpolated No.2	◎	—	—
[Da.22]	Axis to be interpolated No.3	—	—	—
[Da.27]	M code ON signal output timing	○	—	—
[Da.28]	ABS direction in degrees	○	—	—
[Da.29]	Interpolation speed designation method	△	—	—

*1 Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2 Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3 Set the number of pitches for the linear interpolation axis.

Refer to the following for the setting details.

☞ Page 489 Positioning data

Restriction

Set a value in "[Da.8] Command speed" so that the speed of each axis does not exceed the value in "[Pr.8] Speed limit value". (The speed limit does not function for the speed calculated by the Motion module.)

Speed control

In "speed control" ("[Da.2] Control method" = Forward run: speed 1 to 4, Reverse run: speed 1 to 4), control is carried out in the axis direction in which the positioning data has been set by continuously outputting pulses for the speed set in "[Da.8] Command speed" until the input of a stop command.

The eight types of speed control includes "Forward run: speed 1 to 4" in which the control starts in the forward run direction, and "Reverse run: speed 1 to 4" in which the control starts in the reverse run direction.

Refer to the following for the combination of the reference axis and the interpolation axis.

☞ Page 59 Interpolation control

Operation chart

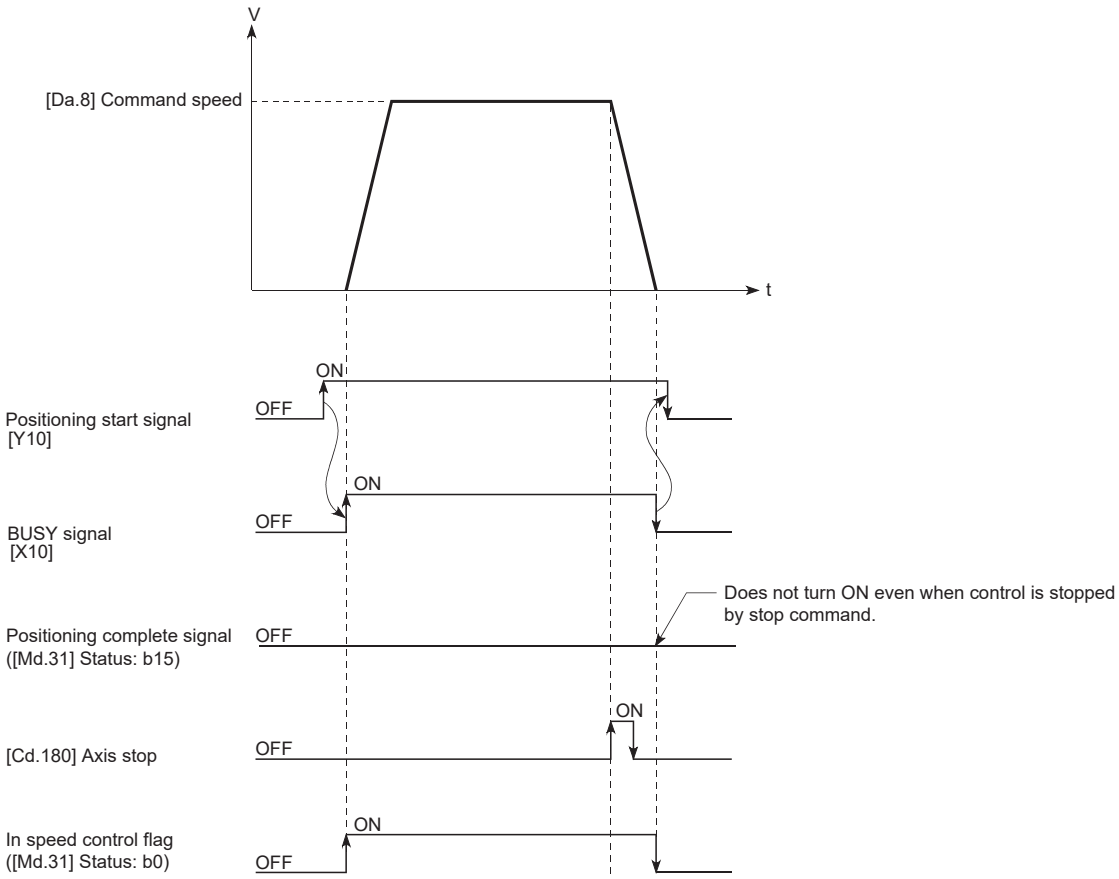
The following charts show the operation timing for 1-axis speed control with axis 1 and 2-axis speed control with axis 2 when the axis 1 is set as the reference axis.

The "in speed control" flag ([Md.31] Status: b0) is turned ON during speed control.

The "Positioning complete signal" is not turned ON.

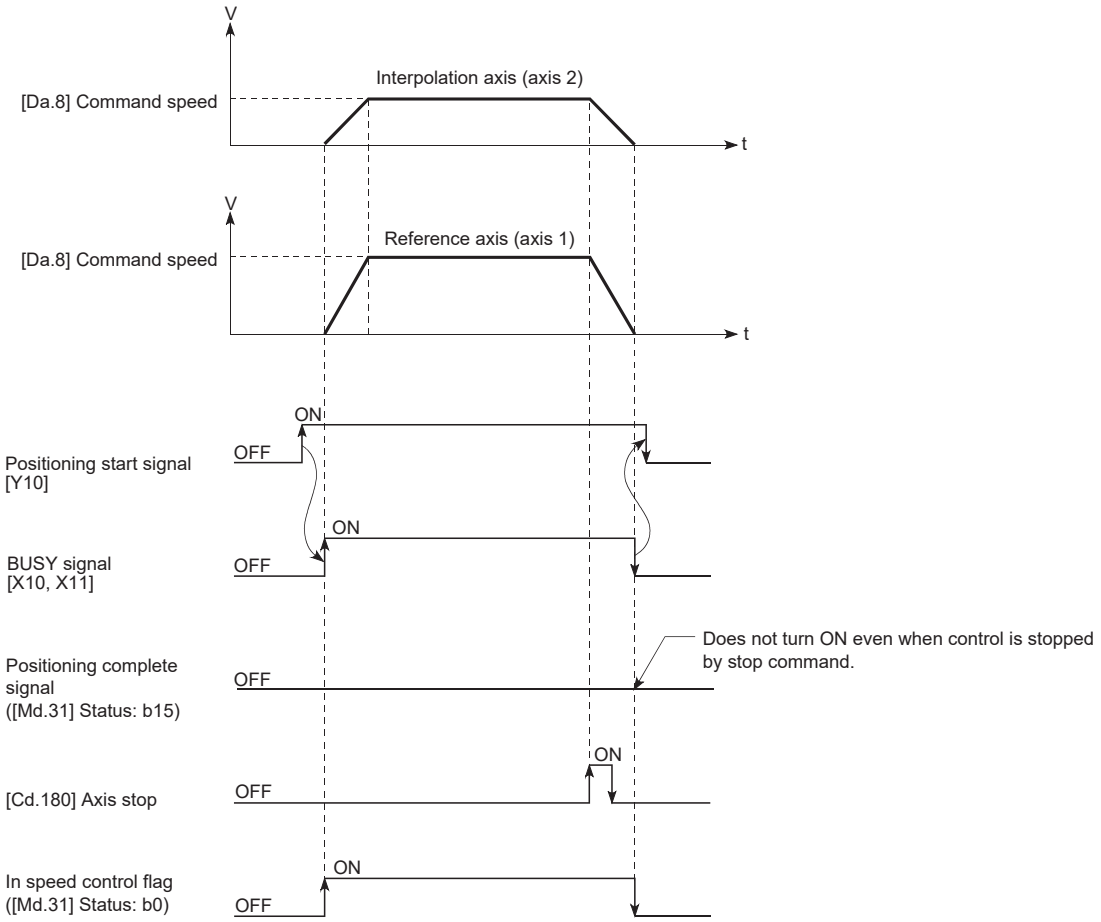
■1-axis speed control

Ex.



■2-axis speed control

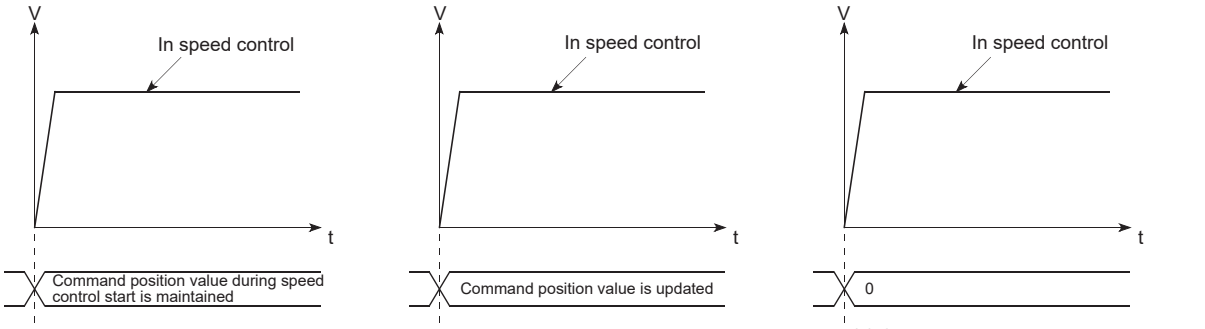
Ex.



Command position value

The following table shows "[Md.20] Command position value" during speed control corresponding to the "[Pr.21] Command position value during speed control" settings. (However, the parameters use the set value of the reference axis.)

"[Pr.21] Command position value during speed control" setting	[Md.20] Command position value
0: Do not update command position value	The command position value at speed control start is maintained.
1: Update command position value	The command position value is updated.
2: Zero clear command position value	The command position value is fixed at 0.



(a) Command position value not updated (b) Command position value updated (c) Command position value zero cleared

Restrictions

- Set "Positioning complete" in "[Da.1] Operation pattern". "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern". ("Continuous positioning control" and "continuous path control" cannot be set in speed control.)
- Set the WITH mode in the output timing when using an M code. The M code will not be output, and the M code ON signal will not turn ON if the AFTER mode is set.
- "No command speed" (error code: 1B12H to 1B14H) will occur if the current speed (-1) is set in "[Da.8] Command speed".
- Set "1: Reference axis speed" in "[Pr.20] Interpolation speed designation method". If "0: Composite speed" is set, "Interpolation mode error" (error code: 1A9AH) occurs and the positioning will not start.
- The software stroke limit check is not carried out if the control unit is set to "degree".

■Restriction for the speed limit value

When either of control axes (1 to 4 axes) exceeds the speed limit, that axis is controlled with the speed limit value.
The speeds of the other axes are limited at the ratios of "[Da.8] Command speed".

Ex.

When the axis 1 and the axis 2 are used

Setting item		Axis 1 setting	Axis 2 setting
[Pr.8]	Speed limit value	4000.00mm/min	5000.00mm/min
[Da.8]	Command speed	8000.00mm/min	6000.00mm/min

With the settings shown above, the operation speed in speed control is as follows.

- Axis 1: 4000.00mm/min (Speed is limited by [Pr.8].)
- Axis 2: 3000.00mm/min (Speed is limited at a ratio of an axis 1 command speed to an axis 2 command speed.)

Operation runs at speed 1 when a reference axis speed is less than 1 as a result of speed limit. In addition, when the bias speed is set, the set value will be the minimum speed.

Positioning data to be set

When using speed control (forward run: speed 1 to 4, reverse run: speed 1 to 4), set the following positioning data.

◎: Always set, ○: Set as required, △: Setting restricted, —: Setting not required

Setting item		Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	◎	—
[Da.2]	Control method	◎	—
[Da.3]	Acceleration time No.	◎	—
[Da.4]	Deceleration time No.	◎	—
[Da.6]	Positioning address/movement amount	—	—
[Da.7]	Arc address	—	—
[Da.8]	Command speed	◎	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	—	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○	—
[Da.20]	Axis to be interpolated No.1	—*1	—
[Da.21]	Axis to be interpolated No.2	—*1	—
[Da.22]	Axis to be interpolated No.3	—*1	—
[Da.27]	M code ON signal output timing	○	—
[Da.28]	ABS direction in degrees	○	—
[Da.29]	Interpolation speed designation method	△	—

*1 When using 2- to 4-axis speed control, it is necessary to set the axis to be used as the interpolation axis.

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Speed-position switching control (INC mode)

In "speed-position switching control (INC mode)" ("[Da.2] Control method" = Forward run: speed/position, Reverse run: speed/position), the pulses of the speed set in "[Da.8] Command speed" are kept output on the axial direction set to the positioning data. When the "speed-position switching signal" is input, position control of the movement amount set in "[Da.6] Positioning address/movement amount" is exercised.

"Speed-position switching control (INC mode)" is available in two different types: "forward run: speed/position" which starts the axis in the forward run direction and "reverse run: speed/position" which starts the axis in the reverse run direction.

Use the detailed parameter 1 "[Pr.81] Speed-position function selection" with regard to the choice for "speed-position switching control (INC mode)".

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.81]	Speed-position function selection	0	Speed-position switching control (INC mode)	34+150n

If the set value is other than 0 and 2, it is regarded as 0 and operation is performed in the INC mode.

For details of the setting, refer to the following.

☞ Page 448 Basic Setting

Switching over from speed control to position control

- The control is selected the switching method from speed control to position control by the setting value of "[Cd.45] Speed-position switching device selection".

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.45]	Speed-position switching device selection	→	The device used for speed-position switching is selected. 0: Use the external command signal for switching from speed control to position control 1: Use the proximity dog signal for switching from speed control to position control 2: Use "[Cd.46] Speed-position switching command" for switching from speed control to position control	4366+100n

The switching is performed by using the following device when "2" is set.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.46]	Speed-position switching command	1	Switch from speed control to position control	4367+100n

- "[Cd.24] Speed-position switching enable flag" must be turned ON to switch over from speed control to position control. (If "[Cd.24] Speed-position switching enable flag" turns ON after the speed-position switching signal turns ON, the control will continue as speed control without switching over to position control. The control will be switched over from position control to speed control when the speed-position switching signal turns from OFF to ON again. Only position control will be carried out when "[Cd.24] Speed-position switching enable flag" and speed-position switching signal are ON at the operation start.)

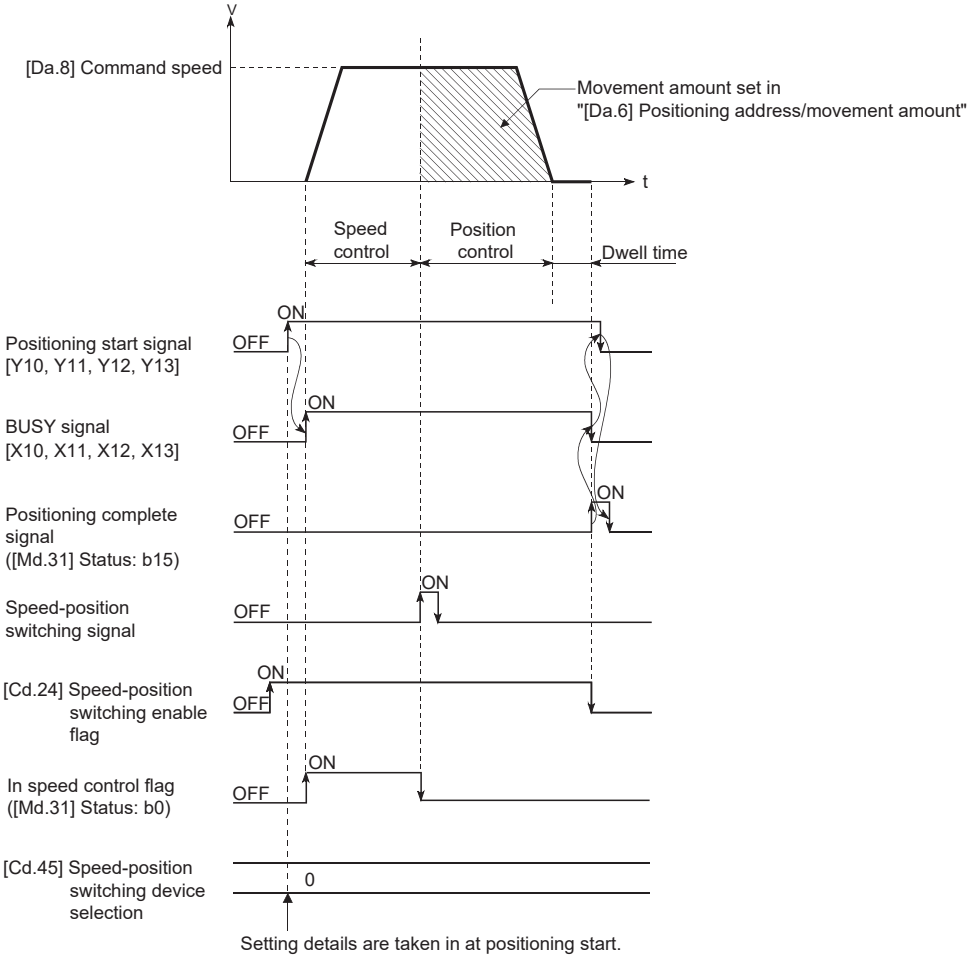
n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.24]	Speed-position switching enable flag	1	Speed control will be taken over by position control when the switching signal set in "[Cd.45] Speed-position switching device selection" turns ON.	4328+100n

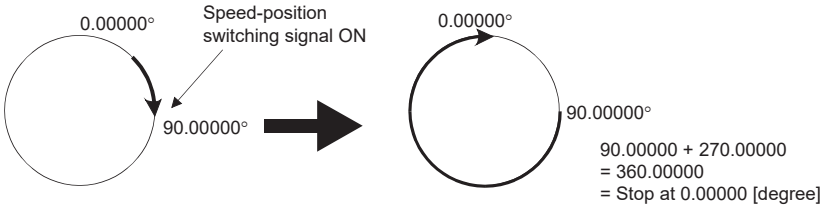
Operation chart

The following chart shows the operation timing for speed-position switching control (INC mode).
The "in speed control flag" ([Md.31] Status: b0) is turned ON during speed control of speed-position switching control (INC mode).

■Operation example

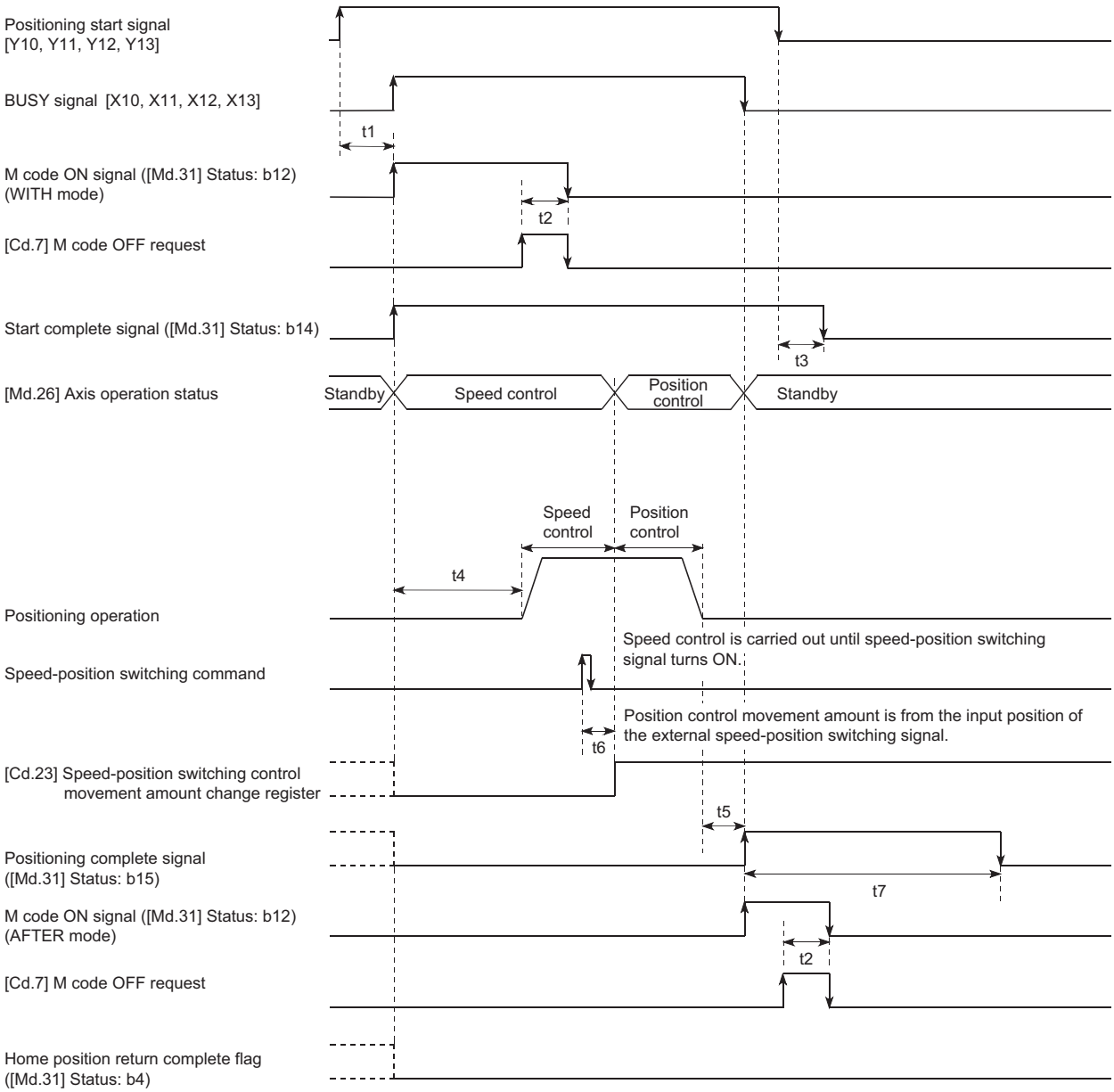


The following operation assumes that the speed-position switching signal is input at the position of the command position value of 90.00000 [degree] during execution of "[Da.2] Control method" "Forward run: speed/position" at "[Pr.1] Unit setting" of "2: degree" and "[Pr.21] Command position value during speed control" setting of "1: Update command position value".
(The value set in "[Da.6] Positioning address/movement amount" is 270.00000 [degree])



Operation timing and processing time

■Operation example



• Normal timing time Unit: [ms]

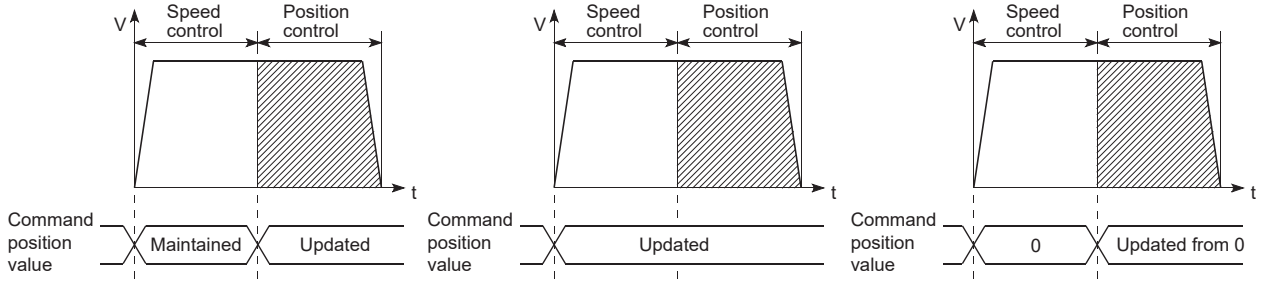
Operation cycle	t1*1	t2	t3	t4*2	t5	t6*3*4	t7
0.25	0.25 to 0.69	0.00 to 0.25	0.00 to 0.25	0.84 to 0.87	0.00 to 0.25	0.95 to 0.96	Follows parameters
0.50	0.38 to 0.84	0.00 to 0.50	0.00 to 0.50	1.53 to 1.59	0.00 to 0.50	1.91 to 1.92	Follows parameters
1.00	0.60 to 1.50	0.00 to 1.00	0.00 to 1.00	3.04 to 3.09	0.00 to 1.00	2.84 to 2.87	Follows parameters
2.00	0.74 to 2.60	0.00 to 2.00	0.00 to 2.00	6.40 to 6.60	0.00 to 2.00	3.85 to 3.91	Follows parameters
4.00	0.77 to 4.50	0.00 to 4.00	0.00 to 4.00	13.35 to 13.65	0.00 to 4.00	7.88 to 7.92	Follows parameters

*1 The t1 timing time could be delayed by the operation state of other axes.
*2 The t4 timing time depends on the setting of the acceleration time, servo parameter, etc.
*3 When using the proximity dog signal or "[Cd.46] Speed-position switching command", the t6 timing time could be delayed or vary influenced by the PLC scan time or communication with servo amplifier.
*4 When the servo parameter of the servo amplifier "Input filter setting (PD11)" is set to "0: No filter", the time fluctuates depending on the setting value of the servo parameter "Input filter setting (PD11)".

Command position value

The following table shows "[Md.20] Command position value" during speed-position switching control (INC mode) corresponding to the "[Pr.21] Command position value during speed control" settings.

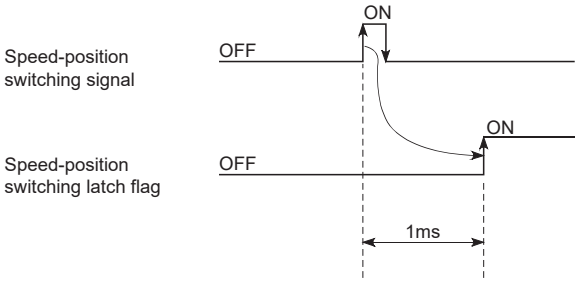
"[Pr.21] Command position value during speed control" setting	[Md.20] Command position value
0: Do not update command position value	The command position value at control start is maintained during speed control, and updated from the switching to position control.
1: Update command position value	The command position value is updated during speed control and position control.
2: Zero clear command position value	The command position value is cleared (set to "0") at control start, and updated from the switching to position control.



(a) Command position value not updated (b) Command position value updated (c) Command position value zero cleared

Switching time from speed control to position control

It takes 1ms from the time the speed-position switching signal is turned ON to the time the speed-position switching latch flag ([Md.31] Status: b1) turns ON.



Speed-position switching signal setting

■External command signals [DI]

The following table shows the items that must be set to use the external command signals [DI] as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.42]	External command function selection	2	Speed-position, position-speed switching request.	62+150n
[Cd.8]	External command valid	1	Validates an external command.	4305+100n
[Cd.45]	Speed-position switching device selection	0	Use the external command signal for switching from speed control to position control	4366+100n

Set the external command signal [DI] in "[Pr.95] External command signal selection". Refer to the following for information on the setting details.

☞ Page 448 Basic Setting, ☞ Page 550 Control Data

■Proximity dog signal (DOG)

The following table shows the items that must be set to use the proximity dog signal (DOG) as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.45]	Speed-position switching device selection	1	Use the proximity dog signal for switching from speed control to position control	4366+100n

This setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.

☞ Page 550 Control Data

If "3: Link device" is selected in "[Pr.118] DOG signal selection", specify the link device to be used by the link device external signal assignment function. The detection accuracy is the operation cycle considering the communication delay.

■[Cd.46] Speed-position switching command

The following table shows the items that must be set to use "[Cd.46] Speed-position switching command" as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.45]	Speed-position switching device selection	2	Use "[Cd.46] Speed-position switching command" for switching from speed control to position control	4366+100n

This setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.

☞ Page 550 Control Data

■Link device

The following table shows the items that must be set to use link devices as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.95]	External command signal selection	900	Link device	69+150n
[Cd.8]	External command valid	1	Validates an external command.	4305+100n
[Cd.45]	Speed-position switching device selection	0	Use the external command signal for switching from speed control to position control.	4366+100n

Specify the link device to be used by the link device external signal assignment function.

If "[Pr.95] External command signal selection" or "[Cd.45] Speed-position switching device selection" is set and no link device is specified at the start, "Speed-position switching request link device incorrect configuration" (error code: 1F18H) occurs, and the operation cannot be started.

To compensate the input timing of speed-position switching signals, set "[Pr.984] Speed-position control switching request: Acquisition delay compensation time". For details of the parameters, refer to the following.

☞ Page 325 Link Device External Signal Assignment Function

When a link device is used as a speed-position switching signal, the detection accuracy is as follows.

The movement amount after position control switching is compensated according to the detection accuracy.

Item	Detection accuracy
Normal	The accuracy is the operation cycle considering the communication delay.
High accuracy	The accuracy is based on the synchronous input timing information of remote I/O. For details, refer to the following manual. CC-Link IE TSN Remote I/O Module User's Manual (CC-Link IE TSN Communication Mode) The communication delay is also compensated.

For the setting method of the higher accuracy, refer to the following.

☞ Page 325 Link Device External Signal Assignment Function

Also, for the use in high accuracy, use "[Pr.983] Speed-position control switching request: Link device logic setting" with "2: Detection at leading edge" or "3: Detection at trailing edge".

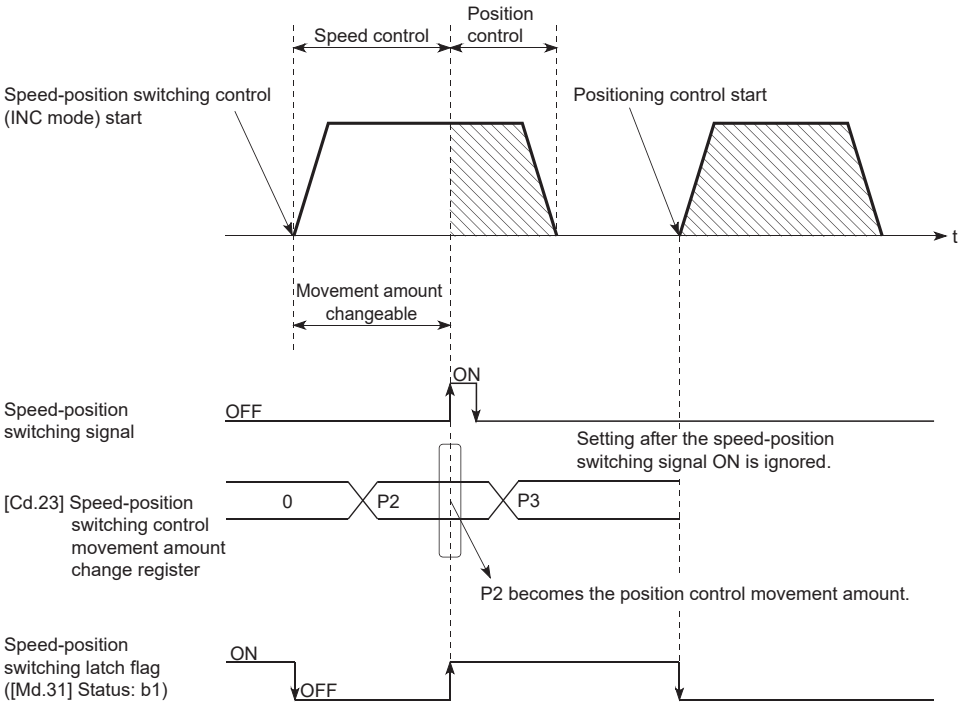
Point

The signal response time varies depending on the input response time setting value of the remote I/O. Therefore, the signal delay caused by the input response time setting value should be corrected by "[Pr.984] Speed-position control switching request: Acquisition delay compensation time".

Changing the position control movement amount

In "speed-position switching control (INC mode)", the position control movement amount can be changed during the speed control section.

- The position control movement amount can be changed during the speed control section of speed-position switching control (INC mode). A movement amount change request will be ignored unless issued during the speed control section of the speed-position switching control (INC mode).
- The "new movement amount" is stored in "[Cd.23] Speed-position switching control movement amount change register" by the program during speed control. When the speed-position switching signal is turned ON, the movement amount for position control is stored in "[Cd.23] Speed-position switching control movement amount change register".
- The movement amount is stored in "[Md.29] Speed-position switching control positioning movement amount" of the axis monitor area from the point where the control changes to position control by the input of a speed-position switching signal from an external device.



Point

- The machine recognizes the presence of a movement amount change request when the data is written to "[Cd.23] Speed-position switching control movement amount change register" with the program.
- The new movement amount is validated after execution of the speed-position switching control (INC mode), before the input of the speed-position switching signal.
- The movement amount change can be enable/disable with the interlock function in position control using the "speed-position switching latch flag" ([Md.31] Status: b1) of the axis monitor area.

Restrictions

- "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur and the operation cannot start if "continuous path control" is set in "[Da.1] Operation pattern".
- "Speed-position switching control" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No.1 is "continuous path control", "speed-position switching control" cannot be set in positioning data No.2.) "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- "No command speed" (error code: 1B12H to 1B14H) will occur if the current speed (-1) is set in "[Da.8] Command speed".
- The software stroke limit range check during speed control is made only when the following are satisfied:

"[Pr.21] Command position value during speed control" is "1: Update command position value".	If the movement amount exceeds the software stroke limit range during speed control in case of the setting of other than "1: Update command position value", "Software stroke limit +" (error code: 1A93H) or "Software stroke limit -" (error code: 1A95H) will occur as soon as speed control is changed to position control and the axis will decelerate to a stop.
When "[Pr.1] Unit setting" is other than "2: degree"	If the unit is "degree", the software stroke limit range check is not performed.

- If the value set in "[Da.6] Positioning address/movement amount" is negative, "Outside address range" (error code: 1B30H, 1B31H) will occur.
- Deceleration processing is carried out from the point where the speed-position switching signal is input if the position control movement amount set in "[Da.6] Positioning address/movement amount" is smaller than the deceleration distance from "[Da.8] Command speed".
- Turn ON the speed-position switching signal in the speed stabilization region (constant speed status). When the switching signal is turned on while the command speed has not been reached, the stop position will vary due to large variation of the droop pulse amount. During use of the servo motor, the movement amount is "[Da.6] Positioning address/movement amount" from the assumed motor position based on "[Md.101] Actual position value" at switching of speed control to position control. Therefore, if the signal is turned ON during acceleration/deceleration, the stop position will vary due to large variation of the droop pulse amount. Even though "[Md.29] Speed-position switching control positioning movement amount" is the same, the stop position will change due to a change in droop pulse amount when "[Da.8] Command speed" is different.

Setting positioning data

When using speed-position switching control (INC mode), set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set "Forward run: speed/position" or "Reverse run: speed/position".)
[Da.3]	Acceleration time No.	◎
[Da.4]	Deceleration time No.	◎
[Da.6]	Positioning address/movement amount	◎
[Da.7]	Arc address	—
[Da.8]	Command speed	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Speed-position switching control (ABS mode)

In case of "speed-position switching control (ABS mode)" ("[Da.2] Control method" = Forward run: speed/position, Reverse run: speed/position), the pulses of the speed set in "[Da.8] Command speed" are kept output in the axial direction set to the positioning data. When the "speed-position switching signal" is input, position control to the address set in "[Da.6] Positioning address/movement amount" is exercised.

"Speed-position switching control (ABS mode)" is available in two different types: "forward run: speed/position" which starts the axis in the forward run direction and "reverse run: speed/position" which starts the axis in the reverse run direction.

"Speed-position switching control (ABS mode)" is valid only when "[Pr.1] Unit setting" is "2: degree".

○: Setting allowed, ×: Setting disallowed (If setting is made, "Speed-position function selection error" (error code: 1BAEH) will occur when PLC READY [Y0] turns ON.)

Speed-position function selection	[Pr.1] Unit setting			
	mm	inch	degree	pulse
INC mode	○	○	○	○
ABS mode	×	×	○	×

Use the detailed parameter 1 "[Pr.81] Speed-position function selection" to choose "speed-position switching control (ABS mode)".

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.81]	Speed-position function selection	2	Speed-position switching control (ABS mode)	34+150n

If the set value is other than 0 and 2, it is regarded as 0 and operation is performed in the INC mode. For details of the setting, refer to the following.

☞ Page 448 Basic Setting

Switching over from speed control to position control

- The control is selected the switching method from speed control to position control by the setting value of "[Cd.45] Speed-position switching device selection".

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.45]	Speed-position switching device selection	→	The device used for speed-position switching is selected. 0: Use the external command signal for switching from speed control to position control 1: Use the proximity dog signal for switching from speed control to position control 2: Use "[Cd.46] Speed-position switching command" for switching from speed control to position control	4366+100n

The switching is performed by using the following device when "2" is set.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.46]	Speed-position switching command	1	Switch from speed control to position control	4367+100n

• "[Cd.24] Speed-position switching enable flag" must be turned ON to switch over from speed control to position control. (If "[Cd.24] Speed-position switching enable flag" turns ON after the speed-position switching signal turns ON, the control will continue as speed control without switching over to position control. The control will be switched over from position control to speed control when the speed-position switching signal turns from OFF to ON again. Only position control will be carried out when "[Cd.24] Speed-position switching enable flag" and speed-position switching signal are ON at the operation start.)

n: Axis No. - 1

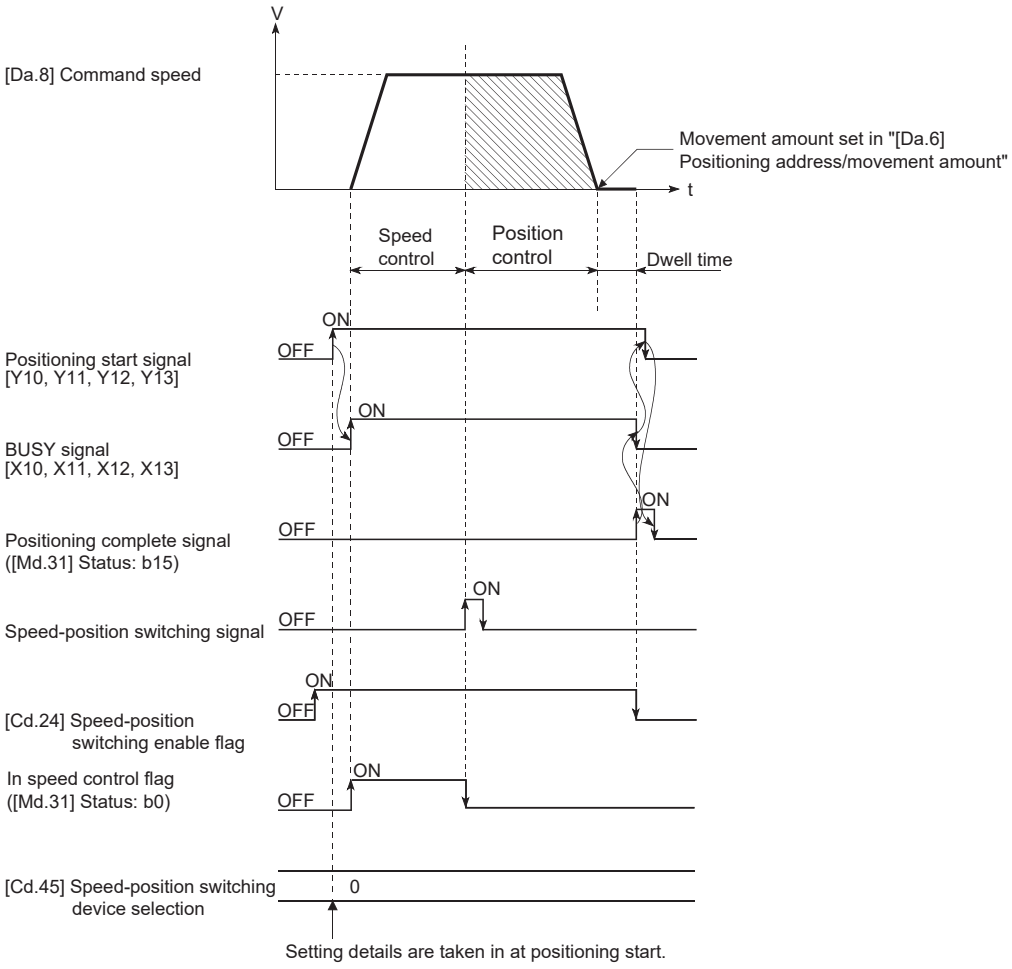
Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.24]	Speed-position switching enable flag	1	Speed control will be taken over by position control when the switching signal set in "[Cd.45] Speed-position switching device selection" turns ON.	4328+100n

Operation chart

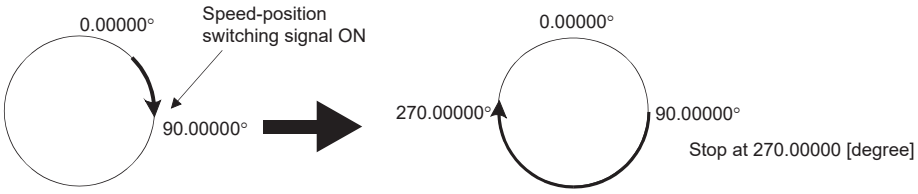
The following chart shows the operation timing for speed-position switching control (ABS mode).

The "in speed control flag" ([Md.31] Status: b0) is turned ON during speed control of speed-position switching control (ABS mode).

■Operation example

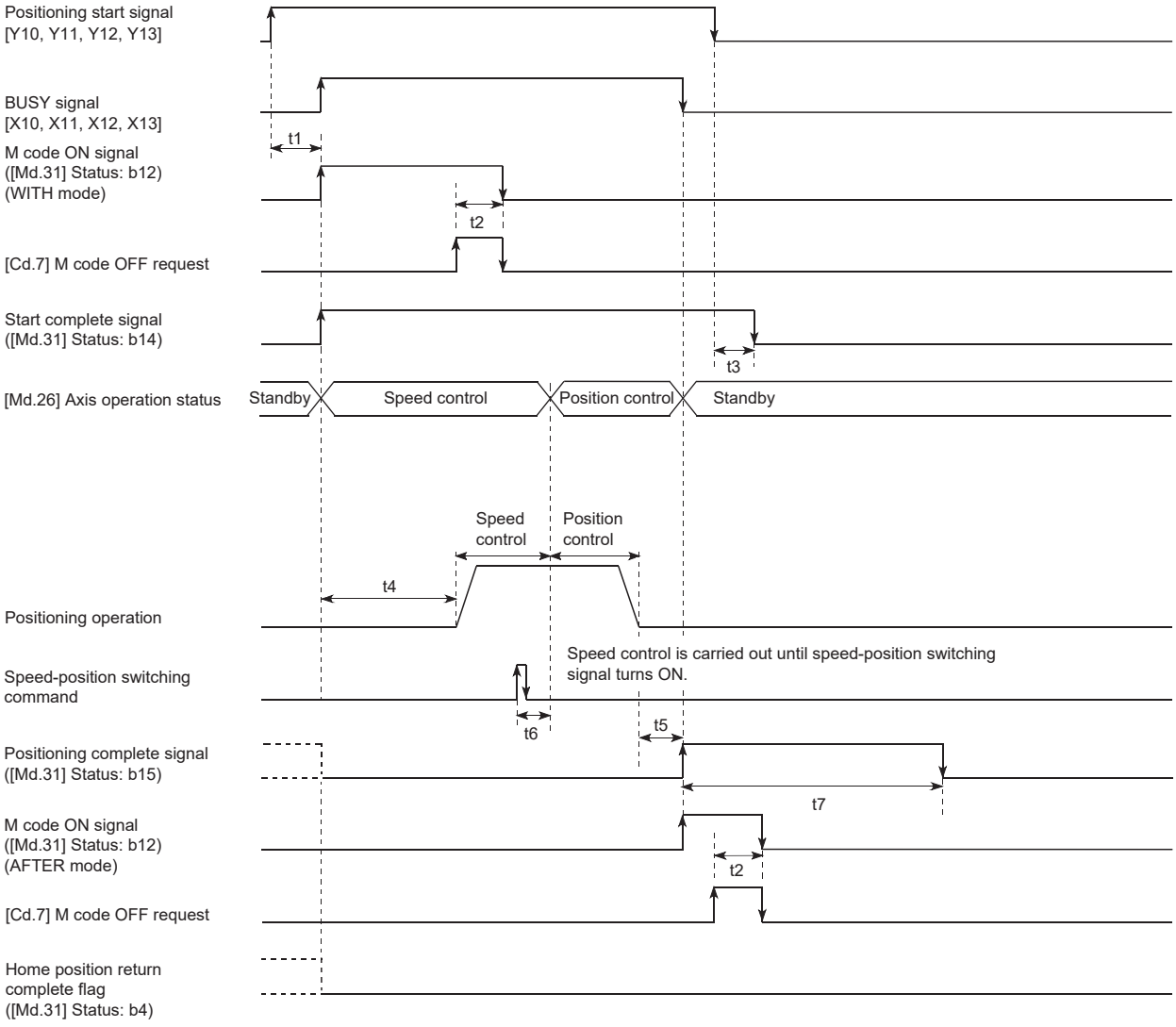


The following operation assumes that the speed-position switching signal is input at the position of the command position value of 90.00000 [degree] during execution of "[Da.2] Control method" "Forward run: speed/position" at "[Pr.1] Unit setting" of "2: degree" and "[Pr.21] Command position value during speed control" setting of "1: Update command position value". (The value set in "[Da.6] Positioning address/movement amount" is 270.00000 [degree])



Operation timing and processing time

■Operation example



• Normal timing time Unit: [ms]

Operation cycle	t1*1	t2	t3	t4*2	t5	t6*3*4	t7
0.25	0.25 to 0.69	0.00 to 0.25	0.00 to 0.25	0.84 to 0.87	0.00 to 0.25	0.95 to 1.46	Follows parameters
0.50	0.38 to 0.84	0.00 to 0.50	0.00 to 0.50	1.55 to 1.61	0.00 to 0.50	1.91 to 1.93	Follows parameters
1.00	0.60 to 1.50	0.00 to 1.00	0.00 to 1.00	3.04 to 3.08	0.00 to 1.00	2.82 to 2.87	Follows parameters
2.00	0.74 to 2.60	0.00 to 2.00	0.00 to 2.00	6.52 to 6.58	0.00 to 2.00	3.87 to 3.98	Follows parameters
4.00	0.77 to 4.50	0.00 to 4.00	0.00 to 4.00	13.40 to 13.70	0.00 to 4.00	7.85 to 7.96	Follows parameters

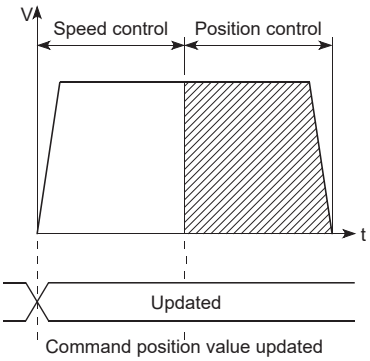
*1 The t1 timing time could be delayed by the operation state of other axes.
*2 The t4 timing time depends on the setting of the acceleration time, servo parameter, etc.
*3 When using the proximity dog signal or "[Cd.46] Speed-position switching command", the t6 timing time could be delayed or vary influenced by the PLC scan time or communication with servo amplifier.
*4 When the servo parameter of the servo amplifier "Input filter setting (PD11)" is set to "0: No filter", the time fluctuates depending on the setting value of the servo parameter "Input filter setting (PD11)".

Command position value

The following table shows "[Md.20] Command position value" during speed-position switching control (ABS mode) corresponding to the "[Pr.21] Command position value during speed control" settings.

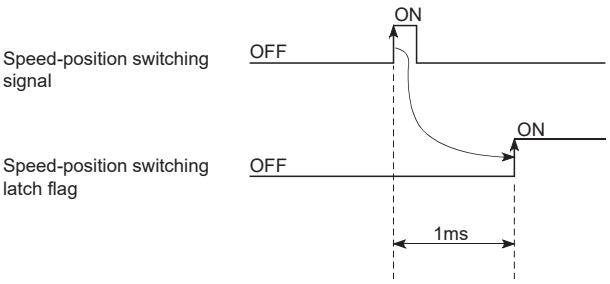
"[Pr.21] Command position value during speed control" setting	[Md.20] Command position value
1: Update command position value	The command position value is updated during speed control and position control.

Only "1: Update command position value" is valid for the setting of "[Pr.21] Command position value during speed control" in speed-position switching control (ABS mode).
"Speed-position function selection error" (error code: 1BAEH) will occur if the "[Pr.21] Command position value during speed control" setting is other than 1.



Switching time from speed control to position control

It takes 1ms from the time the speed-position switching signal is turned ON to the time the speed-position switching latch flag ([Md.31] Status: b1) turns ON.



Speed-position switching signal setting

■External command signals [DI]

The following table shows the items that must be set to use the external command signals [DI] as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.42]	External command function selection	2	Speed-position, position-speed switching request.	62+150n
[Cd.8]	External command valid	1	Validates an external command.	4305+100n
[Cd.45]	Speed-position switching device selection	0	Use the external command signal for switching from speed control to position control	4366+100n

Set the external command signal [DI] in "[Pr.95] External command signal selection". Refer to the following for information on the setting details.

☞ Page 448 Basic Setting, ☞ Page 550 Control Data

■Proximity dog signal (DOG)

The following table shows the items that must be set to use the proximity dog signal (DOG) as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.45]	Speed-position switching device selection	1	Use the proximity dog signal for switching from speed control to position control	4366+100n

This setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.

☞ Page 550 Control Data

If "3: Link device" is selected in "[Pr.118] DOG signal selection", specify the link device to be used by the link device external signal assignment function. The detection accuracy is the operation cycle.

■[Cd.46] Speed-position switching command

The following table shows the items that must be set to use "[Cd.46] Speed-position switching command" as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.45]	Speed-position switching device selection	2	Use "[Cd.46] Speed-position switching command" for switching from speed control to position control.	4366+100n

This setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.

☞ Page 550 Control Data

■Link device

The following table shows the items that must be set to use link devices as speed-position switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.95]	External command signal selection	900	Link device	69+150n
[Cd.8]	External command valid	1	Validates an external command.	4305+100n
[Cd.45]	Speed-position switching device selection	0	Use the external command signal for switching from speed control to position control.	4366+100n

Specify the link device to be used by the link device external signal assignment function.

If "[Pr.95] External command signal selection" or "[Cd.45] Speed-position switching device selection" is set and no link device is specified at the start, "Speed-position switching request link device incorrect configuration" (error code: 1F18H) occurs, and the operation cannot be started.

To delay the input timing of speed-position switching signals, set a negative value in "[Pr.984] Speed-position control switching request: Acquisition delay compensation time". Even if a positive value is set in "[Pr.984] Speed-position control switching request: Acquisition delay compensation time", the signal delay is not compensated. For details of the parameters, refer to the following.

☞ Page 325 Link Device External Signal Assignment Function

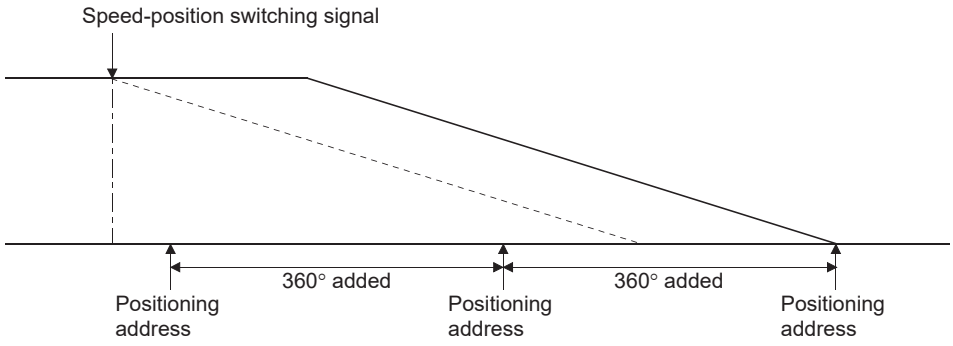
When a link device is used as a speed-position switching signal, the detection accuracy is the operation cycle.

Restrictions

- "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur and the operation cannot start if "continuous path control" is set in "[Da.1] Operation pattern".
- "Speed-position switching control" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No.1 is "continuous path control", "speed-position switching control" cannot be set in positioning data No.2.) "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- "No command speed" (error code: 1B12H to 1B14H) will occur if the current speed (-1) is set in "[Da.8] Command speed".
- If the value set in "[Da.6] Positioning address/movement amount" is negative, "Outside address range" (error code: 1B30H, 1B31H) will occur.
- Even though the axis control data "[Cd.23] Speed-position switching control movement amount change register" was set in speed-position switching control (ABS mode), it would not function. The set value is ignored.
- To exercise speed-position switching control (ABS mode), the following conditions must be satisfied:

1) "[Pr.1] Unit setting" is "2: degree"
2) The software stroke limit function is invalid (upper limit value = lower limit value)
3) "[Pr.21] Command position value during speed control" is "1: Update command position value"
4) The "[Da.6] Positioning address/movement amount" setting range is 0 to 359.99999 (degree). If the value is outside of the range, "Outside address range" (error code: 1B30H, 1B31H) will occur at a start.
5) The "[Pr.81] Speed-position function selection" setting is "2: Speed-position switching control (ABS mode)".

- If any of the conditions in 1) to 3) is not satisfied in the case of 5), "Speed-position function selection error" (error code: 1BAEH) will occur when the PLC READY [Y0] turns from OFF to ON.
- If the axis reaches the positioning address midway through deceleration after automatic deceleration started at the input of the speed-position switching signal, the axis will not stop immediately at the positioning address. The axis will stop at the positioning address after N revolutions so that automatic deceleration can always be made. (N: Natural number) In the following example, since making deceleration in the path of dotted line will cause the axis to exceed the positioning addresses twice, the axis will decelerate to a stop at the third positioning address.



Setting positioning data

When using speed-position switching control (ABS mode), set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set "Forward run: speed/position" or "Reverse run: speed/position".)
[Da.3]	Acceleration time No.	◎
[Da.4]	Deceleration time No.	◎
[Da.6]	Positioning address/movement amount	◎
[Da.7]	Arc address	—
[Da.8]	Command speed	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Position-speed switching control

In "position-speed switching control" ("[Da.2] Control method" = Forward run: position/speed, Reverse run: position/speed), before the position-speed switching signal is input, position control is carried out for the movement amount set in "[Da.6] Positioning address/movement amount" in the axis direction in which the positioning data has been set. When the position-speed switching signal is input, the position control is carried out by continuously outputting the pulses for the speed set in "[Da.8] Command speed" until the input of a stop command.
The two types of position-speed switching control are "Forward run: position/speed" in which the control starts in the forward run direction, and "Reverse run: position/speed" in which control starts in the reverse run direction.

Switching over from position control to speed control

- The control is selected the switching method from position control to speed control by the setting value of "[Cd.45] Speed-position switching device selection".

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.45]	Speed-position switching device selection	→	The device used for speed-position switching is selected. 0: Use the external command signal for switching from position control to speed control 1: Use the proximity dog signal for switching from position control to speed control 2: Use "[Cd.46] Speed-position switching command" for switching from position control to speed control	4366+100n

The switching is performed by using the following device when "2" is set.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.46]	Speed-position switching command	1	Switch from position control to speed control	4367+100n

- "[Cd.26] Position-speed switching enable flag" must be turned ON to switch over from position control to speed control. (If "[Cd.26] Position-speed switching enable flag" turns ON after the position-speed switching signal turns ON, the control will continue as position control without switching over to speed control. The control will be switched over from position control to speed control when the position-speed switching signal turns from OFF to ON again. Only speed control will be carried out when "[Cd.26] Position-speed switching enable flag" and position-speed switching signal are ON at the operation start.)

n: Axis No. - 1

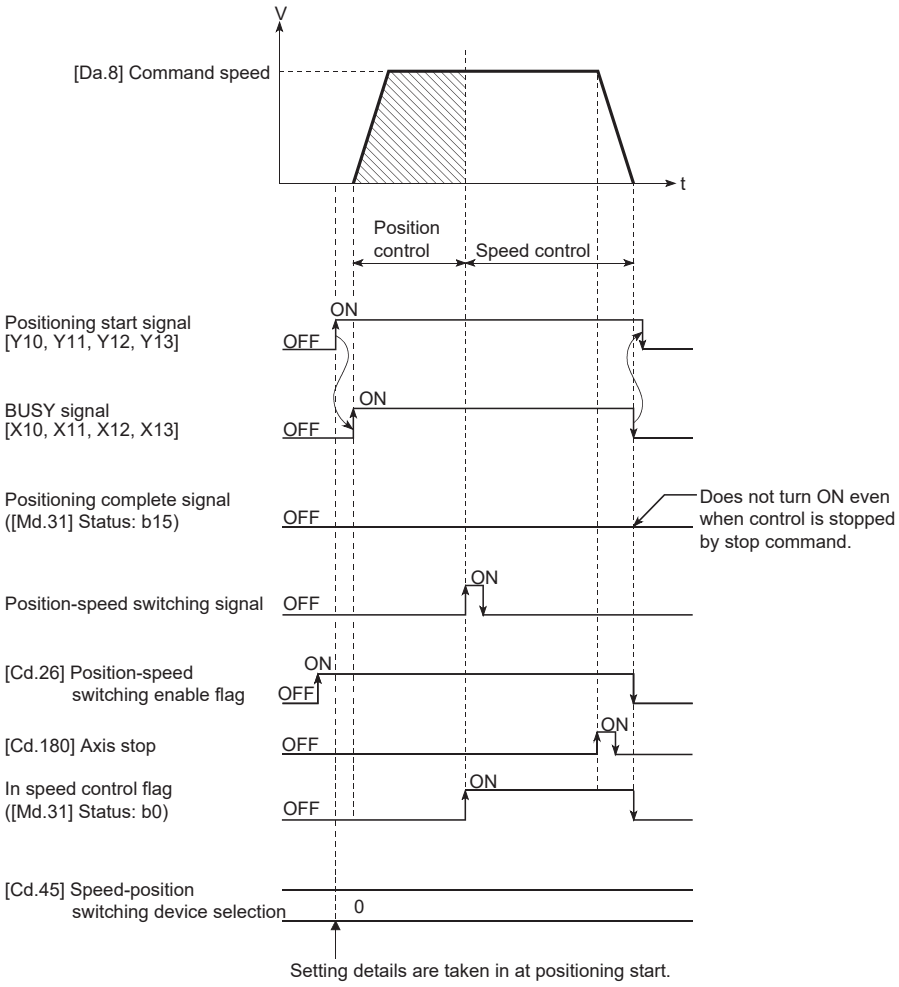
Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.26]	Position-speed switching enable flag	1	Speed control will be taken over by position control when the switching signal set in "[Cd.45] Speed-position switching device selection" comes ON.	4332+100n

Operation chart

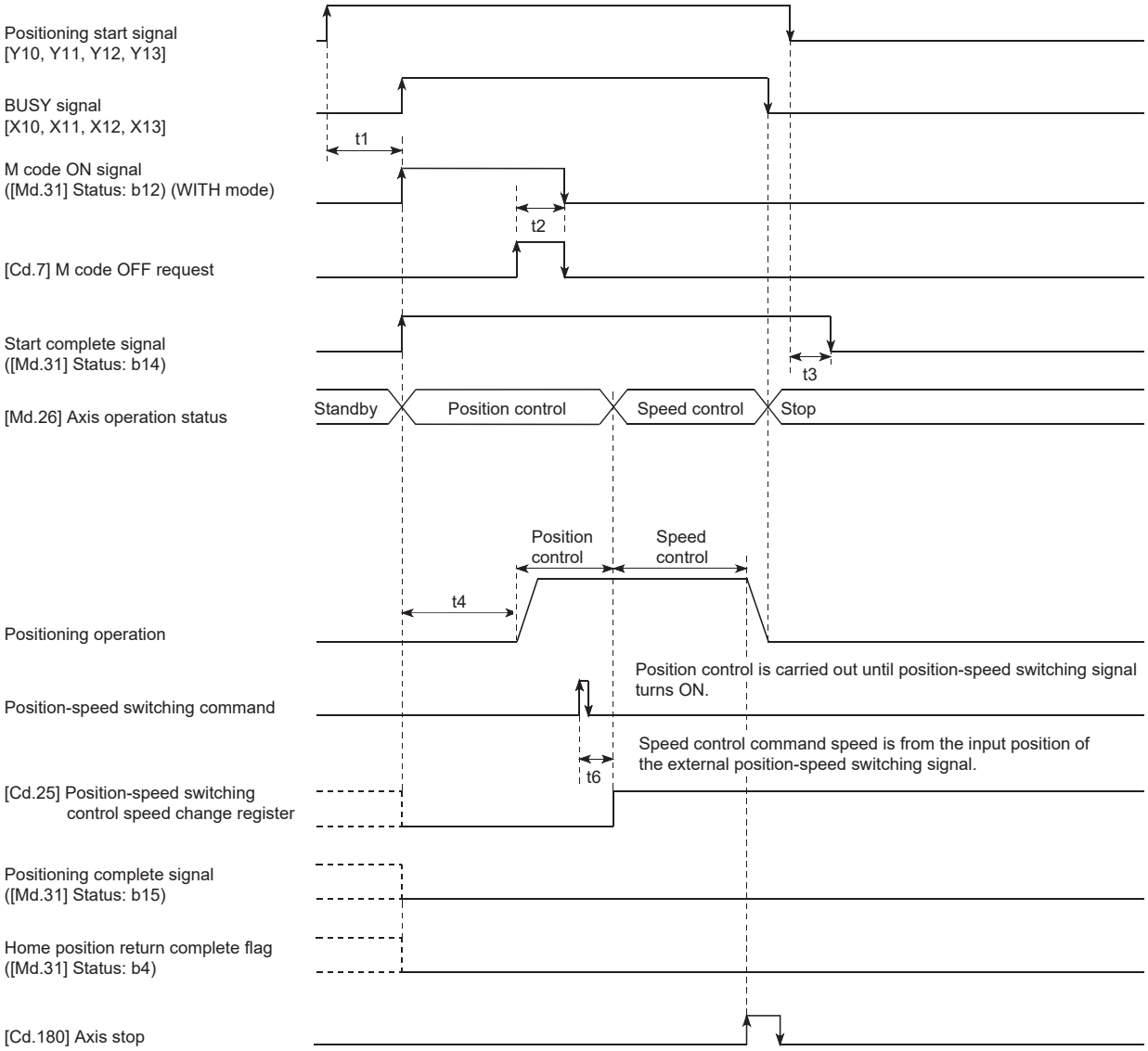
The following chart shows the operation timing for position-speed switching control.

The "in speed control" flag ([Md.31] Status: b0) is turned ON during speed control of position-speed switching control.

■Operation example



Operation timing and processing time



• Normal timing time Unit: [ms]

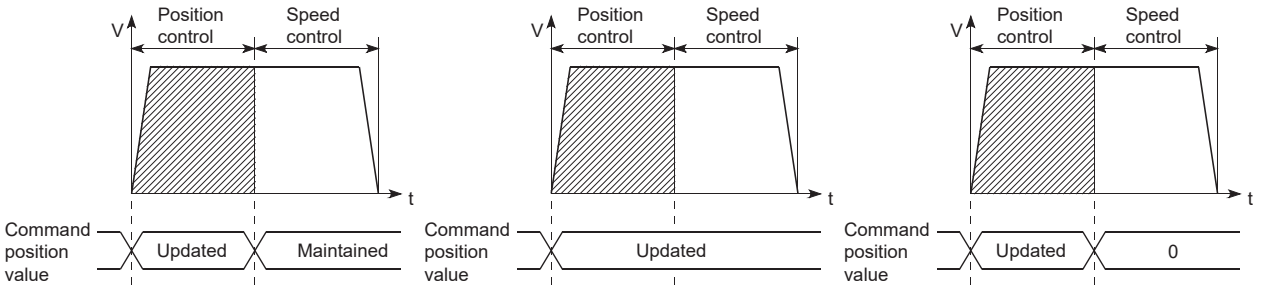
Operation cycle	t1*1	t2	t3	t4*2	t5	t6*3*4
0.25	0.25 to 0.69	0.13 to 0.15	0.23 to 0.25	0.83 to 0.87	—	0.95 to 1.45
0.50	0.38 to 0.84	0.25 to 0.25	0.48 to 0.49	1.55 to 1.58	—	1.91 to 1.92
1.00	0.60 to 1.50	0.61 to 0.62	0.96 to 0.97	3.00 to 3.10	—	2.84 to 2.85
2.00	0.74 to 2.60	1.57 to 1.63	1.95 to 1.96	6.50 to 6.56	—	3.83 to 3.86
4.00	0.77 to 4.50	3.61 to 3.63	3.95 to 3.97	13.45 to 13.57	—	7.85 to 7.87

*1 The t1 timing time could be delayed by the operation state of other axes.
*2 The t4 timing time depends on the setting of the acceleration time, servo parameter, etc.
*3 When using the proximity dog signal and "[Cd.46] Speed-position switching command", the t6 timing time could be delayed or vary influenced by the PLC scan time or communication with servo amplifier.
*4 When the servo parameter of the servo amplifier "Input filter setting (PD11)" is set to "0: No filter", the time fluctuates depending on the setting value of the servo parameter "Input filter setting (PD11)".

Command position value

The following table shows "[Md.20] Command position value" during position-speed switching control corresponding to the "[Pr.21] Command position value during speed control" settings.

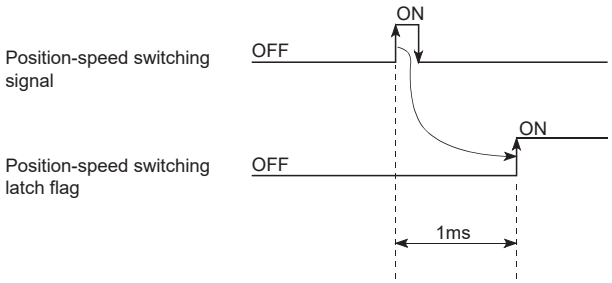
"[Pr.21] Command position value during speed control" setting	[Md.20] Command position value
0: Do not update command position value	The command position value is updated during position control, and the command position value at the time of switching is maintained as soon as position control is switched to speed control.
1: Update command position value	The command position value is updated during position control and speed control.
2: Zero clear command position value	The command position value is updated during position control, and the command position value is cleared (to "0") as soon as position control is switched to speed control.



(a) Command position value not updated (b) Command position value updated (c) Command position value zero cleared

Switching time from position control to speed control

It takes 1ms from the time the position-speed switching signal is turned ON to the time the position-speed switching latch flag ([Md.31] Status: b5) turns ON.



Position-speed switching signal setting

■External command signals [DI]

The following table shows the items that must be set to use the external command signals [DI] as position-speed switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.42]	External command function selection	2	Speed-position, position-speed switching request.	62+150n
[Cd.8]	External command valid	1	Validates an external command.	4305+100n
[Cd.45]	Speed-position switching device selection	0	Use the external command signal for switching from position control to speed control	4366+100n

Set the external command signal [DI] in "[Pr.95] External command signal selection". Refer to the following for information on the setting details.

☞ Page 448 Basic Setting, ☞ Page 550 Control Data

■Proximity dog signal (DOG)

The following table shows the items that must be set to use the proximity dog signal (DOG) as position-speed switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.45]	Speed-position switching device selection	1	Use the proximity dog signal for switching from position control to speed control	4366+100n

This setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.

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If "3: Link device" is selected in "[Pr.118] DOG signal selection", specify the link device to be used by the link device external signal assignment function. The detection accuracy is the operation cycle.

■[Cd.46] Speed-position switching command

The following table shows the items that must be set to use "[Cd.46] Speed-position switching command" as position-speed switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.45]	Speed-position switching device selection	2	Use "[Cd.46] Speed-position switching command" for switching from position control to speed control.	4366+100n

This setting is not required for "[Pr.42] External command function selection" and "[Cd.8] External command valid". Refer to the following for information on the setting details.

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■Link device

The following table shows the items that must be set to use link devices as position-speed switching signals.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.95]	External command signal selection	900	Link device	69+150n
[Cd.8]	External command valid	1	Validates an external command.	4305+100n
[Cd.45]	Speed-position switching device selection	0	Use the external command signal for switching from speed control to position control.	4366+100n

Specify the link device to be used by the link device external signal assignment function.

If "[Pr.95] External command signal selection" or "[Cd.45] Speed-position switching device selection" is set and no link device is specified at the start, "Speed-position switching request link device incorrect configuration" (error code: 1F18H) occurs, and the operation cannot be started.

To delay the input timing of position-speed switching signals, set a negative value in "[Pr.984] Speed-position control switching request: Acquisition delay compensation time". Even if a positive value is set in "[Pr.984] Speed-position control switching request: Acquisition delay compensation time", the signal delay is not compensated. For details of the parameters, refer to the following.

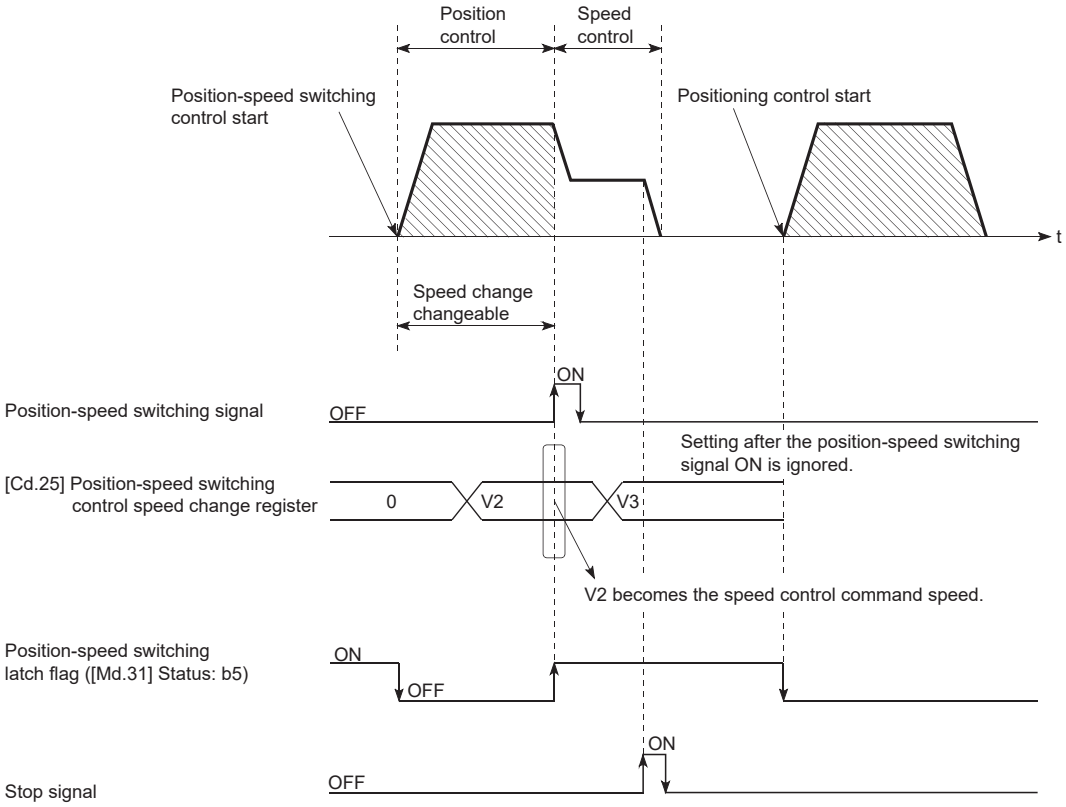
☞ Page 325 Link Device External Signal Assignment Function

When a link device is used as a position-speed switching signal, the detection accuracy is the operation cycle.

Changing the speed control command speed

In "position-speed switching control", the speed control command speed can be changed during the position control.

- The speed control command speed can be changed during the position control of position-speed switching control. A command speed change request will be ignored unless issued during the position control of the position-speed switching control.
- The "new command speed" is stored in "[Cd.25] Position-speed switching control speed change register" by the program during position control. This value then becomes the speed control command speed when the position-speed switching signal turns ON.



Point

- The machine recognizes the presence of a command speed change request when the data is written to "[Cd.25] Position-speed switching control speed change register" with the program.
- The new command speed is validated after execution of the position-speed switching control before the input of the position-speed switching signal.
- The command speed change can be enabled/disabled with the interlock function in speed control using the "position-speed switching latch flag" ([Md.31] Status: b5) of the axis monitor area.

Restrictions

- "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern".
- "Position-speed switching control" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No.1 is "continuous path control", "position-speed switching control" cannot be set in positioning data No.2.) "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- The software stroke limit range is only checked during speed control if the "1: Update command position value" is set in "[Pr.21] Command position value during speed control". The software stroke limit range is not checked when the control unit is set to "degree".
- "Software stroke limit +" (error code: 1A93H) or "Software stroke limit -" (error code: 1A95H) will occur and the operation cannot start if the start point address or end point address for position control exceeds the software stroke limit range.
- Deceleration stop will be carried out if the position-speed switching signal is not input before the machine is moved by a specified movement amount. When the position-speed switching signal is input during automatic deceleration by positioning control, acceleration is carried out again to the command speed to continue speed control. When the position-speed switching signal is input during deceleration to a stop with the stop signal, the control is switched to the speed control to stop the machine. Restart is carried out by speed control using the restart command.
- "Speed limit value over" (warning code: 0D51H) will occur and control is continued by "[Pr.8] Speed limit value" if a new speed exceeds "[Pr.8] Speed limit value" at the time of change of the command speed.
- If the value set in "[Da.6] Positioning address/movement amount" is negative, "Outside address range" (error code: 1B30H, 1B31H) will occur.
- Set WITH mode in the output timing at M code use. The M code will not be output, and the M code ON signal will not turn ON if the AFTER mode is set.

Setting positioning data

When using position-speed switching control, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set "Forward run: position/speed" or "Reverse run: position/speed".)
[Da.3]	Acceleration time No.	◎
[Da.4]	Deceleration time No.	◎
[Da.6]	Positioning address/movement amount	◎
[Da.7]	Arc address	—
[Da.8]	Command speed	◎
[Da.9]	Dwell time/JUMP destination positioning data No.	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Current value changing

When the current value is changed to a new value, control is carried out in which "[Md.20] Command position value" of the stopped axis is changed to a random address set by the user. ("[Md.21] Machine feed value" is not changed when the current value is changed.)

The two methods for changing the current value are shown below.

- Changing to a new current value using the positioning data
- Changing to a new current value using the start No. (No.9003) for a current value changing

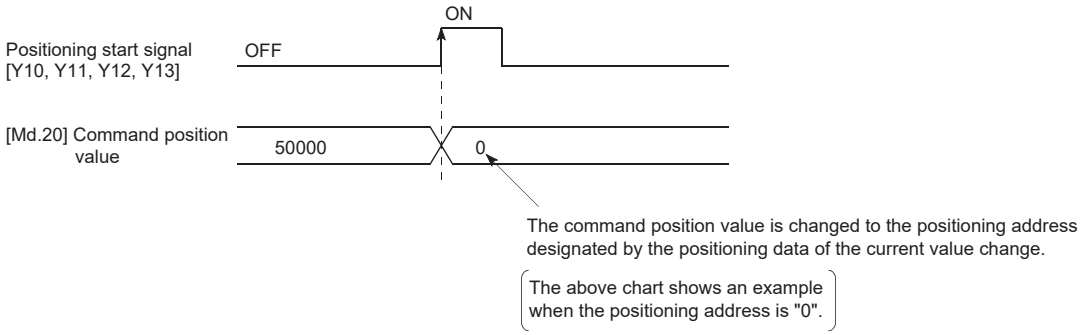
The current value changing using method [1] is used during continuous positioning of multiple blocks, etc.

Changing to a new current value using the positioning data

In "current value changing" ("[Da.2] Control method" = current value changing), "[Md.20] Command position value" is changed to the address set in "[Da.6] Positioning address/movement amount".

■Operation chart

The following chart shows the operation timing for a current value changing. "[Md.20] Command position value" is changed to the value set in "[Da.6] Positioning address/movement amount" when the positioning start signal turns ON.



■Restrictions

- "New current value not possible" (error code: 1B1CH, 1B1DH) will occur and the operation cannot start if "continuous path control" is set in "[Da.1] Operation pattern". ("Continuous path control" cannot be set in current value changing.)
- "Current value changing" cannot be set in "[Da.2] Control method" of the positioning data when "continuous path control" has been set in "[Da.1] Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No.1 is "continuous path control", "current value changing" cannot be set in positioning data No.2.) "New current value not possible" (error code: 1B1CH, 1B1DH) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.
- "Outside new current value range" (error code: 1A97H) will occur and the operation cannot start if "degree" is set in "[Pr.1] Unit setting" and the value set in "[Da.6] Positioning address/movement amount (0 to 359.99999 [degree])" is outside the setting range.
- If the value set in "[Da.6] Positioning address/movement amount" is outside the software stroke limit ([Pr.12], [Pr.13]) setting range, "Software stroke limit +" (error code: 1B18H) or "Software stroke limit -" (error code: 1B1AH) will occur at the positioning start, and the operation will not start.
- "Software stroke limit +" (error code: 1A94H) or "Software stroke limit -" (error code: 1A96H) will occur if the new current value is outside the software stroke limit range.
- The new current value using the positioning data (No.1 to 600) cannot be changed, if "0: Positioning control is not executed" is set in "[Pr.55] Operation setting for incompletion of home position return" and "home position return request flag" ON. "Start at home position return incomplete" (error code: 1AA6H) will occur.
- When using an absolute position system, "[Md.20] Command position value" returns to the value of "[Md.21] Machine feed value" at the start of communication with the servo amplifier after cycling the power or resetting the CPU module.

■Setting positioning data

When using current value changing, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	◎
[Da.2]	Control method	◎ (Set the current value changing.)
[Da.3]	Acceleration time No.	—
[Da.4]	Deceleration time No.	—
[Da.6]	Positioning address/movement amount	◎ (Set the address to be changed.)
[Da.7]	Arc address	—
[Da.8]	Command speed	—
[Da.9]	Dwell time/JUMP destination positioning data No.	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	○
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

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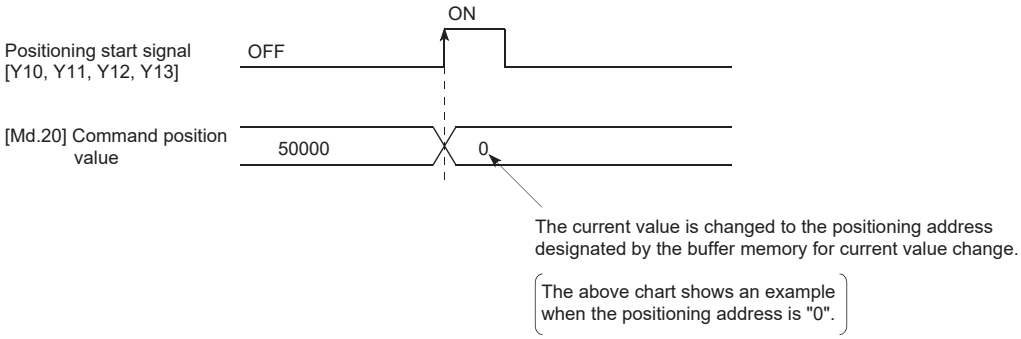
Changing to a new current value using the current value changing start No. (No.9003)

In "current value changing" ("[Cd.3] Positioning start No." = 9003), "[Md.20] Command position value" is changed to the address set in "[Cd.9] New position value".

■Operation chart

The current value is changed by setting the new current value in the current value changing buffer memory "[Cd.9] New position value", setting "9003" in "[Cd.3] Positioning start No.", and turning ON the positioning start signal.



■Restrictions

- "Outside new current value range" (error code: 1A97H) will occur if the designated value is outside the setting range when "degree" is set in "Unit setting".
- "Software stroke limit +" (error code: 1A94H) or "Software stroke limit -" (error code: 1A96H) will occur if the designated value is outside the software stroke limit range.
- The current value cannot be changed during stop commands and while the M code ON signal is ON.
- The M code output function is made invalid.
- When using an absolute position system, "[Md.20] Command position value" returns to the value of "[Md.21] Machine feed value" at the start of communication with the servo amplifier after cycling the power or resetting the CPU module.

Point

The new current value can be changed using the current value changing start No. (No.9003) if "0: Positioning control is not executed" is set in "[Pr.55] Operation setting for incompletion of home position return" and home position return request flag is ON.

■Current value changing procedure

The following shows the procedure for changing the current value to a new value.

1. Write the current value to "[Cd.9] New position value".
2. Write "9003" in "[Cd.3] Positioning start No.".
3. Turn ON the positioning start signal.

■Setting method

The following shows an example of a program and data setting to change the current value to a new value with the positioning start signal. (The value "[Md.20] Command position value" is changed to "5000.0μm" in the example shown.)

- Set the following data. (Set using the program referring to the start time chart.)

n: Axis No. - 1

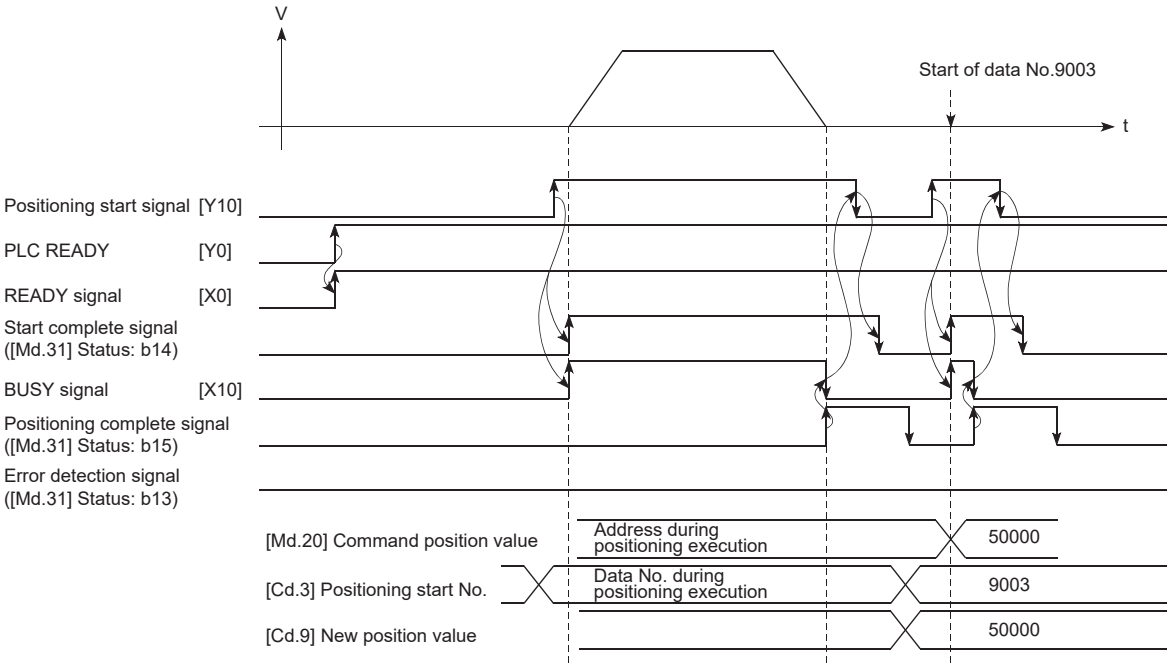
Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.3]	Positioning start No.	9003	Set the start No. "9003" for the new current value.	4300+100n
[Cd.9]	New position value	50000	Set the new "[Md.20] Command position value".	4306+100n 4307+100n

Refer to the following for information on the setting details.

☞ Page 550 Control Data

- The following shows a start time chart.

■Operation example



Program example

- Add the following program to the control program, and write it to the CPU module.



Classification	Label name	Description
Module label	RD78GS_1.bnPositioningStart[0]	Axis 1 Positioning start signal
	RD78GS_1.bnPositioningStart_D[0]	
	RD78GS_1.stnAxMntr_D[0].uStatus_D.E	Axis 1 Start complete
	RD78GS_1.stnAxCtrl1_D[0].dNewPosition_D	Axis 1 New position value
	RD78GS_1.stnAxCtrl1_D[0].uPositioningStartNo_D	Axis 1 Positioning start No.
	RD78GS_1.stnAxMntr_D[0].uStatus_D.D	Axis 1 Error detection
	RD78GS_1.bnBusy_D[0]	Axis 1 BUSY signal
Global label, local label	Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. The following table shows an example for the local label.	

	Label Name	Data Type		Class
1	dNewPositionValue	Double Word [Signed]	...	VAR
2	bCommandPositionValueChangeReq_P	Bit	...	VAR
3	bInputCommandPositionValChangeReq	Bit	...	VAR
4			...	

NOP instruction

The NOP instruction is used for the nonexecutable control method.

Operation

The positioning data No. to which the NOP instruction is set transfers, without any processing, to the operation for the next positioning data No.

Setting positioning data

When using the NOP instruction, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	—
[Da.2]	Control method	◎ (Set the NOP instruction.)
[Da.3]	Acceleration time No.	—
[Da.4]	Deceleration time No.	—
[Da.6]	Positioning address/movement amount	—
[Da.7]	Arc address	—
[Da.8]	Command speed	—
[Da.9]	Dwell time/JUMP destination positioning data No.	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	—
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	—
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Restrictions

"Control method setting error" (error code: 1B26H) will occur if the "NOP instruction" is set for the control method of the positioning data No.600.

Point

Use example of NOP instruction

If there is a possibility of speed switching or temporary stop (automatic deceleration) at a point between two points during positioning, that data can be reserved with the NOP instruction to change the data merely by the replacement of the identifier.

JUMP instruction

The JUMP instruction is used to control the operation so it jumps to a positioning data No. set in the positioning data during "continuous positioning control" or "continuous path control".
JUMP instruction includes the following two types of JUMP.

JUMP instruction	Description
Unconditional JUMP	When execution conditions are not set for the JUMP instruction (When "0" is set to the condition data No.)
Conditional JUMP	When execution conditions are set for the JUMP instruction (The conditions are set to the "condition data" used with "high-level positioning control".)

Using the JUMP instruction enables repeating of the same positioning control, or selection of positioning data by the execution conditions during "continuous positioning control" or "continuous path control".

Operation

■Unconditional JUMP

The JUMP instruction is unconditionally executed. The operation jumps to the positioning data No. set in "[Da.9] Dwell time/JUMP destination positioning data No.".

■Conditional JUMP

The block start condition data is used as the JUMP instruction execution conditions.

- When block positioning data No.7000 to 7004 is started: Each block condition data is used.
- When positioning data No.1 to 600 is started: Start block 0 condition data is used.
- When the execution conditions set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the JUMP instruction have been established: the JUMP instruction is executed to jump the operation to the positioning data No. set in "[Da.9] Dwell time/JUMP destination positioning data No.".
- When the execution conditions set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the JUMP instruction have not been established: the JUMP instruction is ignored, and the next positioning data No. is executed.

Restrictions

- When using a conditional JUMP instruction, establish the JUMP instruction execution conditions by the 4th positioning data No. before the JUMP instruction positioning data No. If the JUMP instruction execution conditions are not established by the time of 4th positioning control before the JUMP instruction, the operation will be processed as an operation regarding that the JUMP instruction execution conditions are not established. (During the execution of continuous path control/ continuous positioning control, the Motion module calculates the positioning data of the positioning data No. four items ahead of the current positioning data.)
- Set JUMP instruction to positioning data No. that "continuous positioning control" or "continuous path control" is set in operation pattern. It cannot set to positioning data No. that "positioning complete" is set in operation pattern.
- Positioning control such as loops cannot be executed by conditional JUMP instructions alone until the conditions have been established. When loop control is executed using JUMP instruction, an axis operation status is "analyzing" during loop control, and the positioning data analysis (start) for other axes are not executed. As the target of the JUMP instruction, specify a positioning data that is controlled by other than JUMP and NOP instructions.

Setting positioning data

When using the JUMP instruction, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	—
[Da.2]	Control method	◎ (Set the JUMP instruction.)
[Da.3]	Acceleration time No.	—
[Da.4]	Deceleration time No.	—
[Da.6]	Positioning address/movement amount	—
[Da.7]	Arc address	—
[Da.8]	Command speed	—
[Da.9]	Dwell time/JUMP destination positioning data No.	◎ (Set the positioning data No.1 to 600 for the JUMP destination.)
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	◎ (Set the JUMP instruction execution conditions with the condition data No. 0: Unconditional JUMP 1 to 10: Condition data No. ("Simultaneous Start" condition data cannot be set.))
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	—
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

LOOP

The LOOP is used for loop control by the repetition of LOOP to LEND.

Operation

The LOOP to LEND loop is repeated by set repeat cycles.

Setting positioning data

When using the LOOP, set the following positioning data.

◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	—
[Da.2]	Control method	◎ (Set the LOOP.)
[Da.3]	Acceleration time No.	—
[Da.4]	Deceleration time No.	—
[Da.6]	Positioning address/movement amount	—
[Da.7]	Arc address	—
[Da.8]	Command speed	—
[Da.9]	Dwell time/JUMP destination positioning data No.	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	◎ (Set the repeat cycles.)
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	—
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.

☞ Page 489 Positioning data

Restrictions

- "Control method LOOP setting error" (error code: 1B33H) will occur if a "0" is set for the repeat cycles.
- Even if LEND is absent after LOOP, no error will occur, but repeat processing will not be carried out.
- Nesting is not allowed between LOOP-LEND's. If such setting is made, only the inner LOOP-LEND is processed repeatedly.

Point

The setting by this control method is easier than that by the special start "FOR Loop". (☞ Page 151 Repeated start (FOR Loop))

- For special start: Positioning start data, special start data, condition data, and positioning data
- For control method: Positioning data

For the special start FOR to NEXT, the positioning data is required for each of FOR and NEXT points. For the control method, loop can be executed even only by one data.

Also, nesting is enabled by using the control method LOOP to LEND in combination with the special start FOR to NEXT. However LOOP to LEND cannot be set across block. Always set LOOP to LEND so that the processing ends within one block.

For details of the "block", refer to the following.

☞ Page 141 HIGH-LEVEL POSITIONING CONTROL

LEND

The LEND is used to return the operation to the top of the repeat (LOOP to LEND) loop.

Operation

When the repeat cycle designated by the LOOP becomes 0, the loop is terminated, and the next positioning data No. processing is started. (The operation pattern, if set to "Positioning complete", will be ignored.)
When the operation is stopped after the repeat operation is executed by designated cycles, the dummy positioning data (for example, incremental positioning without movement amount) is set next to LEND.
The following table shows the operation when the positioning complete (00) is set to LOOP and LEND.

Positioning data No.	Operation pattern	Control method	Conditions	Operation
1	Continuous control	ABS2		Executed in the order of the positioning data No.1 → 2 → 3 → 4 → 5 → 2 → 3 → 4 → 5 → 6. (The operation patterns of the positioning data Nos. 2 and 5 are ignored.)
2	Positioning complete	LOOP	Number of loop cycles: 2	
3	Continuous path control	ABS2		
4	Continuous control	ABS2		
5	Positioning complete	LEND		
6	Positioning complete	ABS2		

Setting positioning data

When using the LEND, set the following positioning data.
◎: Always set, ○: Set as required, —: Setting not required

Setting item		Setting required/not required
[Da.1]	Operation pattern	—
[Da.2]	Control method	◎ (Set the LEND.)
[Da.3]	Acceleration time No.	—
[Da.4]	Deceleration time No.	—
[Da.6]	Positioning address/movement amount	—
[Da.7]	Arc address	—
[Da.8]	Command speed	—
[Da.9]	Dwell time/JUMP destination positioning data No.	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	—
[Da.20]	Axis to be interpolated No.1	—
[Da.21]	Axis to be interpolated No.2	—
[Da.22]	Axis to be interpolated No.3	—
[Da.27]	M code ON signal output timing	—
[Da.28]	ABS direction in degrees	—
[Da.29]	Interpolation speed designation method	—

Refer to the following for information on the setting details.
☞ Page 489 Positioning data

Restrictions

- Ignore the "LEND" before the "LOOP" is executed.
- When the operation pattern "Positioning complete" has been set between LOOP and LEND, the positioning control is completed after the positioning data is executed, and the LOOP control is not executed.

4 HIGH-LEVEL POSITIONING CONTROL

The details and usage of high-level positioning control (control functions using the "block start data") are explained in this chapter.
High-level positioning control is used to carry out applied control using the "positioning data". Examples of applied control are using conditional judgment to control "positioning data" set with the major positioning control, or simultaneously starting "positioning data" for several different axes.
Read the execution procedures and settings for each control, and set as required.

4.1 Outline of High-level Positioning Control

In "high-level positioning control" the execution order and execution conditions of the "positioning data" are set to carry out more applied positioning. (The execution order and execution conditions are set in the "block start data" and "condition data".)
The following applied positioning controls can be carried out with "high-level positioning control".

High-level positioning control	Description
Block*1 start (Normal Start)	With one start, executes the positioning data in a random block with the set order.
Condition Start	Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". • When the condition is established, the "block start data" is executed. • When not established, that "block start data" is ignored, and the next point's "block start data" is executed.
Wait Start	Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". • When the condition is established, the "block start data" is executed. • When not established, stops (waits) the control until the condition is established.
Simultaneous Start*2	Simultaneously executes the designated positioning data of the axis designated with the "condition data". (Outputs command at the same timing.)
Repeated start (FOR Loop)	Repeats the program from the "block start data" set with the "FOR Loop" to the "block start data" set in "NEXT" for the designated number of times.
Repeated start (FOR Condition)	Repeats the program from the "block start data" set with the "FOR Condition" to the "block start data" set in "NEXT" until the conditions set in the "condition data" are established.

*1 "1 block" is defined as all the data continuing from the positioning data in which "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern" to the positioning data in which "independent positioning control (Positioning complete)" is set.
*2 Besides the simultaneous start of "block start data" system, the "simultaneous starts" include the "multiple axes simultaneous start control" of control method. Refer to the following for details.
☞ Page 26 Multiple axes simultaneous start

High-level positioning control sub functions

"High-level positioning control" uses the "positioning data" set with the "major positioning control". Refer to "Combination of Main Function and Sub Function" in the following manual for details on "sub functions" that can be combined with the main functions.
📖MELSEC iQ-R Motion Module User's Manual (Startup)
Note that the pre-reading start function cannot be used together with "high-level positioning control".

Data required for high-level positioning control

"High-level positioning control" is executed by setting the required items in the "block start data" and "condition data", then starting that "block start data". Judgment about whether execution is possible, etc., is carried out at execution using the "condition data" designated in the "block start data".

"Block start data" can be set for each No. from 7000 to 7004 (called "block Nos."), and up to 50 points can be set for each axis. (This data is controlled with Nos. called "points" to distinguish it from the positioning data. For example, the 1st block start data item is called the "1st point block start data" or "point No.1 block start data".)

"Condition data" can be set for each No. from 7000 to 7004 (called "block Nos."), and up to 10 data items can be set for each axis.

The "block start data" and "condition data" are set as 1 set for each block No.

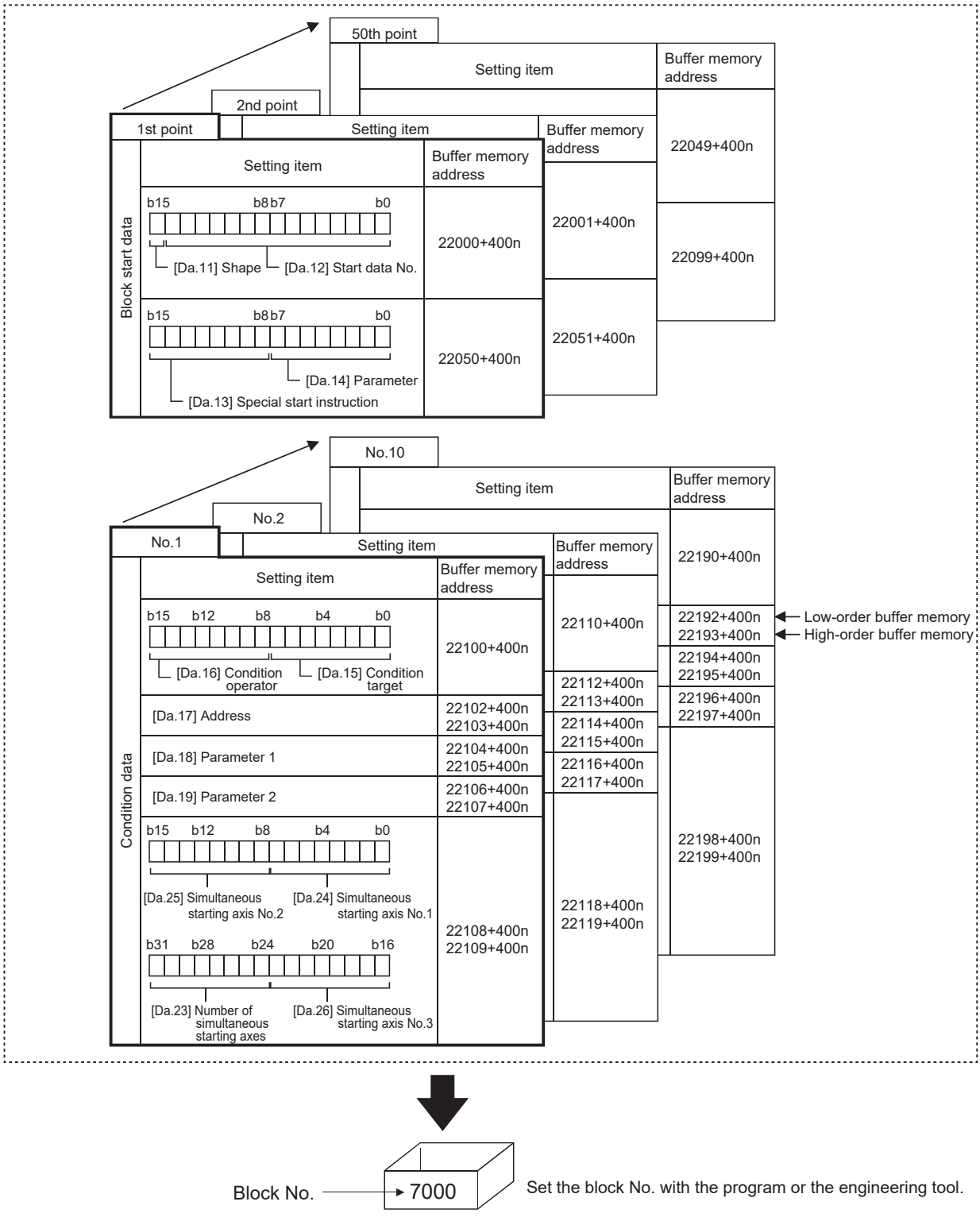
The following table shows an outline of the setting items and setting details for the "block start data" and "condition data" to be stored in the Motion module.

Setting item			Setting details
Block start data	[Da.11]	Shape	Set whether to end the control after executing only the "block start data" of the shape itself, or continue executing the "block start data" set in the next point.
	[Da.12]	Start data No.	Set the "positioning data No." to be executed.
	[Da.13]	Special start instruction	Set the method by which the positioning data set in [Da.12] will be started.
	[Da.14]	Parameter	Set the conditions by which the start will be executed according to the commands set in [Da.13]. (Designate the "condition data No." and "Number of repetitions".)

Setting item			Setting details
Condition data	[Da.15]	Condition target	Designate the "device", "buffer memory storage details", and "positioning data No." elements for which the conditions are set.
	[Da.16]	Condition operator	Set the judgment method carried out for the target set in [Da.15].
	[Da.17]	Address	Set the buffer memory address in which condition judgment is carried out (only when the details set in [Da.15] are "buffer memory storage details").
	[Da.18]	Parameter 1	Set the required conditions according to the details set in [Da.15], [Da.16], and [Da.23].
	[Da.19]	Parameter 2	
	[Da.23]	Number of simultaneous starting axes	Set the number of axes to be started simultaneously in the simultaneously start.
	[Da.24]	Simultaneous starting axis No.1	Set the simultaneous starting axis in the simultaneously start.
	[Da.25]	Simultaneous starting axis No.2	
	[Da.26]	Simultaneous starting axis No.3	

"Block start data" and "condition data" configuration

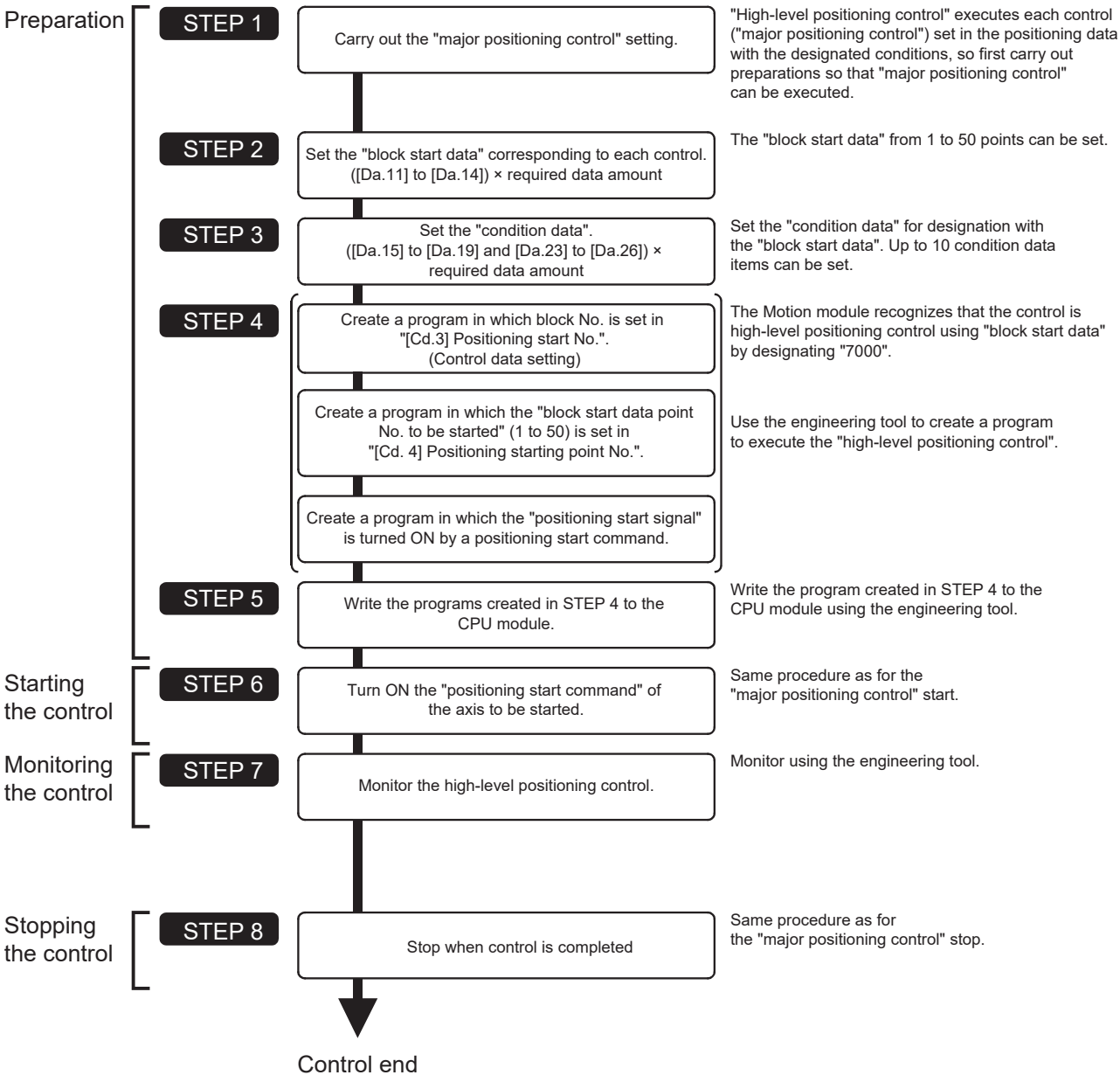
The "block start data" and "condition data" corresponding to "block No.7000" can be stored in the buffer memory.



Set the "block start data" and "condition data" corresponding to the following "block No.7001 to 7004" to the Motion module using the program or engineering tool.

4.2 High-level Positioning Control Execution Procedure

High-level positioning control is carried out using the following procedure.



Point

- Five sets of "block start data (50 points)" and "condition data (10 items)" corresponding to "No.7000 to 7004" are set with a program.
- Five sets corresponding to "7000" to "7004" can be set with an engineering tool as well. When writing to the Motion module after setting the "block start data" and "condition data" corresponding to "7000" to "7004" using an engineering tool, "7000" to "7004" can be set in "[Cd.3] Positioning start No." on STEP4.

4.3 Setting the Block Start Data

Relation between various controls and block start data

The "block start data" must be set to carry out "high-level positioning control".
The setting requirements and details of each "block start data" item to be set differ according to the "[Da.13] Special start instruction" setting.
The following shows the "block start data" setting items corresponding to various control methods.
Also refer to the following for details on "condition data" with which control execution is judged.
☞ Page 154 Setting the Condition Data
(The "block start data" settings in this chapter are assumed to be carried out using the engineering tool.)
◎: One of the two setting items must be set
○: Set as required (Set to "—" when not used)
×: Setting not possible
—: Setting not required (Set the initial value or a value within the setting range.)

Block start data setting items			Block start (Normal Start)	Condition Start	Wait Start	Simultaneous Start	Repeated start (FOR Loop)	Repeated start (FOR Condition)	NEXT Start*1
[Da.11]	Shape	0: End	◎	◎	◎	◎	×	×	◎
		1: Continue	◎	◎	◎	◎	◎	◎	◎
[Da.12]	Start data No.		1 to 600						
[Da.13]	Special start instruction		0	1	2	3	4	5	6
[Da.14]	Parameter		—	Condition data No.			Number of repetitions	Condition data No.	—

*1 The "NEXT Start" instruction is used in combination with "repeated start (FOR Loop)" and "repeated start (FOR Condition)". Control using only the "NEXT Start" will not be carried out.

Point

It is recommended that the "block start data" be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan time will increase.

Block start

In a "block start (normal start)", the positioning data groups of a block are continuously executed in a set PLC starting from the positioning data set in "[Da.12] Start data No." by one start.

The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	0: Block start	—
2nd point	1: Continue	2	0: Block start	—
3rd point	1: Continue	5	0: Block start	—
4th point	1: Continue	10	0: Block start	—
5th point	0: End	15	0: Block start	—
⋮				

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern	
1	00: Positioning complete	
2	11: Continuous path control	1 block*1
3	01: Continuous positioning control	
4	00: Positioning complete	
5	11: Continuous path control	1 block
6	00: Positioning complete	
⋮		
10	00: Positioning complete	
⋮		
15	00: Positioning complete	
⋮		

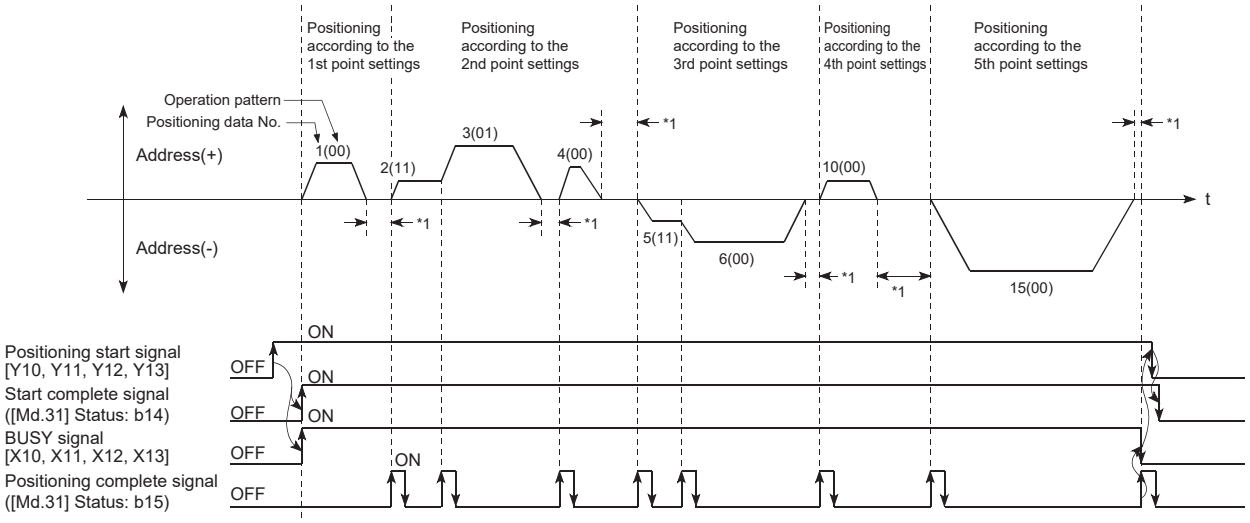
*1 "1 block" is defined as all the data continuing from the positioning data in which "continuous positioning control" or "continuous path control" is set in "[Da.1] Operation pattern" to the positioning data in which "independent positioning control (Positioning complete)" is set.

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

- The positioning data is executed in the following order before stopping. Axis 1 positioning data No.1 → 2 → 3 → 4 → 5 → 6 → 10 → 15.

■Operation example



*1 Dwell time of corresponding positioning data

Condition Start

In a "condition start", the "condition data" conditional judgment designated in "[Da.14] Parameter" is carried out for the positioning data set in "[Da.12] Start data No.". If the conditions have been established, the "block start data" set in "1: condition start" is executed. If the conditions have not been established, that "block start data" will be ignored, and the "block start data" of the next point will be executed.
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	1: Condition Start	1
2nd point	1: Continue	10	1: Condition Start	2
3rd point	0: End	50	0: Block start	—
⋮				

The "condition data Nos." have been set in "[Da.14] Parameter".

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
⋮	
10	11: Continuous path control
11	11: Continuous path control
12	00: Positioning complete
⋮	
50	00: Positioning complete
⋮	

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

1. The conditional judgment set in "condition data No.1" is carried out before execution of "positioning data No.1" for axis 1.
→ Conditions established → Execute positioning data No.1, 2, and 3 → Go to the next 2.
→ Conditions not established → Go to the next 2.

2. The conditional judgment set in "condition data No.2" is carried out before execution of "positioning data No.10" for axis 1.
→ Conditions established → Execute positioning data No.10, 11, and 12 → Go to the next 3.
→ Conditions not established → Go to the next 3.

3. Execute "positioning data No.50" for axis 1 and stop the control.

Wait Start

In a "wait start", the "condition data" conditional judgment designated in "[Da.14] Parameter" is carried out for the positioning data set in "[Da.12] Start data No.". If the conditions have been established, the "block start data" is executed. If the conditions have not been established, the control stops (waits) until the conditions are established.
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	2: Wait Start	3
2nd point	1: Continue	10	0: Block start	—
3rd point	0: End	50	0: Block start	—
⋮				

The "condition data Nos." have been set in "[Da.14] Parameter".

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
⋮	
10	11: Continuous path control
11	11: Continuous path control
12	00: Positioning complete
⋮	
50	00: Positioning complete
⋮	

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

1. The conditional judgment set in "condition data No. 3" is carried out before execution of "positioning data No.1" for axis 1.
→ Conditions established → Execute positioning data No.1, 2, and 3 → Go to the next 2.
→ Conditions not established → Control stops (waits) until conditions are established → Go to the above 1.

2. Execute "positioning data No.10, 11, 12, and 50" for axis 1 and stop the control.

Simultaneous Start

In a "simultaneous start", the positioning data set in "[Da.12] Start data No." and positioning data of other axes set in the "condition data" are simultaneously executed (commands are output with the same timing). (The "condition data" is designated with "[Da.14] Parameter".)
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	0: End	1	3: Simultaneous Start	4
⋮				

It is assumed that the "axis 2 positioning data" for simultaneous starting is set in the "condition data" designated with "[Da.14] Parameter".

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
⋮	

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

1. Check the axis operation status of axis 2 which is regarded as the simultaneous starting axis.
→ Axis 2 is standing by → Go to the next 2.
→ Axis 2 is carrying out positioning. → An error occurs and simultaneous start will not be carried out.

2. Simultaneously start "positioning data No.1" for axis 1 and positioning data for axis 2 set in "condition data No.4".

Precautions

Positioning data No. executed by simultaneous starting axes is set to condition data ("[Da.18] Parameter 1", "[Da.19] Parameter 2"), however, the setting value of the start axis (the axis which carries out positioning start) should be "0". If the setting value is set to other than "0", the positioning data set in "[Da.18] Parameter 1", "[Da.19] Parameter 2" is given priority to be executed rather than "[Da.12] Start data No.".
For details, refer to the following.
☞ Page 509 Condition Data

Repeated start (FOR Loop)

In a "repeated start (FOR Loop)", the data between the "block start data" in which "4: FOR Loop" is set in "[Da.13] Special start instruction" and the "block start data" in which "6: NEXT Start" is set in "[Da.13] Special start instruction " is repeatedly executed for the number of times set in "[Da.14] Parameter". An endless loop will result if the number of repetitions is set to "0".
(The number of repetitions is set in "[Da.14] Parameter" of the "block start data" in which "4: FOR Loop" is set in "[Da.13] Special start instruction".)
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	4: FOR Loop	2
2nd point	1: Continue	10	0: Block start	—
3rd point	0: End	50	6: NEXT Start	—
⋮				

The "condition data Nos." have been set in "[Da.14] Parameter".

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
⋮	
10	11: Continuous path control
11	00: Positioning complete
⋮	
50	01: Continuous positioning control
51	00: Positioning complete
⋮	

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

1. Execute "positioning data No.1, 2, 3, 10, 11, 50, and 51" for axis 1.
2. Return to the "1st point block start data" for axis 1. Again execute "positioning data No.1, 2, 3, 10, 11, 50 and 51" for axis 1, and then stop the control. (Repeat for the number of times (2 times) set in [Da.14].)

Repeated start (FOR condition)

In a "repeated start (FOR Condition)", the data between the "block start data" in which "5: FOR Condition" is set in "[Da.13] Special start instruction" and the "block start data" in which "6: NEXT Start" is set in "[Da.13] Special start instruction" is repeatedly executed until the establishment of the conditions set in the "condition data".
Conditional judgment is performed as soon as switching to the point of "6: NEXT Start" (before positioning of NEXT start point).
(The "condition data" designation is set in "[Da.14] Parameter" of the "block start data" in which "5: FOR Condition" is set in "[Da.13] Special start instruction".)
The control examples are shown when the "block start data" and "positioning data" are set as shown in the setting examples.

Setting examples

■Block start data setting example

Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	5: FOR Condition	5
2nd point	1: Continue	10	0: Block start	—
3rd point	0: End	50	6: NEXT Start	—
⋮				

The "condition data Nos." have been set in "[Da.14] Parameter".

■Positioning data setting example

Axis 1 positioning data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
⋮	
10	11: Continuous path control
11	00: Positioning complete
⋮	
50	01: Continuous positioning control
51	00: Positioning complete
⋮	

Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in the setting examples and started.

1. Execute "positioning data No.1, 2, 3, 10, and 11" for axis 1.

2. Carry out the conditional judgment set in axis 1 "condition data No.5".*1

→ Conditions not established → Execute "Positioning data No.50, 51". Go to the above 1.

→ Conditions established → Execute "Positioning data No.50, 51" and complete the positioning.

*1 Conditional judgment is carried out as soon as switching to the NEXT start point (before positioning of the NEXT start point).

Restrictions when using the NEXT Start

The "NEXT Start" is an instruction indicating the end of the repetitions when executing the repeated start (FOR Loop) and the repeated start (FOR Condition).

(☞ Page 151 Repeated start (FOR Loop), ☞ Page 152 Repeated start (FOR condition))

The following shows the restrictions when setting "6: NEXT Start" in the "block start data".

- The processing when "6: NEXT Start" is set before execution of "4: FOR Loop" or "5: FOR Condition" is the same as that for a "0: Block start".
- Repeated processing will not be carried out if there is no "6: NEXT Start" instruction after the "4: FOR Loop" or "5: FOR Condition" instruction. (Note that an "error" will not occur.)
- Nesting is not possible between "4: FOR Loop" and "6: NEXT Start", or between "5: FOR Condition" and "6: NEXT Start". "FOR to NEXT nest construction" (warning code: 0DB1H) will occur if nesting is attempted.

[Operating examples without nesting structure]

Start block data	[Da.13] Special start instruction
1st point	Normal Start
2nd point	FOR
3rd point	Normal Start
4th point	NEXT → FOR of the 2nd point
5th point	Normal Start
6th point	Normal Start
7th point	FOR
8th point	Normal Start
9th point	NEXT → FOR of the 7th point
⋮	

[Operating examples with nesting structure]

Start block data	[Da.13] Special start instruction
1st point	Normal Start
2nd point	FOR
3rd point	Normal Start
4th point	FOR
5th point	Normal Start
6th point	Normal Start
7th point	NEXT → FOR of the 4th point
8th point	Normal Start
9th point	NEXT
⋮	

A warning will occur when starting the 4th point "FOR". The JUMP destination of the 7th point "NEXT" is the 4th point. The 9th point "NEXT" is processed as normal start.

4.4 Setting the Condition Data

Relation between various controls and the condition data

"Condition data" is set in the following cases.

- When setting conditions during execution of the JUMP instruction (major positioning control)
- When setting conditions during execution of "high-level positioning control"

The "condition data" to be set includes the setting items from [Da.15] to [Da.19] and [Da.23] to [Da.26], but the setting requirements and details differ according to the control method and setting conditions.

The following shows the setting items for "condition data" "[Da.15] Condition target" corresponding to the different types of control.

(The "condition data" settings in this chapter are assumed to be carried out using the engineering tool.)

◎: One of the two setting items must be set.

×: Setting not possible

Setting item for "[Da.15] Condition target"	High-level positioning control				Major positioning control
	Condition Start	Wait Start	Simultaneous Start	Repeated Start (For Condition)	JUMP instruction
01H: Device X*1	◎	◎	×	◎	◎
02H: Device Y*1	◎	◎	×	◎	◎
03H: Buffer memory (1 word)	◎	◎	×	◎	◎
04H: Buffer memory (2 words)	◎	◎	×	◎	◎
05H: Positioning data No.	×	×	◎	×	×

*1 Refer to devices X/Y which belong to the Motion module.

Restriction

It is recommended that the "condition data" be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

The setting requirements and details for the setting items of the following "condition data" [Da.16] to [Da.19] and [Da.23] differ according to the "[Da.15] Condition target" setting.
The following shows the [Da.16] to [Da.19] and [Da.23] setting items corresponding to the "[Da.15] Condition target".
—: Setting not required (Set the initial value or a value within the setting range.)
**: Value stored in buffer memory designated in [Da.17]

[Da.15] Condition target	[Da.16] Condition operator	[Da.23] Number of simultaneous starting axes	[Da.17] Address	[Da.18] Parameter 1	[Da.19] Parameter 2
01H: Device X	07H: DEV = ON 08H: DEV = OFF	—	—	X: 0H, 1H, 10H to 1FH[*1] Y: 0H, 1H, 10H to 1FH[*1] RWr (1 bit), RWw (1 bit): 0 to F	—
02H: Device Y					
03H: Buffer memory (1 word)[*2]	01H: ** = P1 02H: ** ≠ P1 03H: ** ≤ P1 04H: ** ≥ P1 05H: P1 ≤ ** ≤ P2 06H: ** ≤ P1, P2 ≤ **		Buffer memory address	P1 (numeric value)	P2 (numeric value) (Set only when "[Da.16] Condition operator" is [05H] or [06H].)
04H: Buffer memory (2 word)[*2]					
05H: Positioning data No.	Setting not possible	2	—	Low-order 16 bits: "[Da.24] Simultaneous starting axis No.1" positioning data No. High-order 16 bits: "[Da.25] Simultaneous starting axis No.2" positioning data No.	—
		3			Low-order 16 bits: "[Da.26] Simultaneous starting axis No.3" positioning data No. High-order 16 bits: Unusable (Set "0".)
		4			

*1 The setting value, whose axis No. exceeds the number of controlled axes, cannot be used.
*2 Comparison of ≤ and ≥ is judged as signed values. (☞ Page 512 Condition Data)

Judgment whether the condition operator is "=" or "≠" at the start of wait

Judgment on data is performed for each operation cycle of the Motion module. Thus, in the judgment on the data such as command position values which vary continuously, the operator "=" may not be detected. If this occurs, use a range operator.

Condition data setting examples

The following shows the setting examples for "condition data".

Setting the device ON/OFF as a condition

[Condition]

Device "X10" (Axis 1 BUSY signal) is OFF

[Da.15] Condition target	[Da.16] Condition operator	[Da.17] Address	[Da.18] Parameter 1	[Da.19] Parameter 2	[Da.23] Number of simultaneous starting axes	[Da.24] Simultaneous starting axis No.1	[Da.25] Simultaneous starting axis No.2	[Da.26] Simultaneous starting axis No.3
01H: Device X	08H: DEV = OFF	—	10H	—	—	—	—	—

Setting the numeric value stored in the "buffer memory" as a condition

[Condition]

The value stored in buffer memory addresses "2400, 2401" ([Md.20] Command position value) is "1000" or larger.

[Da.15] Condition target	[Da.16] Condition operator	[Da.17] Address	[Da.18] Parameter 1	[Da.19] Parameter 2	[Da.23] Number of simultaneous starting axes	[Da.24] Simultaneous starting axis No.1	[Da.25] Simultaneous starting axis No.2	[Da.26] Simultaneous starting axis No.3
04H: Buffer memory (2 words)	04H: ** ≥ P1	2400	1000	—	—	—	—	—

Designating the axis and positioning data No.

[Condition]

Simultaneous starting "axis 2 positioning data No.3"

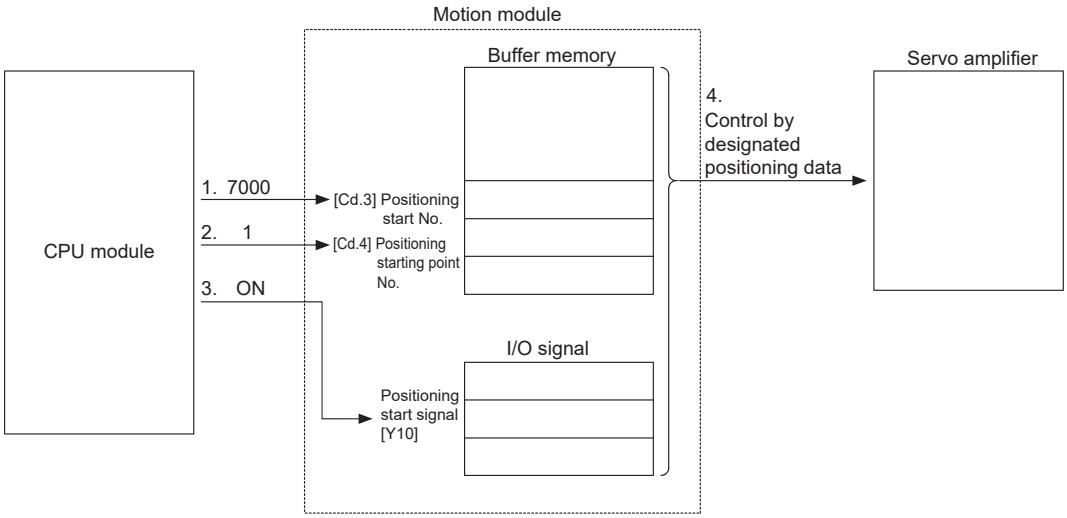
[Da.15] Condition target	[Da.16] Condition operator	[Da.17] Address	[Da.18] Parameter 1	[Da.19] Parameter 2	[Da.23] Number of simultaneous starting axes	[Da.24] Simultaneous starting axis No.1	[Da.25] Simultaneous starting axis No.2	[Da.26] Simultaneous starting axis No.3
05H: Positioning data No.	—	—	Low-order 16 bits "0003H"	—	2H: 2 axes	1H: Axis 2	0H	0H

4.5 Start Program for High-level Positioning Control

Starting high-level positioning control

To execute high-level positioning control, a program must be created to start the control in the same method as for major positioning control.

The following shows the procedure for starting the "1st point block start data" (regarded as block No.7000) set in axis 1.



Point

When performing a positioning start with the next scan after a positioning operation is completed, turn the positioning start signals [Y10 to Y1F] OFF and input the start complete signal ([Md.31] Status: b14) as an interlock condition to start after the start complete signal ([Md.31] Status: b14) is turned OFF.

1. Set "7000" in "[Cd.3] Positioning start No.".

(This establishes that the control as "high-level positioning control" using block start data.)

2. Set the point No. of the "block start data" to be started. (In this case, set "1".)

3. Turn ON the start signal.

4. The positioning data set in the "1st point block start data" is started.

Example of a start program for high-level positioning control

The following shows an example of a start program for high-level positioning control in which the 1st point "block start data" of axis 1 is started. (The block No. is regarded as "7000".)

Control data that require setting

The following control data must be set to execute high-level positioning control. The setting is carried out using a program.
n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.3]	Positioning start No.	7000	Set "7000" to indicate control using "block start data".	4300+100n
[Cd.4]	Positioning starting point No.	1	Set the point No. of the "block start data" to be started.	4301+100n

For details of the setting, refer to the following.
☞ Page 550 Control Data

Start conditions

The following conditions must be fulfilled when starting the control. The required conditions must also be integrated into the program, and configured so the control does not start unless the conditions are fulfilled.

Signal name		Signal state		Device
Interface signal	PLC READY signal	ON	CPU module preparation completed	Y0
	READY signal	ON	Preparation completed	X0
	All axis servo ON	ON	All axis servo ON	Y1
	Synchronization flag	ON	The buffer memory can be accessed.	X1
	Axis stop signal	OFF	Axis stop signal is OFF	[Cd.180] Axis stop
	Start complete signal	OFF	Start complete signal is OFF	[Md.31] Status: b14
	BUSY signal	OFF	BUSY signal is OFF	X10 to X1F*1
	Error detection signal	OFF	There is no error	[Md.31] Status: b13
	M code ON signal	OFF	M code ON signal is OFF	[Md.31] Status: b12
External signal	Forced stop input signal	ON	Forced stop input signal is ON	—
	Stop signal	OFF	Stop signal is OFF	—
	Upper limit signal (FLS)	ON	Within limit range	—
	Lower limit signal (RLS)	ON	Within limit range	—

*1 The BUSY signal, whose axis No. exceeds the number of controlled axes, cannot be used.

Start time chart

The following chart shows a time chart in which the positioning data No.1, 2, 10, 11, and 12 of axis 1 are continuously executed as an example.

■Block start data setting example

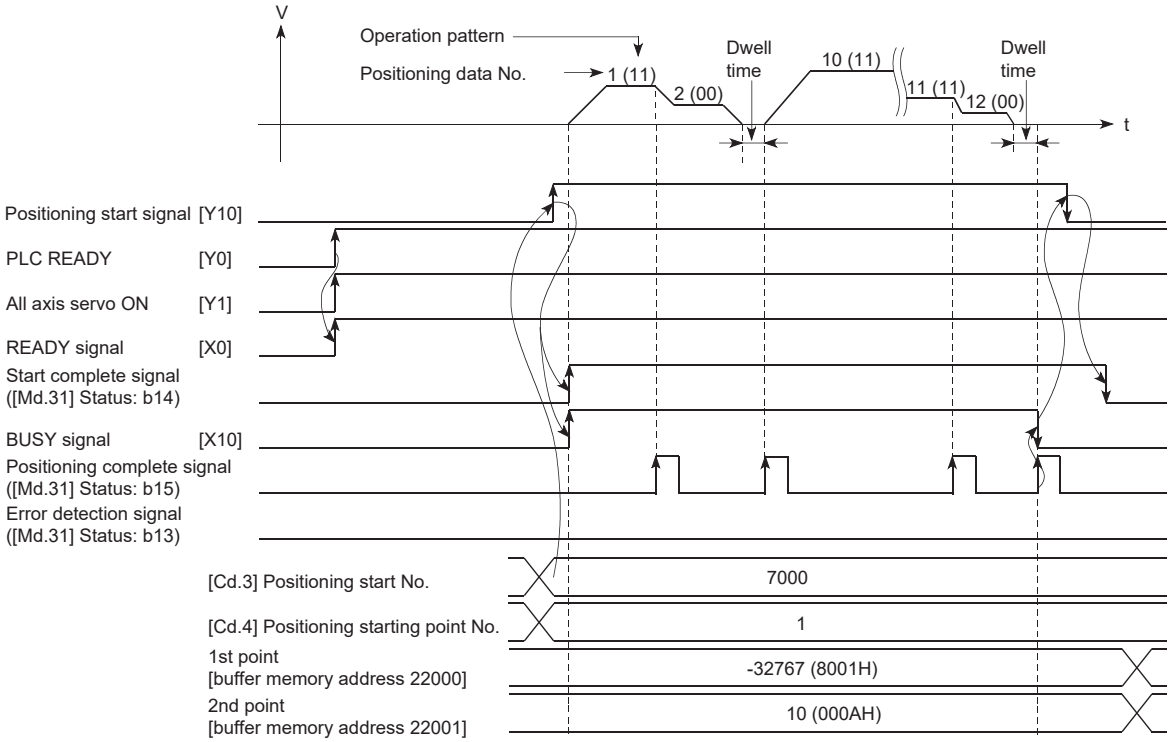
Axis 1 block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction	[Da.14] Parameter
1st point	1: Continue	1	0: Block start	—
2nd point	0: End	10	0: Block start	—
⋮				

■Positioning data setting example

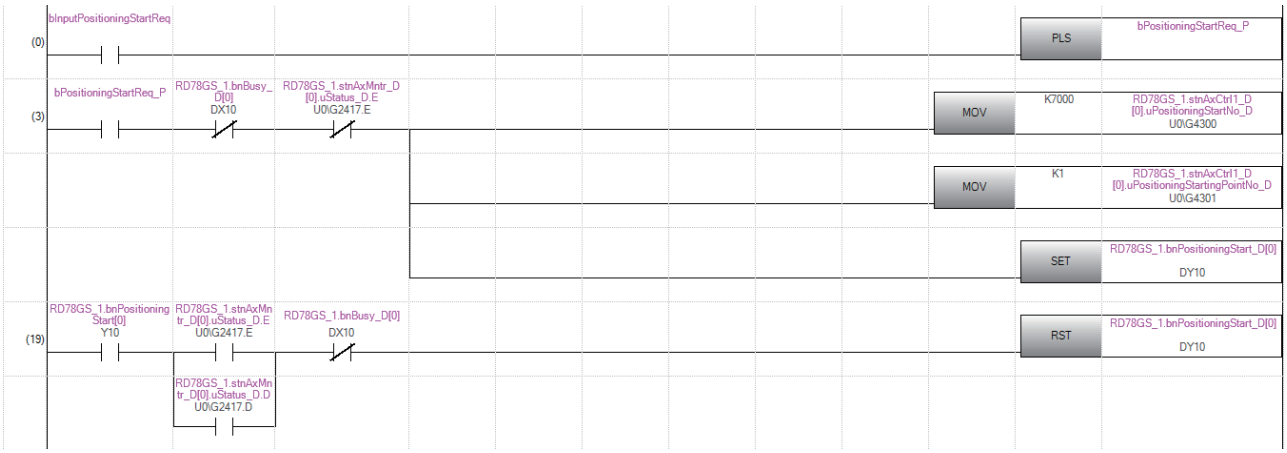
Axis 1 positioning data No.	[Da.1] Operation pattern
1	11: Continuous path control
2	00: Positioning complete
⋮	
10	11: Continuous path control
11	11: Continuous path control
12	00: Positioning complete
⋮	

■Start time chart

Ex.



Program example



Classification	Label name	Description
Module label	RD78GS_1.bnBusy_D[0]	Axis 1 BUSY signal
	RD78GS_1.stnAxMntr_D[0].uStatus_D.E	Axis 1 Start complete
	RD78GS_1.stnAxCtrl1_D[0].uPositioningStartNo_D	Axis 1 Positioning start No.
	RD78GS_1.stnAxCtrl1_D[0].uPositioningStartingPointNo_D	Axis 1 Positioning starting point No.
	RD78GS_1.bnPositioningStart[0]	Axis 1 Positioning start signal
	RD78GS_1.bnPositioningStart_D[0]	
Global label, local label	Defines the global label or local label as follows. The settings of assignment devices are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. The following table shows an example for the local label.	

	Label Name	Data Type		Class
1	bInputPositioningStartReq	Bit	...	VAR
2	bPositioningStartReq_P	Bit	...	VAR
3			...	

5 MANUAL CONTROL

The details and usage of manual control are explained in this chapter.
In manual control, commands are issued during a JOG operation and an inching operation executed by the turning ON of the JOG start signal, or from a manual pulse generator connected to the high-speed counter unit on the same base as the Motion module.
For details of the high-speed counter module, refer to the following manuals.
📖MELSEC iQ-R High-Speed Counter Module User's Manual (Startup)
📖MELSEC iQ-R High-Speed Counter Module User's Manual (Application)
Manual control using a program from the CPU module is explained in this chapter.

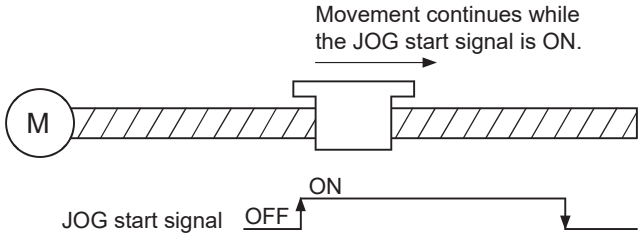
5.1 Outline of Manual Control

Three manual control methods

"Manual control" refers to control in which positioning data is not used, and a positioning operation is carried out in response to signal input from an external device.
The three types of this "manual control" are explained below.

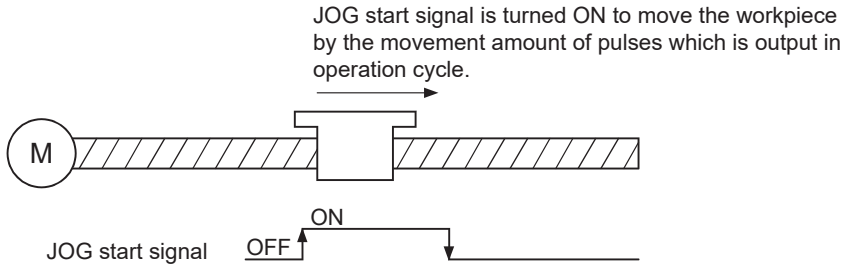
[JOG operation]

"JOG operation" is a control method in which the machine is moved by only a movement amount (commands are continuously output while the JOG start signal is ON). This operation is used to move the workpiece in the direction in which the limit signal is ON, when the operation is stopped by turning the limit signal OFF to confirm the positioning system connection and obtain the positioning data address (☞ Page 293 Teaching function).



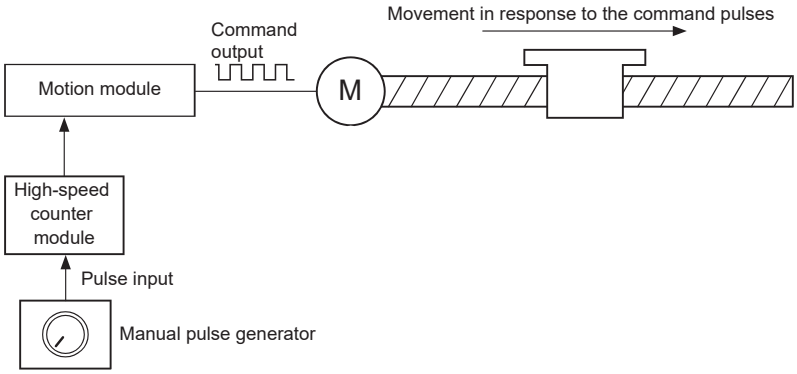
[Inching operation]

"Inching operation" is a control method in which a minute movement amount of command is output manually in operation cycle. When the "inching movement amount" of the axis control data is set by JOG operation, the workpiece is moved by a set movement amount. (When the "inching movement amount" is set to "0", the machine operates as JOG operation.)



[Manual pulse generator operation]

"Manual pulse generator operation" is a control method in which positioning is carried out in response to the number of pulses input from a manual pulse generator (the number of input command is output). This operation is used for manual fine adjustment, etc., when carrying out accurate positioning to obtain the positioning address.



■Manual control sub functions

Refer to the "Combination of Main Functions and Sub Functions" in the following manual for details on "sub functions" that can be combined with manual control.

📖MELSEC iQ-R Motion Module User's Manual (Startup)

Also refer to the following for details on each sub function.

☞ Page 226 CONTROL SUB FUNCTIONS

■Monitoring manual control

Refer to the following for directly monitoring the buffer memory using an engineering tool.

☞ Page 515 Monitor Data

Also refer to "Help" in the "Simple Motion Module Setting Function" when monitoring with the monitor functions of an engineering tool.

5.2 JOG Operation

Outline of JOG operation

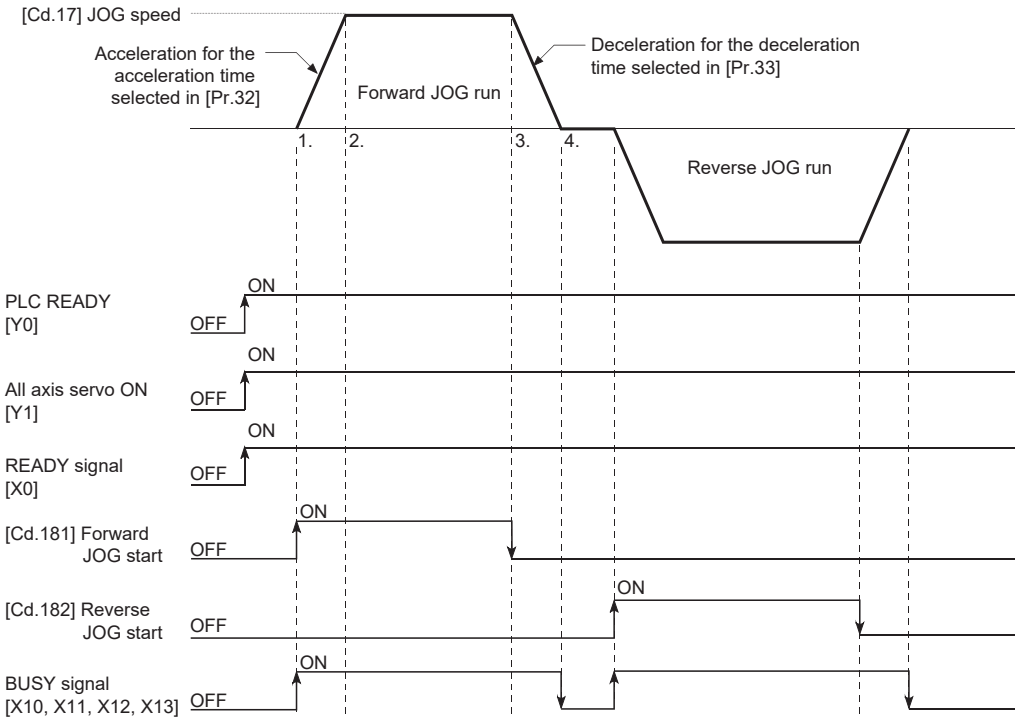
Operation

In JOG operation, the forward run JOG start signal [Cd.181] or reverse run JOG start signal [Cd.182] turns ON, causing pulses to be output to the servo amplifier from the Motion module while the signal is ON. The workpiece is then moved in the designated direction.

The following shows examples of JOG operation.

■Operation example

1. When the start signal turns ON, acceleration begins in the direction designated by the start signal, and continues for the acceleration time designated in "[Pr.32] JOG operation acceleration time selection". At this time, the BUSY signal changes from OFF to ON.
2. When the workpiece being accelerated reaches the speed set in "[Cd.17] JOG speed", the movement continues at this speed. The constant speed movement takes place at 2. and 3.
3. When the start signal is turned OFF, deceleration begins from the speed set in "[Cd.17] JOG speed", and continues for the deceleration time designated in "[Pr.33] JOG operation deceleration time selection".
4. The operation stops when the speed becomes "0". At this time, the BUSY signal changes from ON to OFF.



Restriction

Use the hardware stroke limit function when carrying out JOG operation near the upper or lower limits. (☞ Page 250 Hardware stroke limit function)

If the hardware stroke limit function is not used, the workpiece may exceed the moving range, causing an accident.

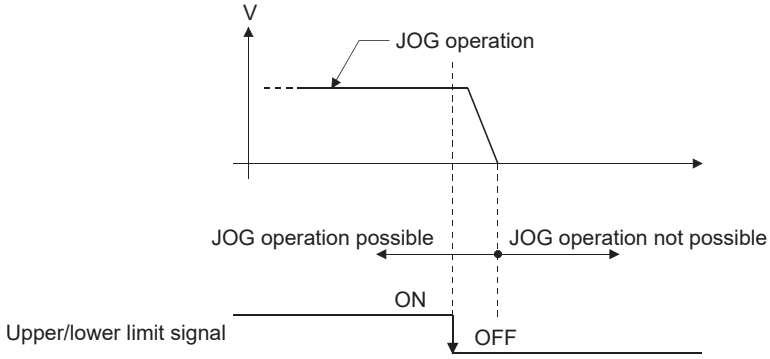
Precautions during operation

The following details must be understood before carrying out JOG operation.

- For safety, set a small value to "[Cd.17] JOG speed" at first and check the movement. Then gradually increase the value.
- "Outside JOG speed range" (error code: 1A80H) will occur and the operation will not start if the "JOG speed" is outside the setting range or 0 at the JOG start.
- "JOG speed limit value error" (error code: 1BB7H, 1BB8H) will occur and the operation will not start if "[Pr.31] JOG speed limit value" is set to a value larger than "[Pr.8] Speed limit value".
- If "[Cd.17] JOG speed" exceeds the speed set in "[Pr.31] JOG speed limit value", the workpiece will move at "[Pr.31] JOG speed limit value" and "JOG speed limit value" (warning code: 0D41H, 0D42H) will occur in the Motion module.
- The JOG operation can be continued even if an "Axis warning" has occurred.
- Set a "0" in "[Cd.16] Inching movement amount". If a value other than "0" is set, the operation will become an inching operation. (☞ Page 173 Inching Operation)

Operations when stroke limit error occurs

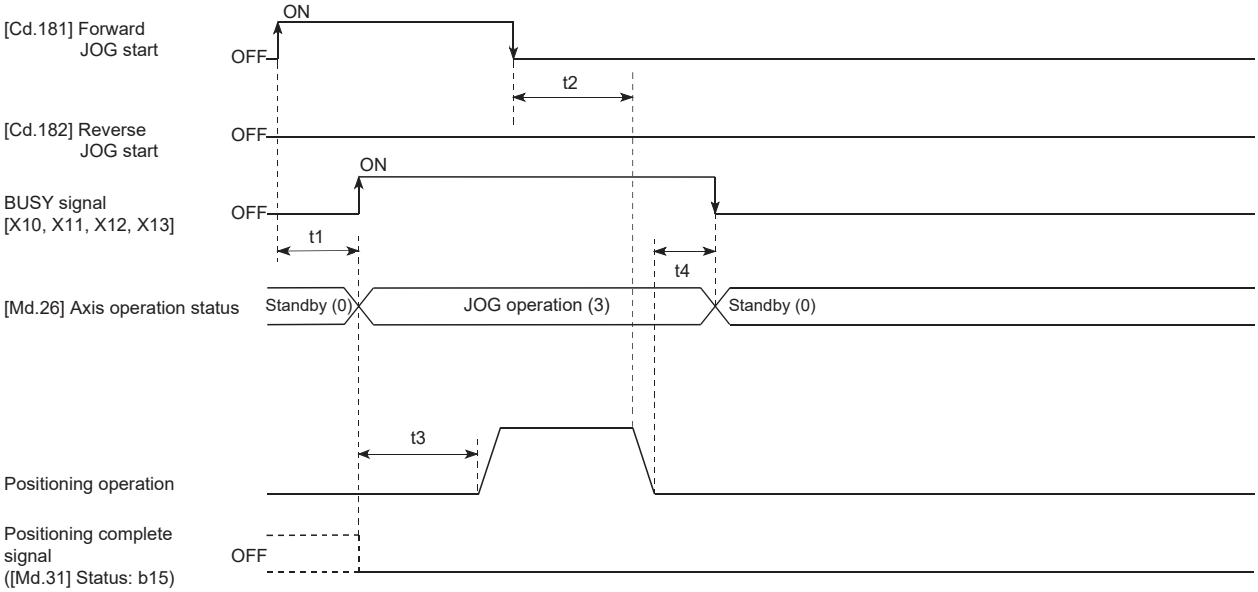
When the operation is stopped by hardware stroke limit error or software stroke limit error, the JOG operation can execute in an opposite way (direction within normal limits) after an error reset. (An error will occur again if JOG start signal is turned ON in a direction to outside the stroke limit.)



Operation timing and processing time

The following drawing shows details of the JOG operation timing and processing time.

■Operation example



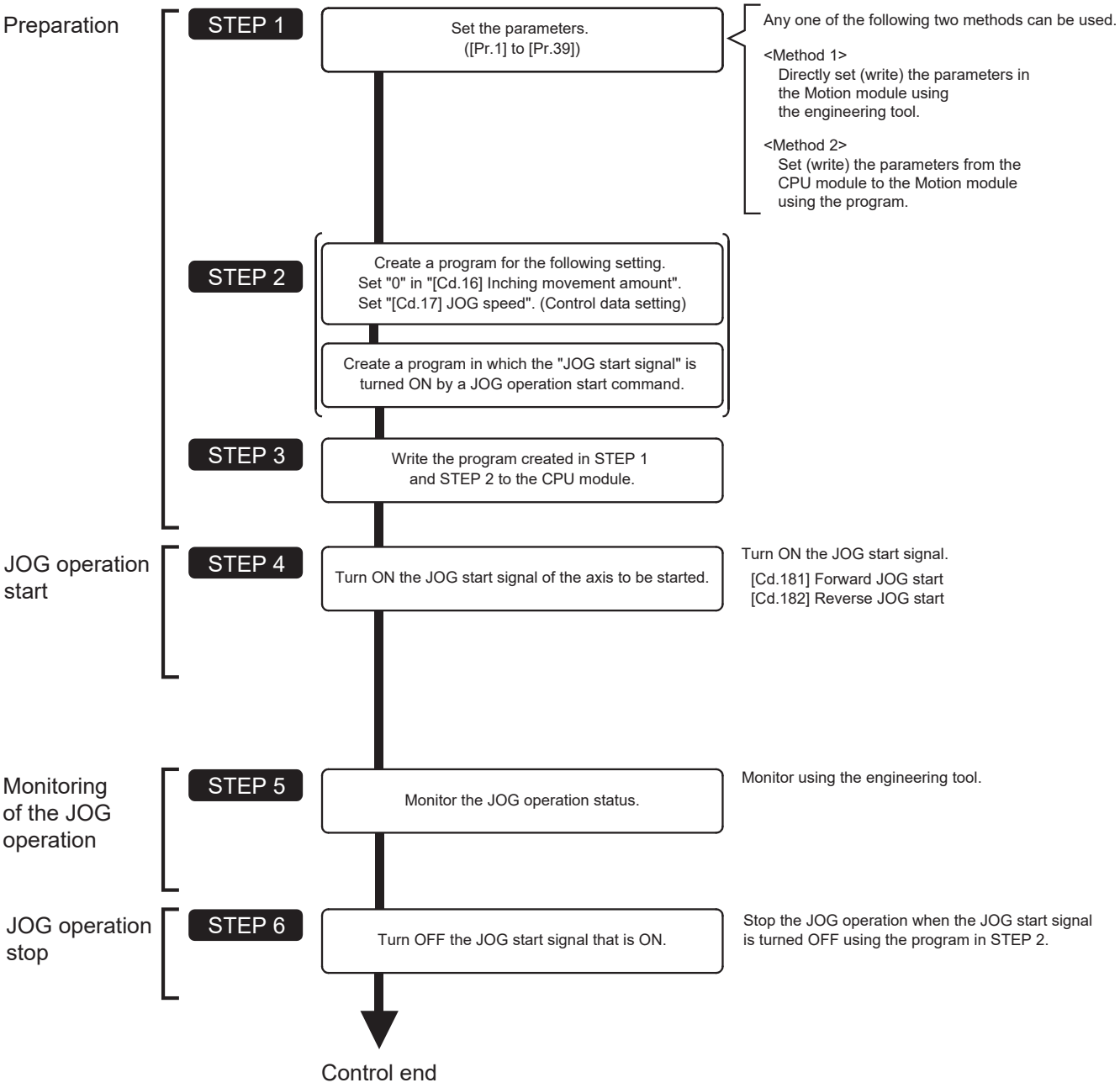
• Normal timing time (Unit: [ms])

Operation cycle	t1*1	t2	t3*2	t4
0.25	0.27 to 0.45	0.00 to 0.25	0.79 to 0.82	0.00 to 0.25
0.50	0.29 to 0.67	0.00 to 0.50	1.55 to 1.59	0.00 to 0.50
1.00	0.61 to 1.32	0.00 to 1.00	3.06 to 3.10	0.00 to 1.00
2.00	0.63 to 2.15	0.00 to 2.00	6.56 to 6.60	0.00 to 2.00
4.00	0.65 to 4.08	0.00 to 4.00	13.56 to 13.60	0.00 to 4.00

*1 Delays may occur in the t1 timing time due to the operation status of other axes.
*2 The t3 timing time depends on the setting of the acceleration time, servo parameter, etc.

JOG operation execution procedure

The JOG operation is carried out by the following procedure.



Point

- Mechanical elements such as limit switches are considered as already installed.
- Parameter settings work in common for all control using the Motion module.

Setting the required parameters for JOG operation

The "Positioning parameters" must be set to carry out JOG operation.

The following table shows the setting items of the required parameters for carrying out JOG operation. Parameters not shown below are not required to be set for carrying out only JOG operation. (Set the initial value or a value within the setting range.)

◎: Setting always required

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

Setting item			Setting requirement
Positioning parameters	[Pr.1]	Unit setting	◎
	[Pr.2]	Number of pulses per rotation (AP) (Unit: pulse)	◎
	[Pr.3]	Movement amount per rotation (AL) (Unit: pulse)	◎
	[Pr.4]	Unit magnification (AM)	◎
	[Pr.7]	Bias speed at start (Unit: pulse/s)	○
	[Pr.8]	Speed limit value (Unit: pulse/s)	◎
	[Pr.9]	Acceleration time 0 (Unit: ms)	◎
	[Pr.10]	Deceleration time 0 (Unit: ms)	◎
	[Pr.11]	Backlash compensation amount (Unit: pulse)	○
	[Pr.12]	Software stroke limit upper limit value (Unit: pulse)	○
	[Pr.13]	Software stroke limit lower limit value (Unit: pulse)	○
	[Pr.14]	Software stroke limit selection	○
	[Pr.15]	Software stroke limit valid/invalid setting	○
	[Pr.17]	Torque limit setting value (Unit: 0.1%)	○
	[Pr.25]	Acceleration time 1 (Unit: ms)	○
	[Pr.26]	Acceleration time 2 (Unit: ms)	○
	[Pr.27]	Acceleration time 3 (Unit: ms)	○
	[Pr.28]	Deceleration time 1 (Unit: ms)	○
	[Pr.29]	Deceleration time 2 (Unit: ms)	○
	[Pr.30]	Deceleration time 3 (Unit: ms)	○
	[Pr.31]	JOG speed limit value (Unit: pulse/s)	◎
	[Pr.32]	JOG operation acceleration time selection	◎
	[Pr.33]	JOG operation deceleration time selection	◎
	[Pr.34]	Acceleration/deceleration process selection	○
	[Pr.35]	S-curve ratio (Unit: %)	○
	[Pr.36]	Rapid stop deceleration time (Unit: ms)	○
	[Pr.37]	Stop group 1 rapid stop selection	○
	[Pr.38]	Stop group 2 rapid stop selection	○
	[Pr.39]	Stop group 3 rapid stop selection	○

Refer to the following for the setting details.

☞ Page 448 Basic Setting

Point

- Parameter settings work in common for all controls using the Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", "home position return positioning control"), set the respective setting items as well.
- Parameters are set for each axis.

Creating start programs for JOG operation

A program must be created to execute a JOG operation. Consider the "required control data setting", "start conditions" and "start time chart" when creating the program.

The following shows an example when a JOG operation is started for axis 1. ("[Cd.17] JOG speed" is set to "100.00mm/min" in the example shown.)

Required control data setting

The control data shown below must be set to execute a JOG operation. The setting is carried out with the program.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.16]	Inching movement amount	0	Set "0".	4317+100n
[Cd.17]	JOG speed	10000	Set a value equal to or below "[Pr.31] JOG speed limit value".	4318+100n 4319+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

Start conditions

The following conditions must be fulfilled when starting. The required conditions must also be assembled in the program, and the program must be configured so the operation will not start if the conditions are not fulfilled.

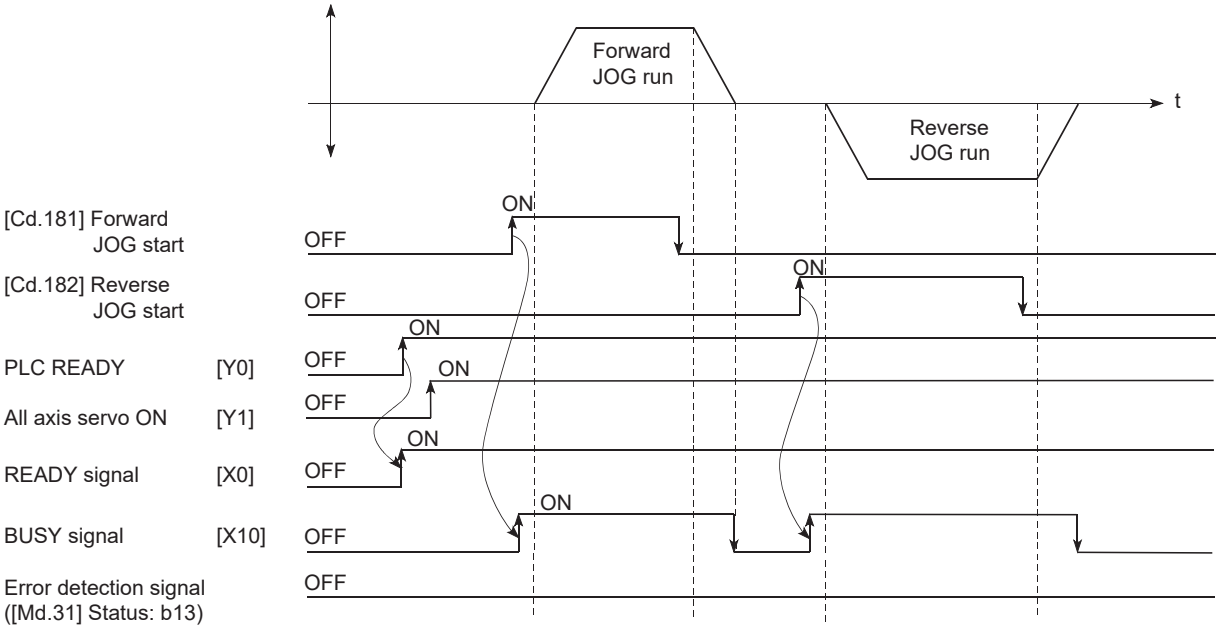
Signal name		Signal state		Device
Interface signal	PLC READY signal	ON	CPU module preparation completed	Y0
	READY signal	ON	Preparation completed	X0
	All axis servo ON	ON	All axis servo ON	Y1
	Synchronization flag*1	ON	The buffer memory can be accessed	X1
	Axis stop signal	OFF	Axis stop signal is OFF	[Cd.180] Axis stop
	Start complete signal	OFF	Start complete signal is OFF	[Md.31] Status: b14
	BUSY signal	OFF	Not operating	X10 to X1F*2
	Error detection signal	OFF	There is no error	[Md.31] Status: b13
	M code ON signal	OFF	M code ON signal is OFF	[Md.31] Status: b12
External signal	Forced stop input signal	ON	There is no forced stop input	—
	Stop signal	OFF	Stop signal is OFF	—
	Upper limit (FLS)	ON	Within limit range	—
	Lower limit (RLS)	ON	Within limit range	—

*1 The interlock must be provided so that the buffer memory is accessed after Synchronization flag [X1] turns on. When no interlock is provided, it may be accessed during an update of module parameters distributed from the CPU module or module extended parameters. If accessed during an update, an unexpected value may be read or written.

*2 The BUSY signal, whose axis No. exceeds the number of controlled axes, cannot be used.

Start time chart

■Operation example



Program example

Refer to the following for the program example of the JOG operation.

☞ Page 627 JOG operation setting program

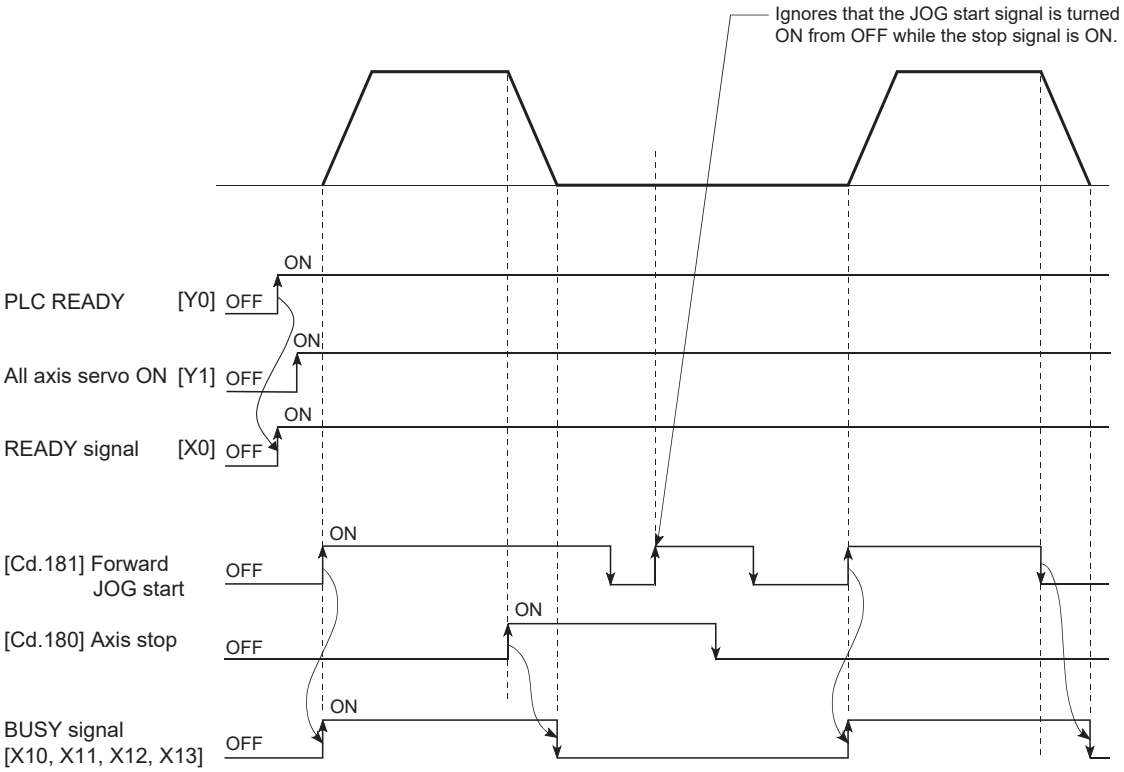
☞ Page 628 JOG operation/inching operation execution program

JOG operation example

Example 1

When the stop signal is turned ON during JOG operation, the JOG operation will stop by the deceleration stop method.
If the JOG start signal is turned ON while the stop signal is ON, "Stop signal ON at start" (error code: 1A08H) will occur.
The inching operation can be re-started when the stop signal is turned OFF and the JOG start signal is turned ON from OFF.

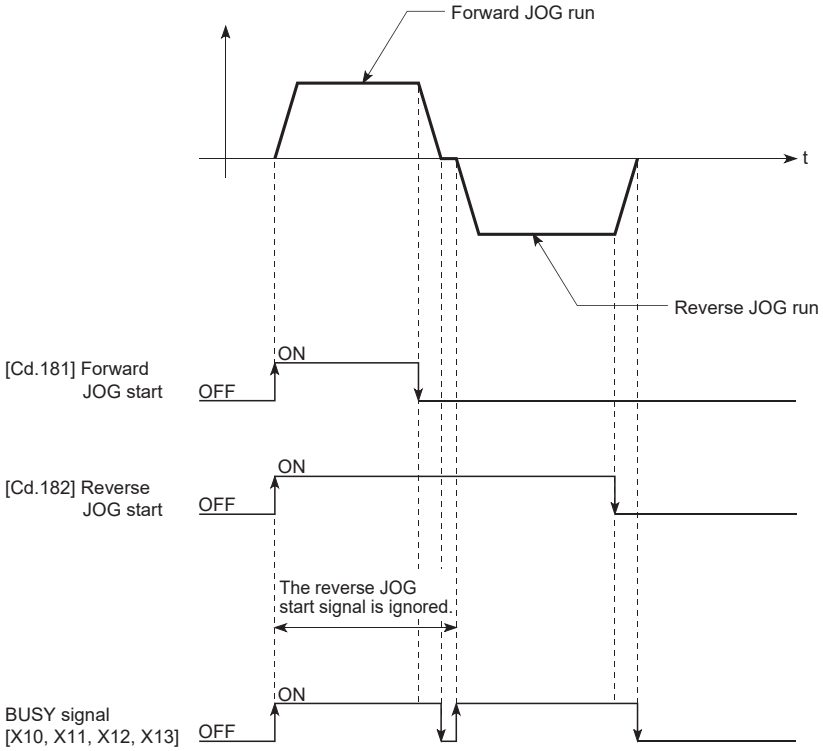
■Operation example



Example 2

When both the forward run JOG start signal and reverse run JOG start signal are turned ON simultaneously for one axis, the forward run JOG start signal is given priority. In this case, the reverse run JOG start signal is validated when the BUSY signal of Motion module is turned OFF. If the forward run JOG operation is stopped due to stop by a stop signal or axis error, the reverse run JOG operation will not be executed even if the reverse run JOG start signal turns ON.

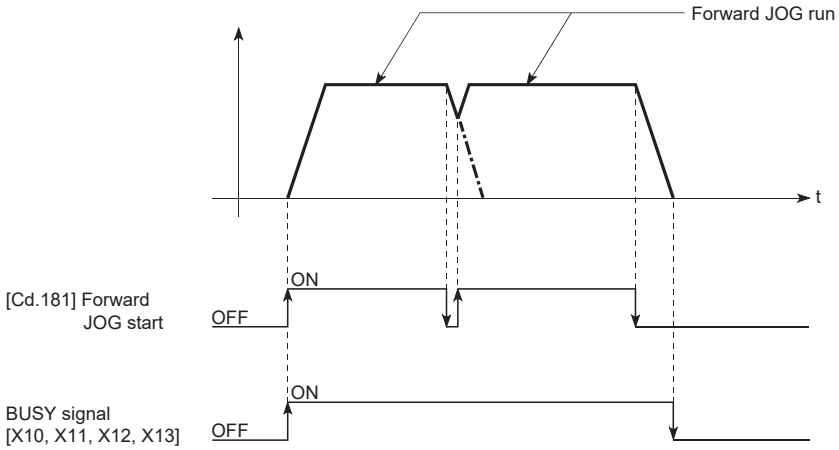
■Operation example



Example 3

When the JOG start signal is turned ON again during deceleration caused by the ON → OFF of the JOG start signal, the JOG operation will be carried out from the time the JOG start signal is turned ON.

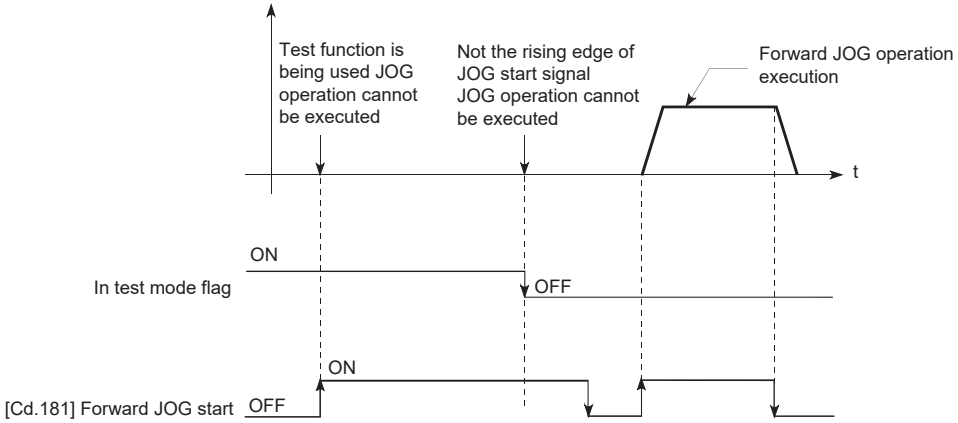
■Operation example



Example 4

If the JOG start signal is turned ON while the test function of GX Works3 is used, the JOG start signal is ignored and JOG operation is not executed.

■Operation example



5.3 Inching Operation

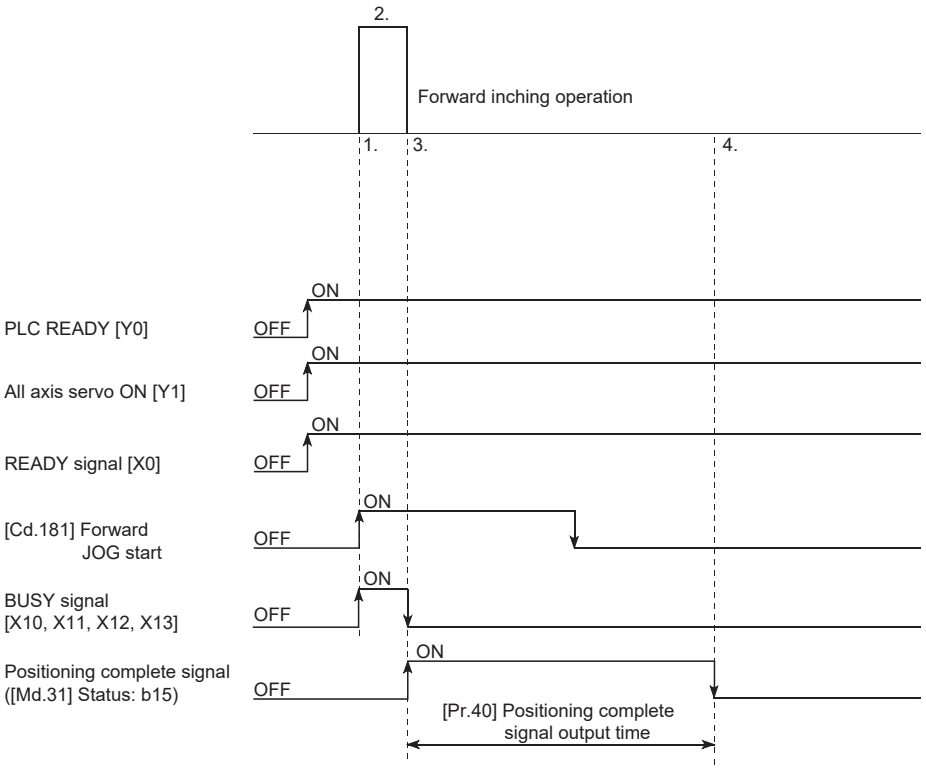
Outline of inching operation

Operation

In inching operation, pulses are output to the servo amplifier at operation cycle to move the workpiece by a designated movement amount after the forward run JOG start signal [Cd.181] or reverse JOG start signal [Cd.182] is turned ON.
The following shows the example of inching operation.

1. When the start signal is turned ON, inching operation is carried out in the direction designated by the start signal. In this case, BUSY signal is turned from OFF to ON.
2. The workpiece is moved by a movement amount set in "[Cd.16] Inching movement amount".
3. The workpiece movement stops when the speed becomes "0". In this case, BUSY signal is turned from ON to OFF. The positioning complete signal is turned from OFF to ON.
4. The positioning complete signal is turned from ON to OFF after a time set in "[Pr.40] Positioning complete signal output time" has been elapsed.

■Operation example



Restriction

When the inching operation is carried out near the upper or lower limit, use the hardware stroke limit function. (☞ Page 250 Hardware stroke limit function)
If the hardware stroke limit function is not used, the workpiece may exceed the movement range, and an accident may result.

Precautions during operation

The following details must be understood before inching operation is carried out.

• Acceleration/deceleration processing is not carried out during inching operation.

(Commands corresponding to the designated inching movement amount are output at operation cycle. When the movement direction of inching operation is reversed and backlash compensation is carried out, the backlash compensation amount and inching movement amount are output at the same operation cycle.)

"[Cd.17] JOG speed" is ignored even if it is set. "Inching movement amount error" (error code: 1A81H) will occur in the following case.

([Cd.16] Inching movement amount) × (A) > ([Pr.31] JOG speed limit value)

However, (A) is as follows.

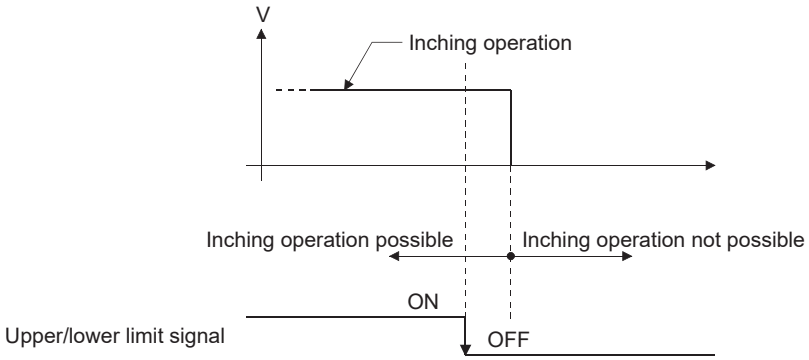
Unit setting	Operation cycle				
	0.25ms	0.50ms	1.00ms	2.00ms	4.00ms
When the unit setting is pulse	4000	2000	1000	500	250
When the unit setting is degree and "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid	240	120	60	30	15
When the unit setting is other than the above	1200	1200	600	300	150

• Set a value other than a "0" in "[Cd.16] Inching movement amount".

If a "0" is set, the operation will become JOG operation. (☞ Page 163 JOG Operation)

Operations when stroke limit error occurs

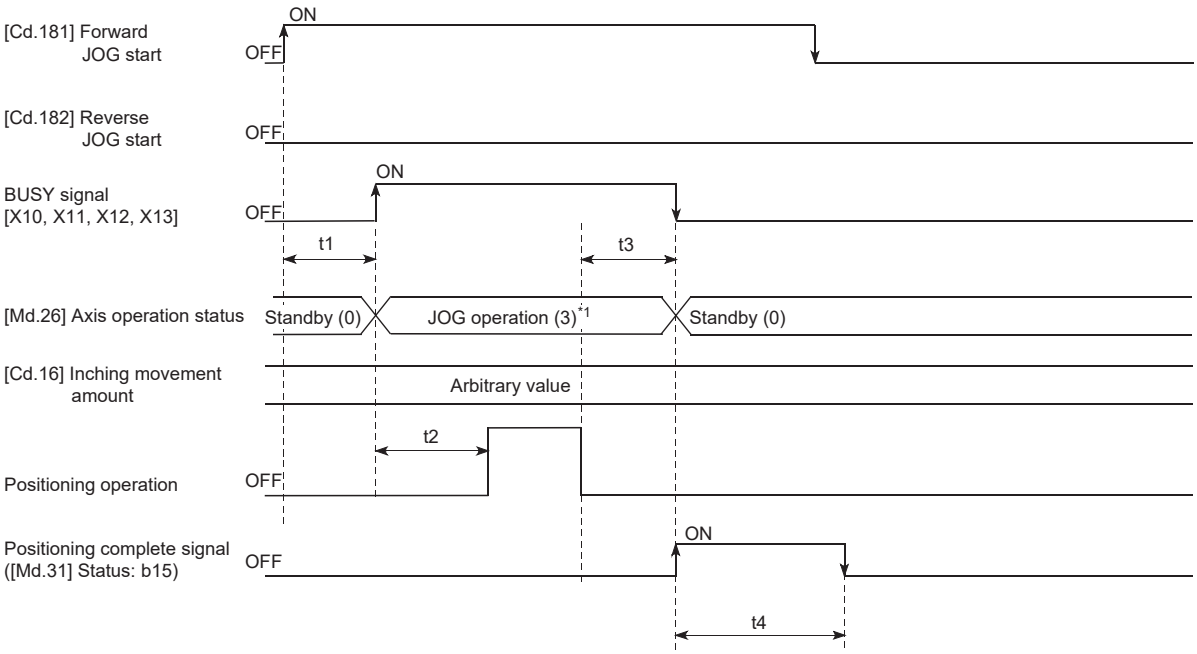
When the operation is stopped by hardware stroke limit error or software stroke limit error, the inching operation can be performed in an opposite way (direction within normal limits) after an error reset. (An error will occur again if JOG start signal is turned ON in a direction to outside the stroke limit.)



Operation timing and processing times

The following drawing shows the details of the inching operation timing and processing time.

■Operation example



*1 "JOG operation" is set in "[Md.26] Axis operation status" even during inching operation.

• Normal timing time (Unit: [ms])

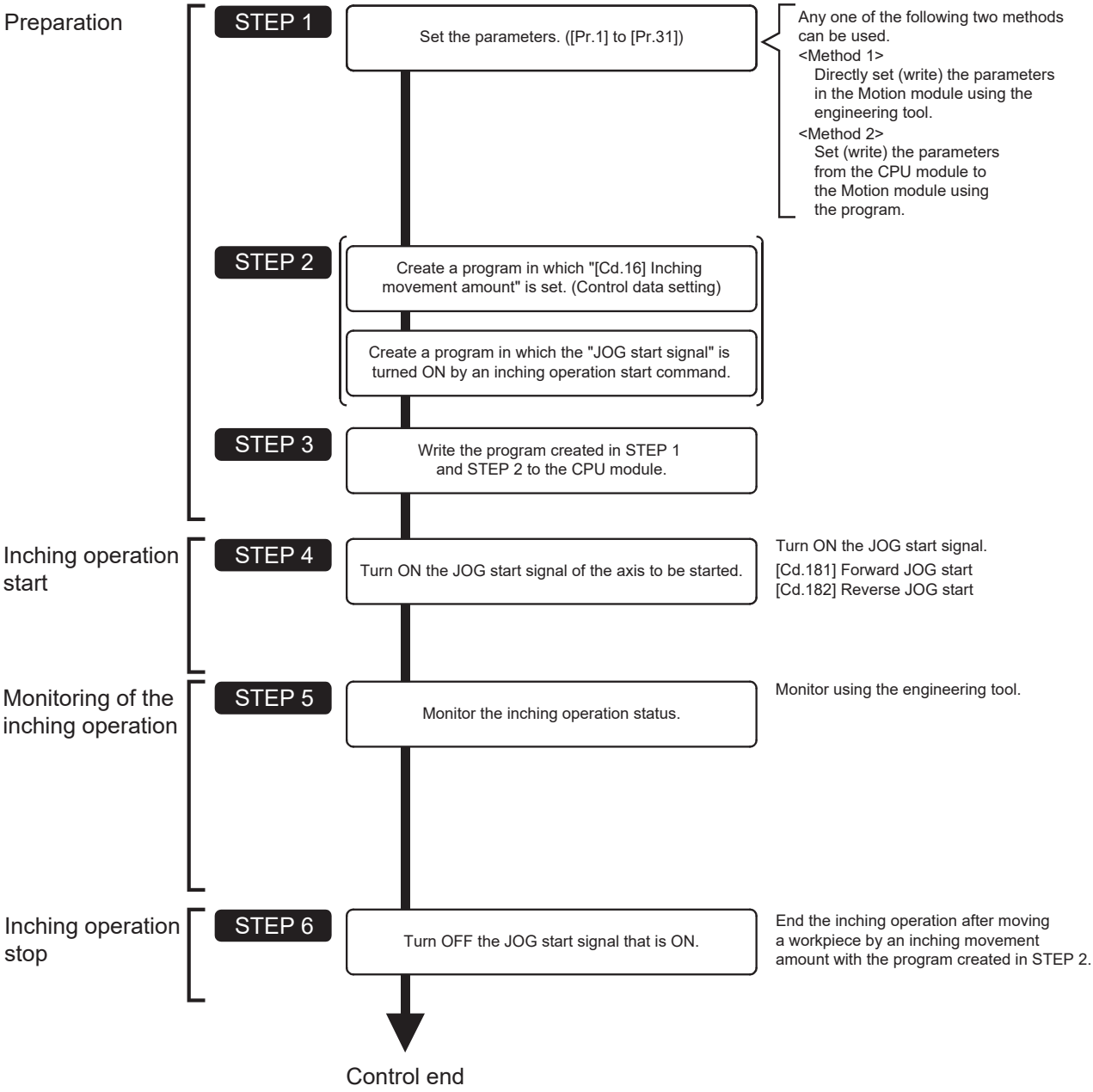
Operation cycle	t1*1	t2*2	t3	t4
0.25	0.21 to 0.44	0.55 to 0.61	0.00 to 0.25	Follows parameters
0.50	0.37 to 0.71	1.30 to 1.33	0.00 to 0.50	Follows parameters
1.00	0.50 to 1.08	2.82 to 2.85	0.00 to 1.00	Follows parameters
2.00	0.62 to 2.14	6.33 to 6.36	0.00 to 2.00	Follows parameters
4.00	0.74 to 4.34	13.30 to 13.60	0.00 to 4.00	Follows parameters

*1 Depending on the operating statuses of the other axes, delay may occur in the t1 timing time.

*2 The t2 timing time depends on the setting of the acceleration time, servo parameter, etc.

Inching operation execution procedure

The inching operation is carried out by the following procedure.



Point

- Mechanical elements such as limit switches are considered as already installed.
- Positioning parameter settings work in common for all controls using the Motion module.

Setting the required parameters for inching operation

The "Positioning parameters" must be set to carry out inching operation.

The following table shows the setting items of the required parameters for carrying out inching operation. Parameters not shown below are not required to be set for carrying out only inching operation. (Set the initial value or a value within the setting range.)

◎: Setting always required

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

Setting item			Setting requirement
Positioning parameters	[Pr.1]	Unit setting	◎
	[Pr.2]	Number of pulses per rotation (AP) (Unit: pulse)	◎
	[Pr.3]	Movement amount per rotation (AL) (Unit: pulse)	◎
	[Pr.4]	Unit magnification (AM)	◎
	[Pr.11]	Backlash compensation amount (Unit: pulse)	○
	[Pr.12]	Software stroke limit upper limit value (Unit: pulse)	○
	[Pr.13]	Software stroke limit lower limit value (Unit: pulse)	○
	[Pr.14]	Software stroke limit selection	○
	[Pr.15]	Software stroke limit valid/invalid setting	○
	[Pr.17]	Torque limit setting value (Unit: 0.1%)	○
	[Pr.31]	JOG speed limit value (Unit: pulse/s)	◎

Refer to the following for the setting details.

☞ Page 448 Basic Setting

Point

- Positioning parameter settings work in common for all controls using the Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", and "home position return control"), set the respective setting items as well.
- Parameters are set for each axis.

Creating a program to start the inching operation

A program must be created to execute an inching operation. Consider the "required control data setting", "start conditions", and "start time chart" when creating the program.
The following shows an example when an inching operation is started for axis 1. (The example shows the inching operation when a "10.0μm" is set in "[Cd.16] Inching movement amount".)

Required control data setting

The control data shown below must be set to execute an inching operation. The setting is carried out with the program.
n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.16]	Inching movement amount	100	Set the setting value so that the JOG speed limit value is not increased larger than the maximum output pulse	4317+100n

Refer to the following for the setting details.
☞ Page 550 Control Data

Start conditions

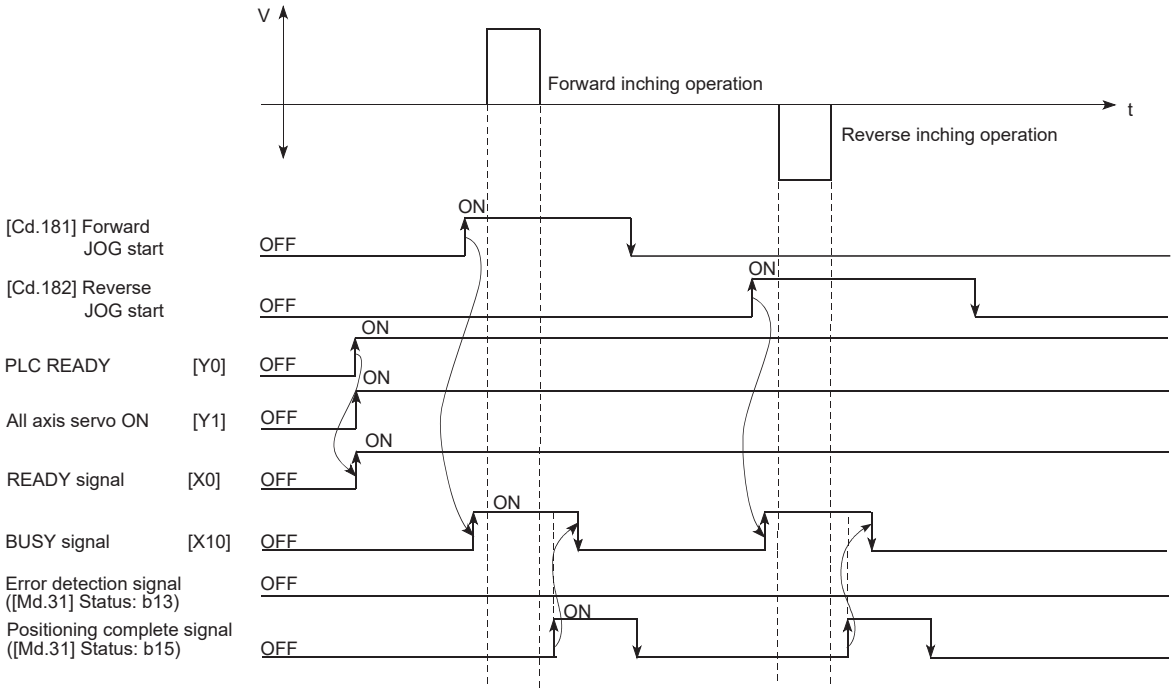
The following conditions must be fulfilled when starting. The required conditions must also be assembled in the program, and the program must be configured so the operation will not start if the conditions are not fulfilled.

Signal name		Signal state		Device
Interface signal	PLC READY signal	ON	CPU module preparation completed	Y0
	READY signal	ON	Preparation completed	X0
	All axis servo ON	ON	All axis servo ON	Y1
	Synchronization flag*1	ON	The buffer memory can be accessed	X1
	Axis stop signal	OFF	Axis stop signal is OFF	[Cd.180] Axis stop
	Start complete signal	OFF	Start complete signal is OFF	[Md.31] Status: b14
	BUSY signal	OFF	Not operating	X10 to X1F*2
	Positioning complete signal	OFF	Positioning complete signal is OFF	[Md.31] Status: b15
	Error detection signal	OFF	There is no error	[Md.31] Status: b13
	M code ON signal	OFF	M code ON signal is OFF	[Md.31] Status: b12
External signal	Forced stop input signal	ON	There is no forced stop input	—
	Stop signal	OFF	Stop signal is OFF	—
	Upper limit (FLS)	ON	Within limit range	—
	Lower limit (RLS)	ON	Within limit range	—

*1 The interlock must be provided so that the buffer memory is accessed after Synchronization flag [X1] turns on. When no interlock is provided, it may be accessed during an update of module parameters distributed from the CPU module or module extended parameters. If accessed during an update, an unexpected value may be read or written.
*2 The BUSY signal, whose axis No. exceeds the number of controlled axes, cannot be used.

Start time chart

■Operation example



Program example

Refer to the following for the program example of the inching operation.

☞ Page 628 Inching operation setting program

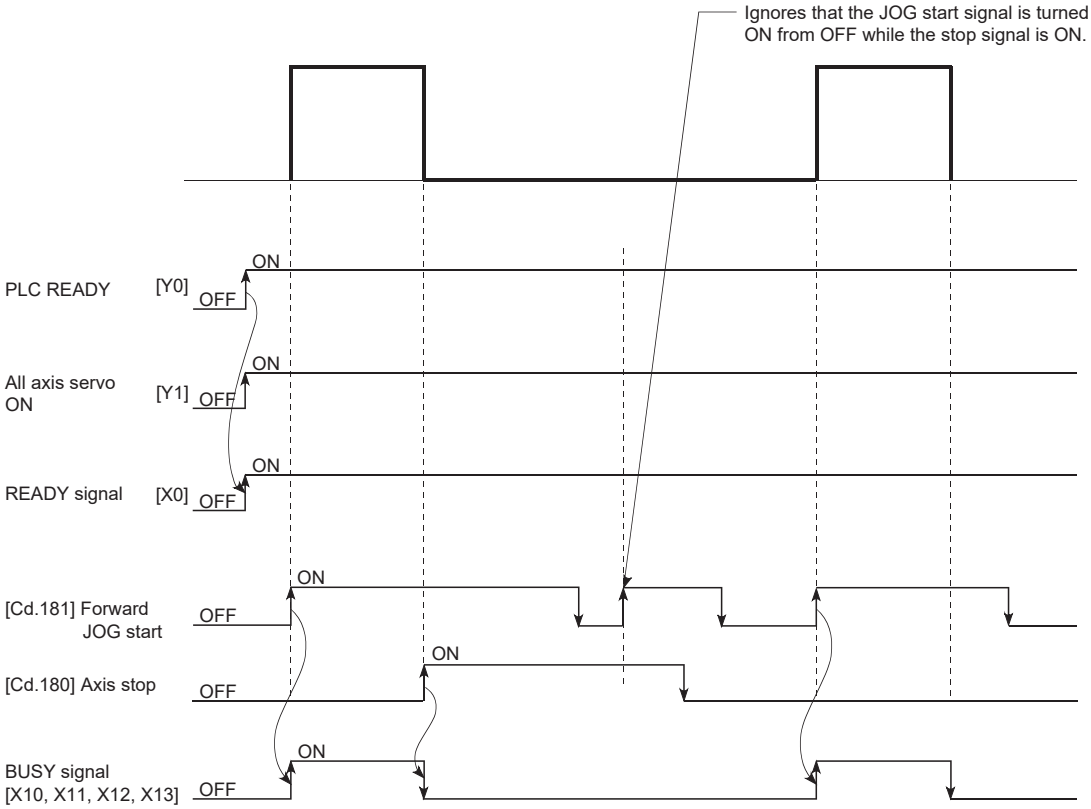
☞ Page 628 JOG operation/inching operation execution program

Inching operation example

Example 1

If the JOG start signal is turned ON while the stop signal is ON, "Stop signal ON at start" (error code: 1A08H) will occur.
The inching operation can be re-started when the stop signal is turned OFF and the JOG start signal is turned ON from OFF.

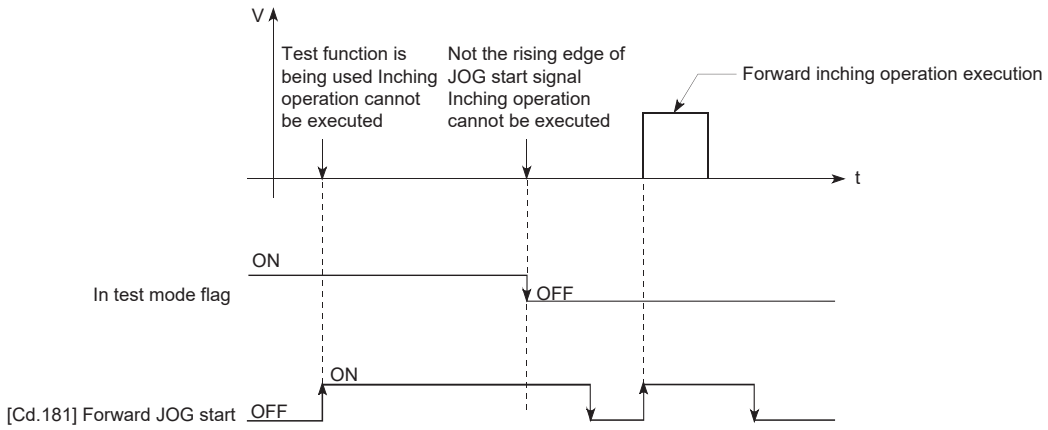
■Operation example



Example 2

If the JOG start signal is turned ON while the test function of GX Works3 is used, the JOG start signal is ignored and inching operation is not executed.

■Operation example



5.4 Manual Pulse Generator Operation

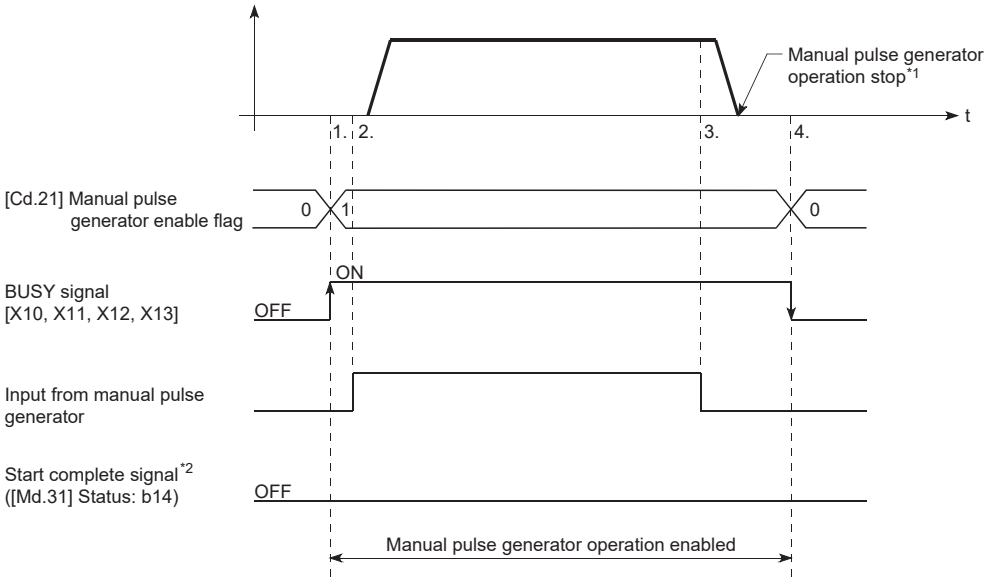
Outline of manual pulse generator operation

Operation

In manual pulse generator operations, pulses are input to the Motion module or the CC-Link IE TSN Network device from the manual pulse generator. This causes the same number of input command to be output from the Motion module to the servo amplifier, and the workpiece is moved in the designated direction.
The following shows an example of manual pulse generator operation.

1. When "[Cd.21] Manual pulse generator enable flag" is set to "1", the BUSY signal turns ON and the manual pulse generator operation is enabled.
2. The workpiece is moved corresponding to the number of pulses input from the manual pulse generator.
3. The workpiece movement stops when no more pulses are input from the manual pulse generator.
4. When "[Cd.21] Manual pulse generator enable flag" is set to "0", the BUSY signal turns OFF and the manual pulse generator operation is disabled.

■Operation example



*1 If the input from the manual pulse generator stops or "0" is set in "[Cd.21] Manual pulse generator enable flag" during manual pulse generator operation, the machine will decelerate to a stop.
*2 The start complete signal does not turn ON in manual pulse generator operation.

Restriction

- Create the program so that "[Cd.21] Manual pulse generator enable flag" is always set to "0" (disabled) when a manual pulse generator operation is not carried out. Mistakenly touching the manual pulse generator when the "manual pulse generator enable flag" is set to "1" (enable) can cause accidents or incorrect positioning.
- A pulse generator such as a manual pulse generator is required to carry out manual pulse generator operation.

Precautions during operation

The following details must be understood before carrying out manual pulse generator operation.

- If "[Pr.123] Manual pulse generator speed limit value" is set to a value larger than "[Pr.8] Speed limit value", "Manual pulse generator speed limit value error" (error code: 1BBBH) will occur and the operation will not start.
- If "[Cd.21] Manual pulse generator enable flag" is turned ON while the Motion module is BUSY (BUSY signal ON), "Start during operation" (warning code: 0D00H) will occur.
- If a stop factor occurs during manual pulse generator operation, the operation will stop, and the BUSY signal will turn OFF. At this time, "[Cd.21] Manual pulse generator enable flag" will remain ON. However, manual pulse generator operation will not be possible. To carry out manual pulse generator operation again, measures must be carried out to eliminate the stop factor. Once eliminated, the operation can be carried out again by turning "[Cd.21] Manual pulse generator enable flag" ON → OFF → ON. (Note that this excludes hardware/software stroke limit error.)
- Command will not be output if an error occurs when the manual pulse generator operation starts.

Restriction

The speed command is issued according to the input from the manual pulse generator irrelevant of the speed limit setting. When the speed command is larger than 62914560 [pulse/s], the servo alarm "Command frequency error" (alarm No.: 35) will occur.
The following calculation formula is used to judge whether or not a servo alarm will occur.

$$\text{(Speed command)} = \text{Number of input pulses for one second} \times \text{Manual pulse generator 1 pulse input magnification} \times \text{Manual pulse generator 1 pulse movement amount} \times \frac{\text{Number of pulses per rotation}}{\text{Movement amount per rotation}}$$

If a large value is set to the manual pulse generator 1 pulse input magnification, there is a high possibility of the servo alarm "Command frequency error" (alarm No.: 35) occurrence. Note that the servo motor does not work rapidly by rapid pulse input even if the servo alarm does not occur.

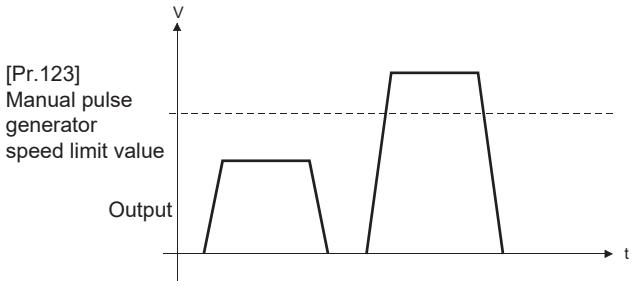
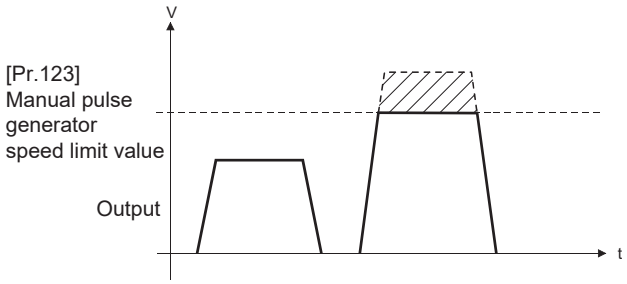
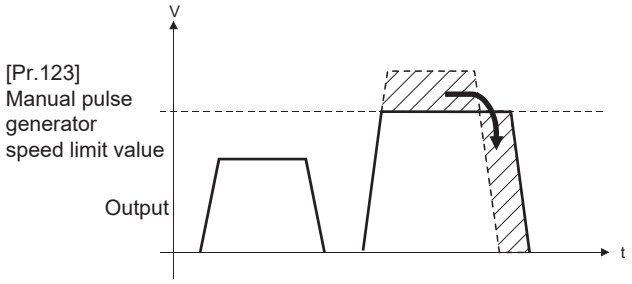
Point

- Connect a manual pulse generator to the high-speed counter module. One Motion module can be connected to one manual pulse generator.
- The Motion module can simultaneously command to multiple servo amplifiers by one manual pulse generator. (Axis 1 to the number of maximum control axes)

Manual pulse generator speed limit mode

In "[Pr.122] Manual pulse generator speed limit mode", the output operation which exceeds "[Pr.123] Manual pulse generator speed limit value" can be set during manual pulse generator operation.

The setting value and operation for "[Pr.122] Manual pulse generator speed limit mode" are shown below.

Setting value	Operation
0	The speed limit by "[Pr.123] Manual pulse generator speed limit value" is not executed. 
1	The pulses which exceed "[Pr.123] Manual pulse generator speed limit value" are not output.*1 
2	The pulses which exceed "[Pr.123] Manual pulse generator speed limit value" are output later. The overcarrying movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value" can be checked in "[Md.62] Amount of the manual pulser driving carrying over movement" (-2147483648 to 2147483647). When the movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value" is generated continuously and "[Md.62] Amount of the manual pulser driving carrying over movement" exceeds tolerance (-2147483648 to 2147483647), "Overcarrying movement amount overflow in manual pulse generator" (error code: 1A82H) occurs and a deceleration stop is executed.*2 

*1 When "[Pr.123] Manual pulse generator speed limit value" is exceeded, the input from the manual pulse generator is not the same as the output from the Motion module.

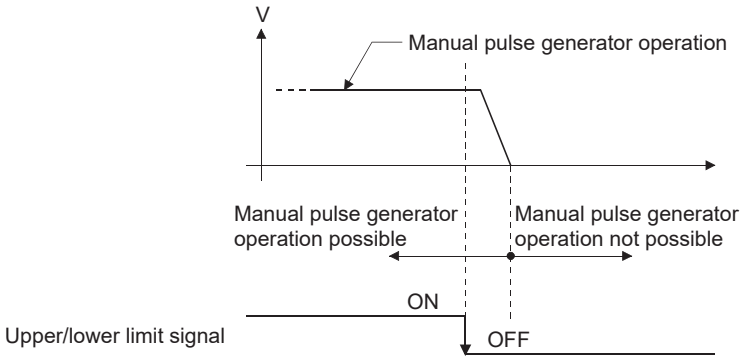
*2 When the pulses which exceed "[Pr.123] Manual pulse generator speed limit value" are large, it takes time between when the input from the manual pulse generator stops and when the output from the Motion module stops.

- When "1: Don't output over value of speed limit" or "2: Output over value of speed limit later" is set in "[Pr.122] Manual pulse generator speed limit mode", "Outside manual pulse generator speed limit value" (warning code: 0D49H) occurs at exceeding "[Pr.123] Manual pulse generator speed limit value".
- "Outside manual pulse generator speed limit value" (warning code: 0D49H) will not be detected again until the speed below the speed limit value is maintained for at least 10 seconds to prevent continuous detection due to chattering.
- When "0: Don't output over value of speed limit" is set in "[Pr.122] Manual pulse generator speed limit mode", "Outside manual pulse generator speed limit value" (warning code: 0D49H) is not output even if the speed limit value is exceeded.

Operations when stroke limit error occurs

When the hardware stroke limit error or the software stroke limit error is detected[*1] during operation, the operation will decelerate to a stop. However, in case of "[Md.26] Axis operation status", "Manual pulse generator operation" will continue[*1]. After stopping, input pulses from a manual pulse generator to the outside direction of the limit range are not accepted, but operation can be executed within the range.

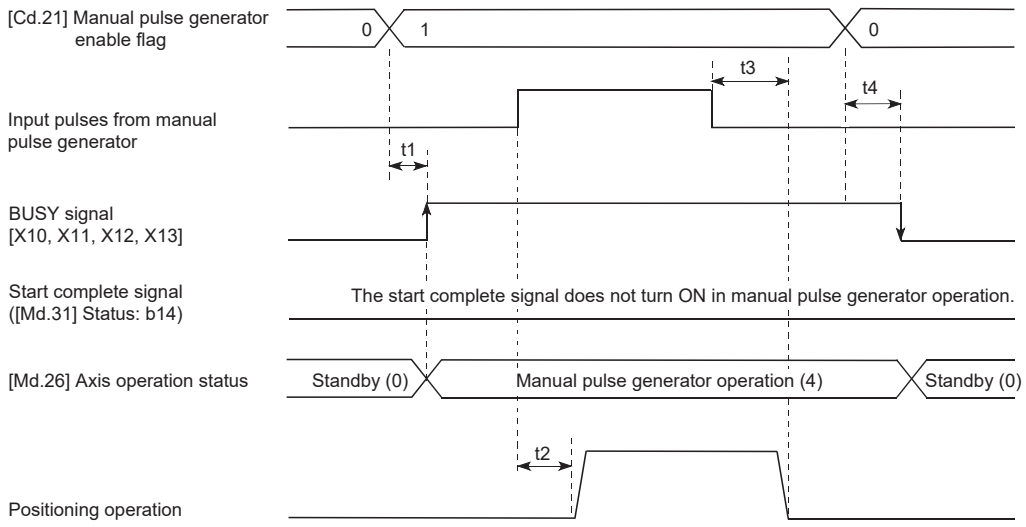
*1 Only when the command position value or the machine feed value overflows or underflows during deceleration, the manual pulse generator operation will terminate as "error occurring". To carry out manual pulse generator operation again, "[Cd.21] Manual pulse generator enable flag" must be turned OFF once and turn ON.



Operation timing and processing time

The following drawing shows details of the manual pulse generator operation timing and processing time.

■Operation example



• Normal timing time (Unit: [ms])

Operation cycle	t1[*1]	t2[*2]	t3[*2]	t4
0.25	0.24 to 0.26	3.13 to 10.80	16.00 to 24.00	8.06 to 9.76
0.50	0.49 to 0.50	5.06 to 10.74	16.00 to 24.00	8.06 to 9.76
1.00	0.98 to 0.99	6.12 to 12.05	16.00 to 24.00	8.06 to 9.76
2.00	1.97 to 1.99	6.55 to 14.25	16.00 to 24.00	8.06 to 9.76
4.00	3.98 to 3.99	13.81 to 18.50	16.00 to 24.00	8.06 to 9.76

*1 Delays may occur in the t1 timing time due to the operation status of other axes.

*2 The t2 and t3 timing time depends on the setting of the acceleration time, servo parameter, etc.

Position control by manual pulse generator operation

In manual pulse generator operation, the position is moved by a "manual pulse generator 1 pulse movement amount" per pulse. The command position value in the positioning control by manual pulse generator operation can be calculated using the expression shown below.

Command position value = Number of input pulses × [Cd.20] Manual pulse generator 1 pulse input magnification × Manual pulse generator 1 pulse movement amount

[Pr.1] Unit setting	mm	inch	degree	pulse
Manual pulse generator 1 pulse movement amount	0.1μm	0.00001inch	0.00001degree	1pulse

For example, when "[Pr.1] Unit setting" is mm and "[Cd.20] Manual pulse generator 1 pulse input magnification" is 2, and 100pulses are input from the manual pulse generator, the command position value is as follows.

100 × 2 × 0.1 = 20 [μm] ("[Md.20] Command position value" = 200)

The number of pulses output actually to the servo amplifier is "Manual pulse generator 1 pulse movement amount/movement amount per pulse".

The movement amount per pulse can be calculated using the expression shown below.

$$\text{Movement amount per pulse} = \frac{\text{[Pr.3] Movement amount per rotation (AL)}}{\text{[Pr.2] Number of pulses per rotation (AP)}} \times \text{[Pr.4] Unit magnification (AM)}$$

For example, when "[Pr.1] Unit setting" is mm and the movement amount per pulse is 1μm, 0.1/1 = 1/10, i.e., the output to the servo amplifier per pulse from the manual pulse generator is 1/10pulse. Thus, the Motion module outputs 1pulse to the servo amplifier after receiving 10pulses from the manual pulse generator.

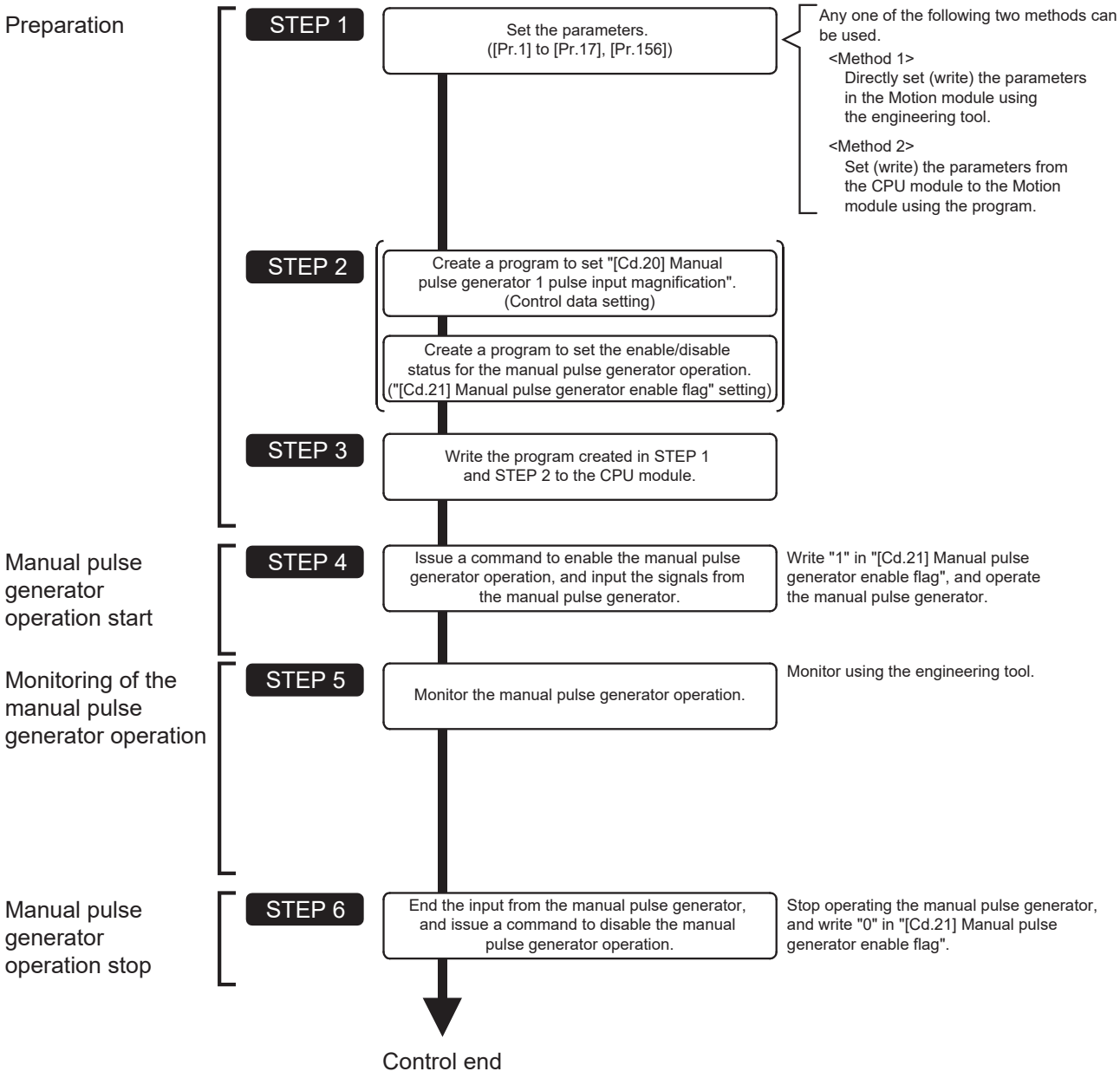
Speed control by manual pulse generation operation

The speed during positioning control by manual pulse generator operation is a speed corresponding to the number of input pulses per unit time, and can be obtained using the following equation.

Output command frequency = Input frequency × [Cd.20] Manual pulse generator 1 pulse input magnification

Manual pulse generator operation execution procedure

The manual pulse generator operation is carried out by the following procedure.



Point

- Mechanical elements such as limit switches are considered as already installed.
- Parameter settings work in common for all control using the Motion module.

Setting the required parameters for manual pulse generator operation

The "Positioning parameters", "Common parameters" and "Link device external signal assignment parameters" must be set to carry out manual pulse generator operation.

The following table shows the setting items of the required parameters for carrying out manual pulse generator operation. Parameters not shown below are not required to be set for carrying out only manual pulse generator operation. (Set the initial value or a value within the setting range.)

◎: Setting always required

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

Setting item			Setting requirement
Positioning parameters	[Pr.1]	Unit setting	◎
	[Pr.2]	Number of pulses per rotation (AP) (Unit: pulse)	◎
	[Pr.3]	Movement amount per rotation (AL) (Unit: pulse)	◎
	[Pr.4]	Unit magnification (AM)	◎
	[Pr.8]	Speed limit value (Unit: pulse/s)	◎
	[Pr.11]	Backlash compensation amount (Unit: pulse)	○
	[Pr.12]	Software stroke limit upper limit value (Unit: pulse)	○
	[Pr.13]	Software stroke limit lower limit value (Unit: pulse)	○
	[Pr.14]	Software stroke limit selection	○
	[Pr.15]	Software stroke limit valid/invalid setting	○
	[Pr.17]	Torque limit setting value (Unit: 0.1%)	○
Common parameters	[Pr.156]	Manual pulse generator smoothing time constant	○

Refer to the following for the setting details.

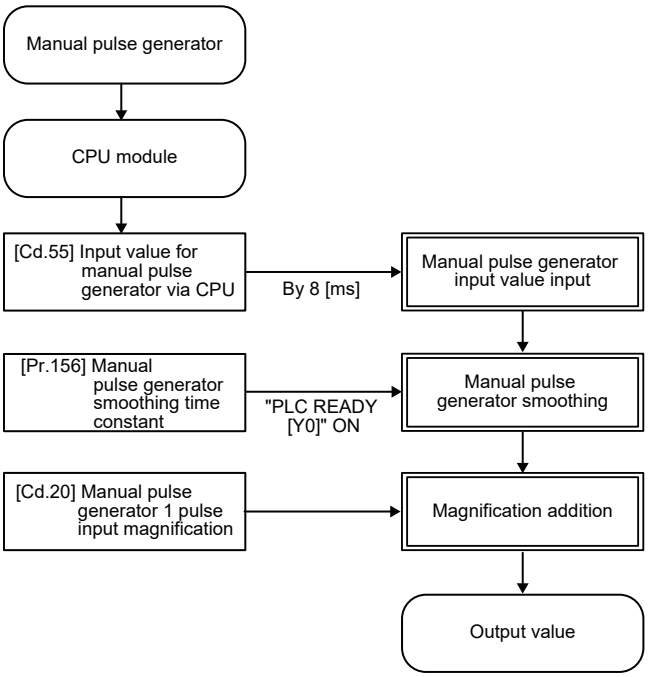
☞ Page 448 Basic Setting

Point

- Positioning parameter settings and common parameters settings work in common for all controls using the Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", "home position return control"), set the respective setting items as well.
- "Positioning parameters" are set for each axis.

Block diagram of the manual pulse generator operation

The flow of the manual pulse generator operation is shown below.



Creating a program to enable/disable the manual pulse generator operation

A program must be created to execute a manual pulse generator operation. Consider the "required control data setting", "start conditions" and "start time chart" when creating the program.
The following shows an example when a manual pulse generator operation is started for axis 1.

Required control data setting

The control data shown below must be set to execute a manual pulse generator operation. The setting is carried out with the program.
n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.20]	Manual pulse generator 1 pulse input magnification	1	Set the manual pulse generator 1 pulse input magnification. (1 to 10000 times)	4322+100n 4323+100n
[Cd.21]	Manual pulse generator enable flag	1(0)	Set "1: Enable manual pulse generator operation". (Set "0: Disable manual pulse generator operation" when finished with the manual pulse generator operation.)	4324+100n
[Cd.55]	Input value for manual pulse generator via CPU	→	Set the values used as the input values for the manual pulse generator via CPU in order. Setting range: -2147483648 to 2147483647 [pulse]	5946 5947

Refer to the following for the setting details.
☞ Page 550 Control Data

Restriction

Set the movement amount per capture cycle in "[Cd.55] Input value for manual pulse generator via CPU" within the range of -2147483648 to 2147483647. When set to a value outside of the range, the movement amount of the manual pulse generator and the movement amount of the output value may not match.

Start conditions

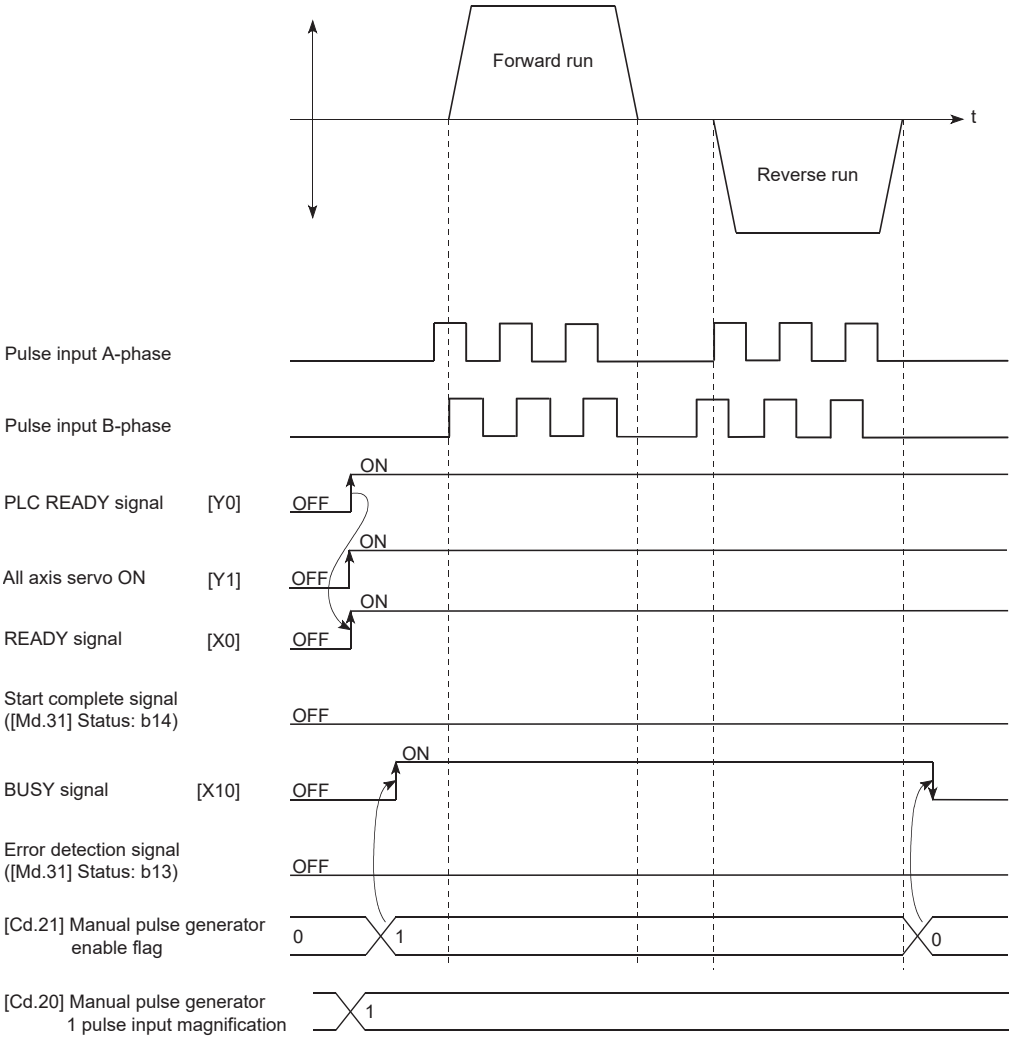
The following conditions must be fulfilled when starting. The required conditions must also be assembled in the program, and the program must be configured so the operation will not start if the conditions are not fulfilled.

Signal name		Signal state		Device
Interface signal	PLC READY signal	ON	CPU module preparation completed	Y0
	READY signal	ON	Preparation completed	X0
	All axis servo ON	ON	All axis servo ON	Y1
	Synchronization flag*1	ON	The buffer memory can be accessed	X1
	Axis stop signal	OFF	Axis stop signal is OFF	[Cd.180] Axis stop
	Start complete signal	OFF	Start complete signal is OFF	[Md.31] Status: b14
	BUSY signal	OFF	Not operating	X10 to X1F*2
	Error detection signal	OFF	There is no error	[Md.31] Status: b13
	M code ON signal	OFF	M code ON signal is OFF	[Md.31] Status: b12
External signal	Forced stop input signal	ON	There is no forced stop input	—
	Stop signal	OFF	Stop signal is OFF	—
	Upper limit signal (FLS)	ON	Within limit range	—
	Lower limit signal (RLS)	ON	Within limit range	—

*1 The interlock must be provided so that the buffer memory is accessed after Synchronization flag [X1] turns on. When no interlock is provided, an unexpected value may be read or written.
*2 The BUSY signal, whose axis No. exceeds the number of controlled axes, cannot be used.

Start time chart

■Operation example



Program example

Refer to the following for the program example of the manual pulse generator operation.

☞ Page 629 Manual pulse generator operation program

6 INTER-MODULE SYNCHRONIZATION FUNCTION

"Inter-module synchronization function" can synchronize the control timing among multiple modules on the same base.
For the synchronous communication of the CC-Link IE TSN Network, refer to "FUNCTIONS" of the following manual.
MELSEC iQ-R Motion Module User's Manual (Network)

Control details

The execution cycle of the interrupt program for the CPU module and the operation cycle of the Motion module can be synchronized. Refresh in synchronization with the operation cycle can be performed between some buffer memory addresses*1 and the devices and labels of the CPU module.
The inter-module synchronization cycle becomes the synchronous communication cycle of the CC-Link IE TSN Network.

*1 Buffer memory that can be refreshed in synchronization: [Cd.183] Execution prohibition flag

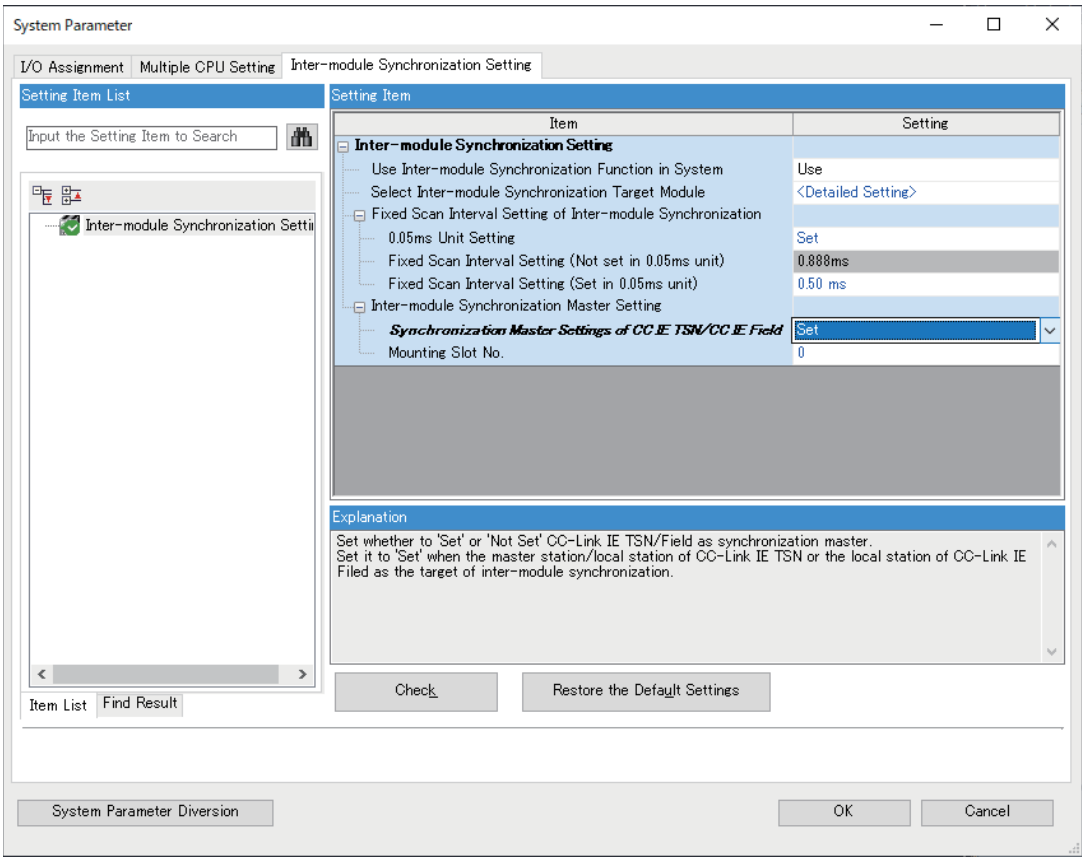
Precautions during control

- The following shows the synchronization cycles that can be set when the inter-module synchronization of the Motion module is performed. 0.25ms, 0.50ms, 1.00ms, 2.00ms, 4.00ms
- When a synchronization cycle other than the above is set, "Inter-module synchronization cycle unsupported" (error code: 3017H) or "Inter-module synchronization cycle mismatch" (error code: 3600H) will occur.
- Make sure that the synchronization cycle matches the operation cycle of the Motion module. When the cycles are mismatched, "Inter-module synchronization cycle mismatch" (error code: 3600H) will occur. For details of the error, refer to "List of Error Codes" in the following manual.
  MELSEC iQ-R Motion Module User's Manual (Network)
- The inter-module synchronization is supported by the baseSystem version 1.20 or later. If a Motion module with the version earlier than the above is set as a target module of the inter-module synchronization, "Module major error" will occur in the CPU module.
- When using the inter-module synchronization, execute the EI instruction in the CPU module to enable the inter-module synchronization interrupt (I44) program.

Setting method of the inter-module synchronization

Set the inter-module synchronization in [Inter-module Synchronization Setting] tab in the "System Parameter" screen on the engineering tool.

1. Select "Use" in "Use Inter-module Synchronization Function in System" under "Inter-module Synchronization Setting".
2. Set the Motion module to be synchronized to "Synchronous" in "Detailed Setting" under "Select Inter-module Synchronization Target Module".
3. Set the inter-module synchronization cycle in "Fixed Scan Interval Setting of Inter-module Synchronization".
   Enter the cycle to be synchronized in "Fixed Scan Interval Setting (0.05ms Unit Setting)".
4. Set the synchronization master in "Inter-module Synchronization Master Setting". Set "Synchronization Master Setting of CC IE TSN/CC IE Field" to "Set", and enter the slot No. of the own module or synchronization master support module in "Mounting Slot No.".



Simultaneous start using inter-module synchronization

This function synchronizes the start timing between different modules. It can synchronize the start timing between modules by using the pre-reading start function together. After the start, each Motion module operates independently.

The RD78G modes that can be combined with the Simple Motion mode of the RD78G by simultaneous start using inter-module synchronization are as follows.*1

○: Simultaneous start possible, ×: Simultaneous start not possible

Mode	Combination availability
PLCopen motion control FB mode	×
Simple Motion mode	○

*1 Cannot be combined with a module other than the RD78G.

For "Pre-reading start function", refer to the following.

☞ Page 273 Pre-reading start function

■Simultaneous start procedure using inter-module synchronization

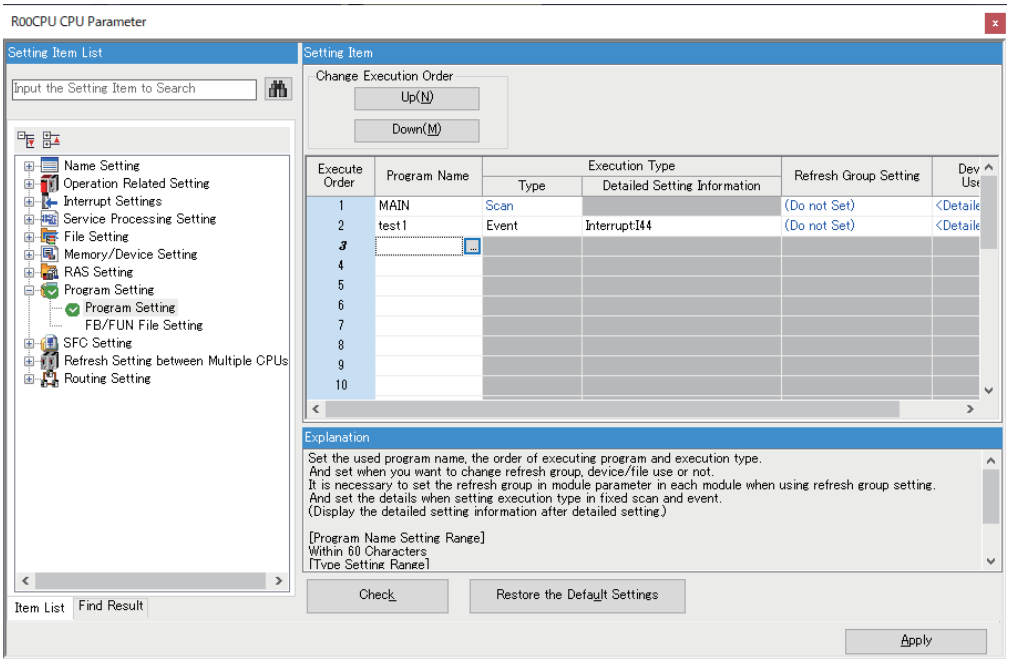
1. Set the Motion modules to be started at the same time as the inter-module synchronization targets.
2. Use the pre-reading start function. Perform the positioning start after turning ON "[Cd.183] Execution prohibition flag".
3. Turn OFF "[Cd.183] Execution prohibition flag" within the same inter-module synchronization cycle while the inter-module synchronous interruption (I44) is in progress.

Ex.

To execute the inter-module synchronous interruption (I44) as an event, set the following to the execution type of the program to be executed in "Program Setting" under "CPU Parameter".

Type "Event"

Detailed Setting Information "Interrupt:I44"



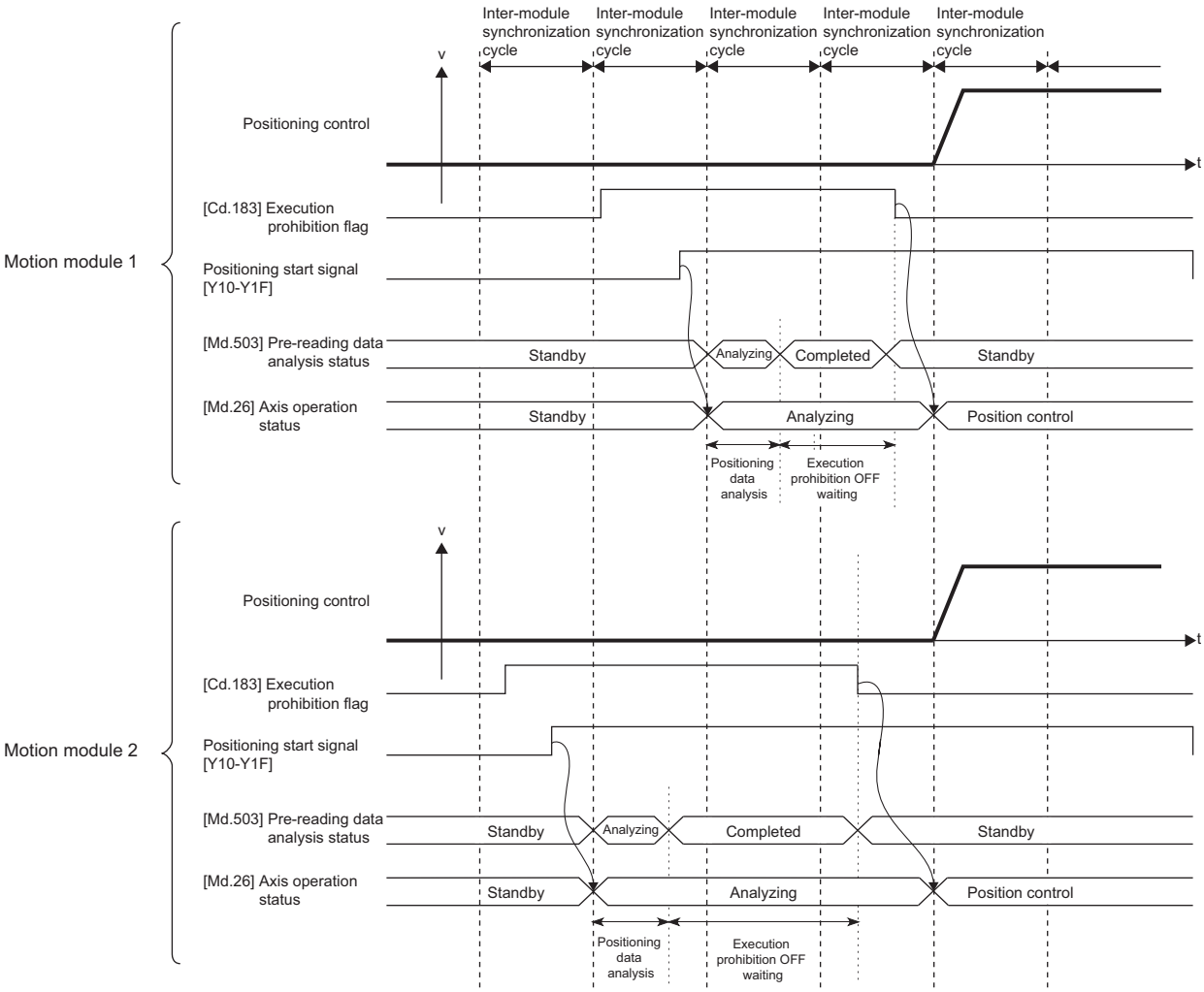
Precautions

- Turn OFF "[Cd.183] Execution prohibition flag" after "2: Completed" is set to "[Md.503] Pre-reading data analysis status".
- Because each positioning module operates independently after the start, the following operation is performed.

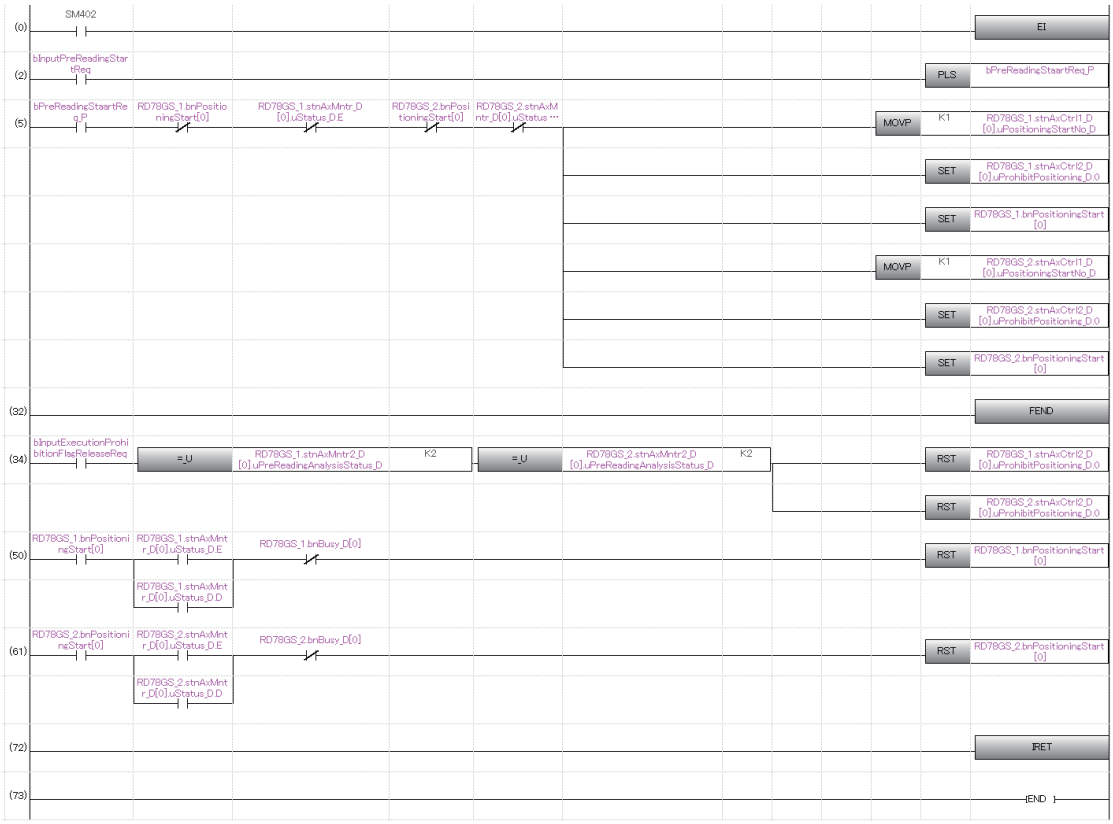
- Even if a module stops due to an error, other modules where no error occurs continue to operate.
- Even if stop signals are input at the same time in the program, the stop signal detection timing may not be the same and the stop positions may be different.

- When the inter-module synchronization is enabled, "[Cd.183] Execution prohibition flag" is read in the processing caused by the interruption of the inter-module synchronous interruption (I44). Therefore, if "[Cd.183] Execution prohibition flag" is operated without using the inter-module synchronous interruption (I44), it is not read. If the inter-module synchronous interruption (I44) is used, the processing is performed even when "[Cd.183] Execution prohibition flag" is not used in the event, but the inter-module synchronous start cannot be guaranteed.

■Operation example of the RD78G16



Program example



7 EXPANSION CONTROL

The details and usage of expansion control are explained in this chapter.
Expansion control includes the speed-torque control to execute the speed control and torque control not including position loop and the advanced synchronous control to synchronize with input axis using software with "advanced synchronous control parameter" instead of controlling mechanically with gear, shaft, speed change gear or cam.
Execute the required settings to match each control.

7.1 Speed-torque Control

Outline of speed-torque control

This function is used to execute the speed control or torque control that does not include the position loop for the command to servo amplifier.
"Continuous operation to torque control mode" that switches the control mode to torque control mode without stopping the servo motor during positioning operation is also available for tightening a bottle cap or a screw.
Switch the control mode from "position control mode" to "speed control mode", "torque control mode" or "continuous operation to torque control mode" to execute the "Speed-torque control".

Control mode	Control	Remark
Position control mode	Positioning control, home position return control, JOG operation, Inching operation and Manual pulse generator operation	Control that include the position loop for the command to servo amplifier
Speed control mode	Speed-torque control	Control that does not include the position loop for the command to servo amplifier
Torque control mode		
Continuous operation to torque control mode		Control that does not include the position loop for the command to servo amplifier Control mode can be switched during positioning control or speed control.

Use the servo amplifiers whose software versions are compatible with each control mode to execute the "Speed-torque control".
If the servo amplifier does not support each control mode, "Driver control not supported" (error code: 1AE7H) occurs.

Supported software version

Servo amplifier software versions that are compatible with each control mode are shown below. For the support information not listed in the table below, refer to the instruction manual of the servo amplifier to be used.
—: There is no restriction by the version.

Servo amplifier model	Software version		
	Speed control	Torque control	Continuous operation to torque control*1
MR-J5-_G_/MR-JET-_G	—	—	B2 or later
MR-J5-_G_-RJ			
MR-J5W_-_G			
MR-J5D_-_G_			—

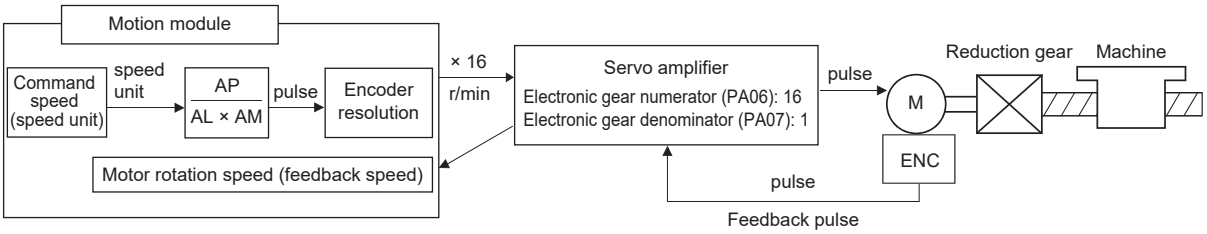
*1 The torque generation direction of servo motor can be changed by setting the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" for the servo amplifier that is compatible with the continuous operation to torque control. (☞ Page 201 Operation of speed-torque control)
For the servo amplifier that is not compatible with the continuous operation to torque control, the operation is the same as that of when "0: Enabled" is set in servo parameter "Function selection C-B POL reflection selection at torque control (PC29)".

⚠CAUTION

- If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor stop status (servo lock status) or in a 30r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal relay protection.

Point

When controlling motor HK-KT (67108864pulse/rev), set the servo parameters of the MR-J5(W)-G as follows.
PA06 (Electronic gear numerator): 16
PA07 (Electronic gear denominator): 1
PT01.1 (Speed/acceleration/deceleration unit selection): 0 (r/min, mm/s)
In speed control, torque control, and continuous operation to torque control mode, the Motion module multiplies the electronic gear ratio of the servo amplifier at the command speed set in the control data and sends the result to the servo amplifier.



Operation example for speed control mode

• Condition

[Pr.1] Unit setting: 0 [mm]

[Pr.2] Number of pulses per rotation: 67108864 [pulse] × 1/16 = 4194304 [pulse]

[Pr.3] Movement amount per rotation: 20000.0 [μm]

[Pr.4] Unit magnification: 1 (× 1)

[Cd.140] Command speed at speed control mode: 4000000 [$\times 10^{-2}$mm/min]

• Control details

[Md.103] Motor rotation speed: 200000 [0.01r/min]

Servo motor speed: 2000 [r/min]

Setting the required parameters for speed-torque control

The "Positioning parameters" must be set to carry out speed-torque control.

The following table shows the setting items of the required parameters for carrying out speed-torque control. Parameters not shown below are not required to be set for carrying out only speed-torque control. (Set the initial value or a value within the setting range.)

◎: Setting always required.

○: Set according to requirements (Set the initial value or a value within the setting range when not used.)

Setting item			Setting requirement
Positioning parameters	[Pr.1]	Unit setting	◎
	[Pr.2]	Number of pulses per rotation (AP)	◎
	[Pr.3]	Movement amount per rotation (AL)	◎
	[Pr.4]	Unit magnification (AM)	◎
	[Pr.8]	Speed limit value	◎
	[Pr.12]	Software stroke limit upper limit value	○
	[Pr.13]	Software stroke limit lower limit value	○
	[Pr.14]	Software stroke limit selection	○
	[Pr.22]	Input signal logic selection	◎
	[Pr.83]	Speed control 10 × multiplier setting for degree axis	○
	[Pr.90]	Operation setting for speed-torque control mode	○
	[Pr.127]	Speed limit value input selection at control mode switching	○
Common parameters	[Pr.82]	Forced stop valid/invalid selection	○

Refer to the following for the setting details.

☞ Page 448 Basic Setting

Point

- Positioning parameter settings and common parameters settings work in common for all controls using the Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", "home position return control"), set the respective setting items as well.
- "Positioning parameters" are set for each axis.

Setting the required data for speed-torque control

Required control data setting for the control mode switching

The control data shown below must be set to execute the control mode switching.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.138]	Control mode switching request	1	Set "1: Switching request" after setting "[Cd.139] Control mode setting".	4374+100n
[Cd.139]	Control mode setting	→	Set the control mode to switch. 0: Position control mode 10: Speed control mode 20: Torque control mode 30: Continuous operation to torque control	4375+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

When "30: Continuous operation to torque control" is set, set the switching condition of the control mode to switch to the continuous operation to torque control mode.

The control data shown below must be set to set the switching condition of control mode.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.153]	Control mode auto-shift selection	→	Set the switching condition when switching to continuous operation to torque control mode. 0: No switching condition 1: Command position value pass 2: Actual position value pass	4393+100n
[Cd.154]	Control mode auto-shift parameter	→	Set the condition value when setting the control mode switching condition.	4394+100n 4395+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

Required control data setting for the speed control mode

The control data shown below must be set to execute the speed control.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.140]	Command speed at speed control mode	→	Set the command speed at speed control mode.	4376+100n 4377+100n
[Cd.141]	Acceleration time at speed control mode	→	Set the acceleration time at speed control mode.	4378+100n
[Cd.142]	Deceleration time at speed control mode	→	Set the deceleration time at speed control mode.	4379+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

Required control data setting for the torque control mode

The control data shown below must be set to execute the torque control.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.143]	Command torque at torque control mode	→	Set the command torque at torque control mode.	4380+100n
[Cd.144]	Torque time constant at torque control mode (Forward direction)	→	Set the time constant at driving during torque control mode.	4381+100n
[Cd.145]	Torque time constant at torque control mode (Negative direction)	→	Set the time constant at regeneration during torque control mode.	4382+100n
[Cd.146]	Speed limit value at torque control mode	→	Set the speed limit value at torque control mode.	4384+100n 4385+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

Required control data setting for the continuous operation to torque control mode

The control data shown below must be set to execute the continuous operation to torque control.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.147]	Speed limit value at continuous operation to torque control mode	→	Set the speed limit value at continuous operation to torque control mode.	4386+100n 4387+100n
[Cd.148]	Acceleration time at continuous operation to torque control mode	→	Set the acceleration time at continuous operation to torque control mode.	4388+100n
[Cd.149]	Deceleration time at continuous operation to torque control mode	→	Set the deceleration time at continuous operation to torque control mode.	4389+100n
[Cd.150]	Target torque at continuous operation to torque control mode	→	Set the target torque at continuous operation to torque control mode.	4390+100n
[Cd.151]	Torque time constant at continuous operation to torque control mode (Forward direction)	→	Set the time constant at driving during continuous operation to torque control mode.	4391+100n
[Cd.152]	Torque time constant at continuous operation to torque control mode (Negative direction)	→	Set the time constant at regeneration during continuous operation to torque control mode.	4392+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

Operation of speed-torque control

Switching of control mode (Speed control/Torque control)

■Switching method of control mode

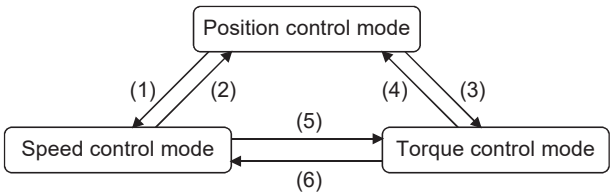
To switch the control mode to the speed control or the torque control, set "1" in "[Cd.138] Control mode switching request" after setting the control mode in "[Cd.139] Control mode setting".

When the mode is switched to the speed control mode or the torque control mode, the control data used in each control mode must be set before setting "1" in "[Cd.138] Control mode switching request".

When the switching condition is satisfied at control mode switching request, "30: Control mode switch" is set in "[Md.26] Axis operation status", and the BUSY signal turns ON. "0" is automatically stored in "[Cd.138] Control mode switching request" by Motion module after completion of switching.

"Control mode switching during BUSY" (warning code: 0DA6H) or "Control mode switching during zero speed OFF" (warning code: 0DA7H) occurs if the switching condition is not satisfied, and the control mode is not switched.

The following shows the switching condition of each control mode.



Switching operation		Switching condition
(1)	Position control mode → Speed control mode	Not during positioning*1 and during motor stop*2*3
(2)	Speed control mode → Position control mode	During motor stop*2*3
(3)	Position control mode → Torque control mode	Not during positioning*1 and during motor stop*2*3
(4)	Torque control mode → Position control mode	During motor stop*2*3
(5)	Speed control mode → Torque control mode	None
(6)	Torque control mode → Speed control mode	

*1 BUSY signal is OFF.

*2 ZERO speed ([Md.119] Servo status2: b3) is ON.

n: Axis No. - 1

Monitor item	Buffer memory address
	Axis 1 to axis 16
[Md.119] Servo status2: b3	2476+100n

*3 Change the setting of "Condition selection at mode switching (b12 to b15)" in "[Pr.90] Operation setting for speed-torque control mode" when switching the control mode without waiting for the servo motor to stop. Note that it may cause vibration or impact at control switching. (☞ Page 478 [Pr.90] Operation setting for speed-torque control mode)

The history of control mode switching is stored to the start history at request of control mode switching. (☞ Page 515 System monitor data)

Confirm the control mode with "control mode ([Md.108] Servo status1: b2, b3)" of "[Md.108] Servo status". (☞ Page 523 Axis monitor data)

n: Axis No. - 1

Monitor item	Buffer memory address
	Axis 1 to axis 16
[Md.108] Servo status1: b2, b3	2477+100n

■Precautions at control mode switching

- The start complete signal and the positioning complete signal do not turn ON at control mode switching.
- When "30: Control mode switch", "31: Speed control", or "32: Torque control" is set in "[Md.26] Axis operation status", the BUSY signal turns ON.
- The motor rotation speed might change momentarily at switching from the speed control mode to the torque control mode. Therefore, it is recommended that the control mode is switched from the speed control to the torque control after the servo motors stop.
- Use the continuous operation to torque control mode for the usage such as pressing a workpiece. When using the continuous operation during speed control mode for a usage such as pressing a workpiece, set servo parameter "Function selection B-1 Model adaptive control selection (PB25.0)" to "2: Disabled (PID control)".
- "In speed control flag" ([Md.31] Status: b0) does not turn ON during the speed control mode in the speed-torque control.

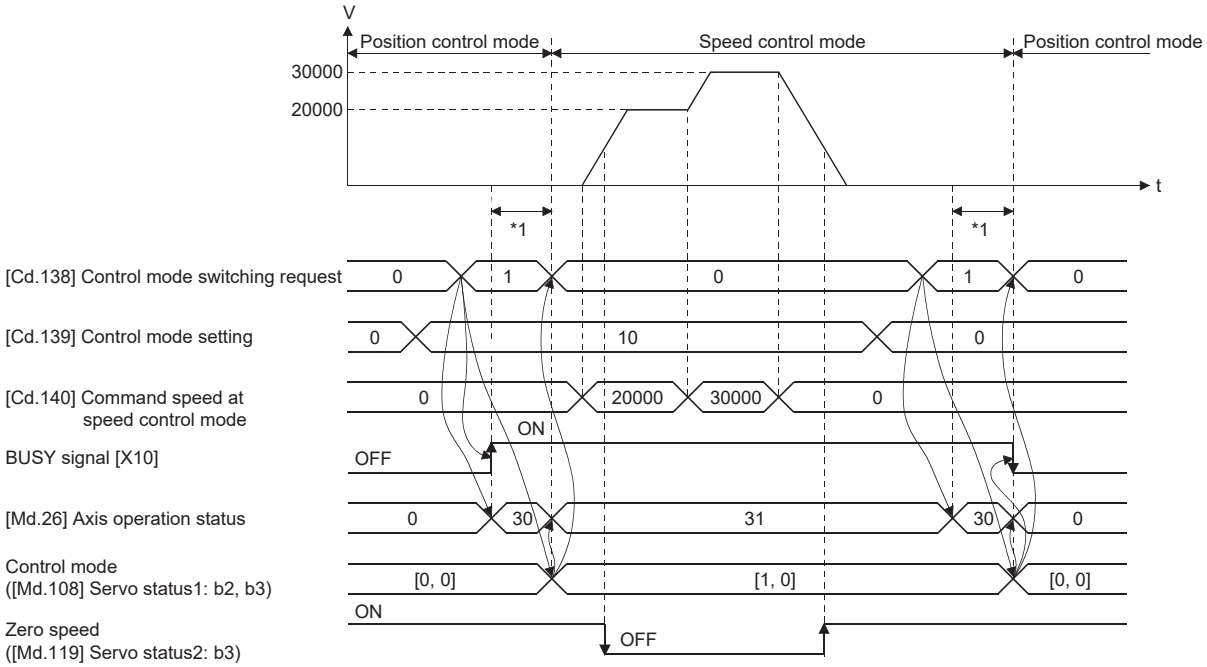
■Operation for "Position control mode ⇔ Speed control mode switching"

When the position control mode is switched to the speed control mode, the command speed immediately after the switching is the speed set in "speed initial value selection (b8 to b11)" of "[Pr.90] Operation setting for speed-torque control mode".

Speed initial value selection ([Pr.90]: b8 to b11)	Command speed to servo amplifier immediately after switching from position control mode to speed control mode
0: Command speed	The speed to servo amplifier immediately after switching is "0".
1: Feedback speed	Motor rotation speed received from servo amplifier at switching.
2: Automatic selection	The command speed is invalid due to the setting of continuous operation to torque control mode. At control mode switching, operation is the same as "0: Command speed".

When the speed control mode is switched to the position control mode, the command position immediately after the switching is the command position value at switching.

The following chart shows the operation timing for axis 1.



*1 The switching time differs by the specification of the servo amplifier. When "ZSP disabled selection at control switching" of the servo parameter "Function selection C-E (PC76)" is set to "0: Enabled" at MR-J5(W)-G used, the control mode switches after the motor speed becomes zero.
When the control mode of the servo amplifier does not change within 1 second, "Control mode switching error" (error code: 1F04H) occurs.

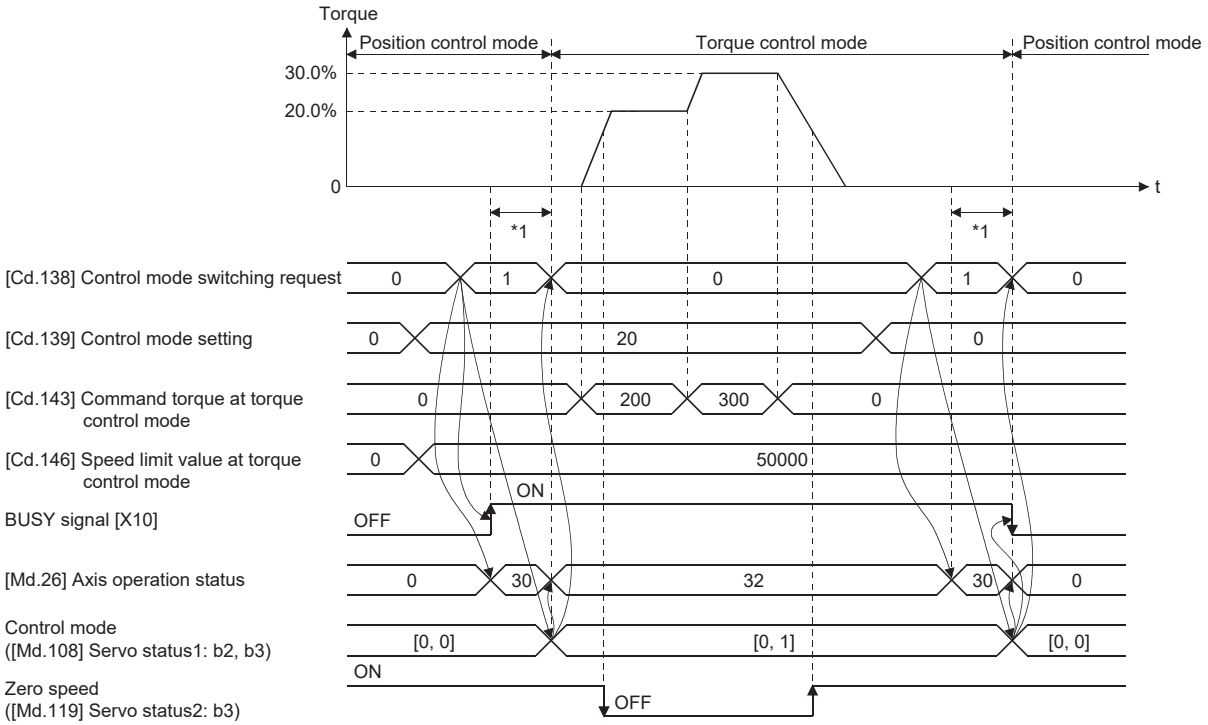
■Operation for "Position control mode ⇔ Torque control mode switching"

When the position control mode is switched to the torque control mode, the command torque immediately after the switching is the torque set in "Torque initial value selection (b4 to b7)" of "[Pr.90] Operation setting for speed-torque control mode".

Torque initial value selection ([Pr.90]: b4 to b7)	Command torque to servo amplifier immediately after switching from position control mode to torque control mode
0: Command torque	The value of "[Cd.143] Command torque at torque control mode" at switching.
1: Feedback torque	Motor torque value at switching.

When the torque control mode is switched to the position control mode, the command position immediately after the switching is the command position value at switching.

The following chart shows the operation timing for axis 1.



*1 The switching time differs by the specification of the servo amplifier. When "ZSP disabled selection at control switching" of the servo parameter "Function selection C-E (PC76)" is set to "0: Enabled" at MR-J5(W)-G used, the control mode switches after the motor speed becomes zero.
When the control mode of the servo amplifier does not change within 1 second, "Control mode switching error" (error code: 1F04H) occurs.

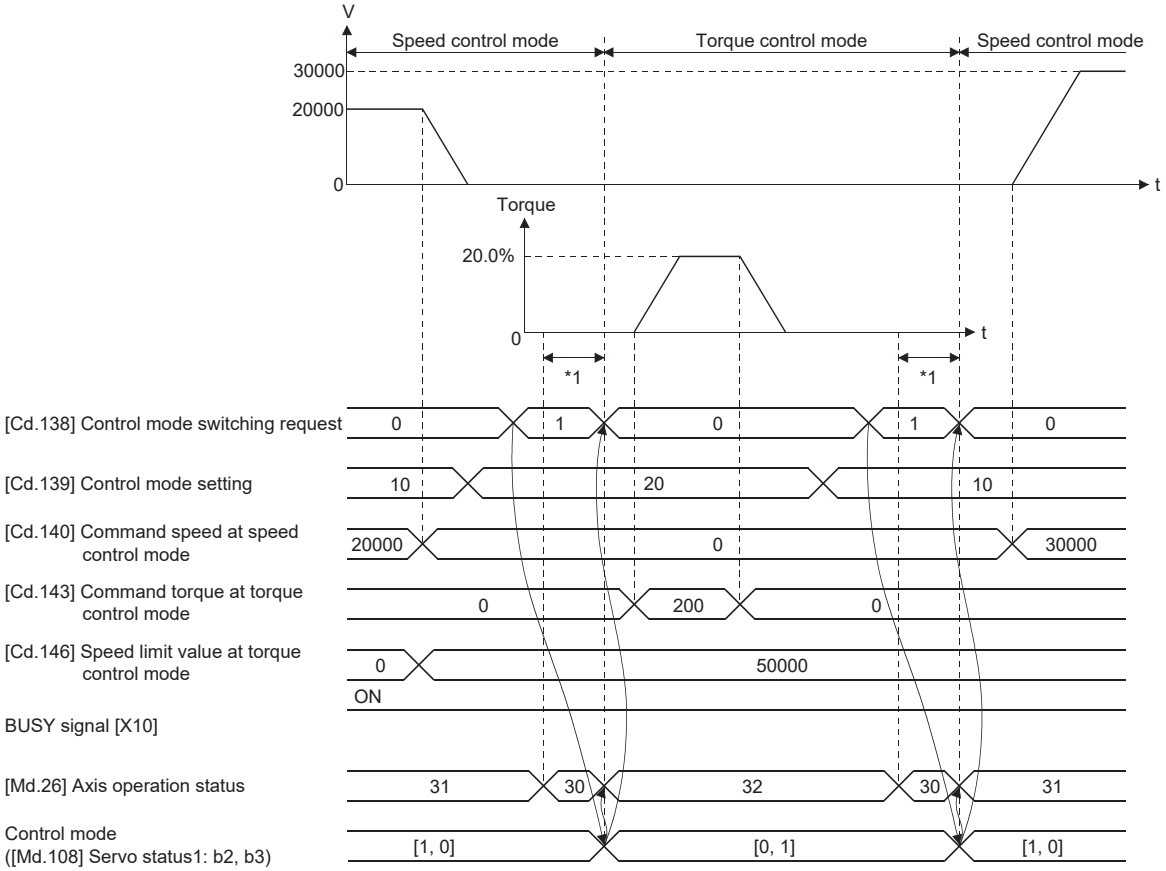
■Operation for "Speed control mode ⇔ Torque control mode switching"

When the speed control mode is switched to the torque control mode, the command torque immediately after the switching is the torque set in "Torque initial value selection (b4 to b7)" of "[Pr.90] Operation setting for speed-torque control mode".

Torque initial value selection ([Pr.90]: b4 to b7)	Command torque to servo amplifier immediately after switching from speed control mode to torque control mode
0: Command torque	The value of "[Cd.143] Command torque at torque control mode" at switching.
1: Feedback torque	Motor torque value at switching.

When the torque control mode is switched to the speed control mode, the command speed immediately after the switching is the motor rotation speed at switching.

The following chart shows the operation timing for axis 1.



*1 The switching time differs by the specification of the servo amplifier. When "ZSP disabled selection at control switching" of the servo parameter "Function selection C-E (PC76)" is set to "0: Enabled" at MR-J5(W)-G used, the control mode switches after the motor speed becomes zero.
When the control mode of the servo amplifier does not change within 1 second, "Control mode switching error" (error code: 1F04H) occurs.

Switching of control mode (Continuous operation to torque control)

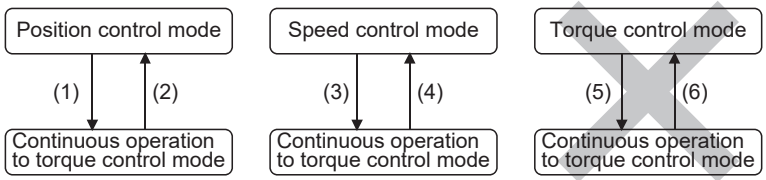
■Switching method of control mode

To switch the control mode to the continuous operation to torque control mode, set "1" in "[Cd.138] Control mode switching request" after setting the control mode to switch to "[Cd.139] Control mode setting" (30: Continuous operation to torque control mode) from position control mode or speed control mode.

The selected control mode can be checked in "[Md.26] Axis operation status".

When the switching condition is satisfied at control mode switching request, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "[Md.124] Control mode switching status", and the BUSY signal turns ON.

The following shows the switching condition of the continuous operation to torque control mode.



Switching operation		Switching condition
(1)	Position control mode → Continuous operation to torque control mode	Not during positioning*1 or during following positioning/synchronous mode • ABS1: 1-axis linear control (ABS) • INC1: 1-axis linear control (INC) • FEED1: 1-axis fixed-feed control • VF1: 1-axis speed control (Forward) • VR1: 1-axis speed control (Reverse) • VPF: Speed-position switching control (Forward) • VPR: Speed-position switching control (Reverse) • PVF: Position-speed switching control (Forward) • PVR: Position-speed switching control (Reverse) • Synchronous control
(2)	Continuous operation to torque control mode → Position control mode	During motor stop*2*3
(3)	Speed control mode → Continuous operation to torque control mode	None
(4)	Continuous operation to torque control mode → Speed control mode	
(5)	Torque control mode → Continuous operation to torque control mode	Switching is impossible.
(6)	Continuous operation to torque control mode → Torque control mode	

*1 BUSY signal is OFF.

*2 ZERO speed ([Md.119] Servo status2: b3) is ON.

n: Axis No. - 1

Monitor item	Buffer memory address
	Axis 1 to axis 16
[Md.119] Servo status2: b3	2476+100n

*3 Change the setting of "Condition selection at mode switching (b12 to b15)" in "[Pr.90] Operation setting for speed-torque control mode" when switching the control mode without waiting for the servo motor to stop. Note that it may cause vibration or impact at control switching. (☞ Page 478 [Pr.90] Operation setting for speed-torque control mode)

The history of control mode switching is stored to the start history at request of control mode switching. (☞ Page 515 System monitor data)

Confirm the status of the continuous operation to torque control mode with "b14: Continuous operation to torque control" of "[Md.125] Servo status3". When the mode is switched to the continuous operation to torque control mode, the value in "control mode (b2, b3)" of "[Md.108] Servo status1" remains the same as before switching the control mode. (☞ Page 523 Axis monitor data)

n: Axis No. - 1

Monitor item	Buffer memory address
	Axis 1 to axis 16
[Md.108] Servo status1: b2, b3	2477+100n

Point

- When the mode is switched from position control mode to continuous operation to torque control mode, only the switching from continuous operation to torque control mode to position control mode is possible. If the mode is switched to other control modes, "Control mode switching not possible" (warning code: 0DABH) will occur, and the control mode is not switched.
- When the mode is switched from speed control mode to continuous operation to torque control mode, only the switching from continuous operation to torque control mode to speed control mode is possible. If the mode is switched to other control modes, "Control mode switching not possible" (warning code: 0DABH) will occur, and the control mode is not switched.

■Precautions at control mode switching

- The start complete signal and positioning complete signal do not turn ON at control mode switching.
- When "33: Continuous operation to torque control" is set in "[Md.26] Axis operation status" and "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "[Md.124] Control mode switching status", the BUSY signal turns ON.
- When using the continuous operation to torque control mode, use the servo amplifiers that are compatible with the continuous operation to torque control. If the servo amplifiers that are not compatible with the continuous operation to torque control are used, "Driver control not supported" (error code: 1AE7H) occurs at request of switching to continuous operation to torque control mode, and the operation stops. (In the positioning control, the operation stops according to the setting of "[Pr.39] Stop group 3 rapid stop selection". In the speed control, the mode switches to the position control, and the operation immediately stops.)

■Operation for "Position control mode ⇔ Continuous operation to torque control mode switching"

To switch to the continuous operation to torque control mode, set the control data used in the control mode before setting "1" in "[Cd.138] Control mode switching request".

When the switching condition is satisfied at control mode switching request, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "[Md.124] Control mode switching status" and the BUSY signal turns ON. (When the control mode switching request is executed while the BUSY signal is ON, the BUSY signal does not turn OFF but stays ON at control mode switching.)

"0" is automatically stored in "[Cd.138] Control mode switching request" and "[Md.124] Control mode switching status" after completion of switching.

When the position control mode is switched to the continuous operation to torque control mode, the command torque and command speed immediately after the switching are the values set according to the following setting in "Torque initial value selection (b4 to b7)" and "Speed initial value selection (b8 to b11)" of "[Pr.90] Operation setting for speed-torque control mode".

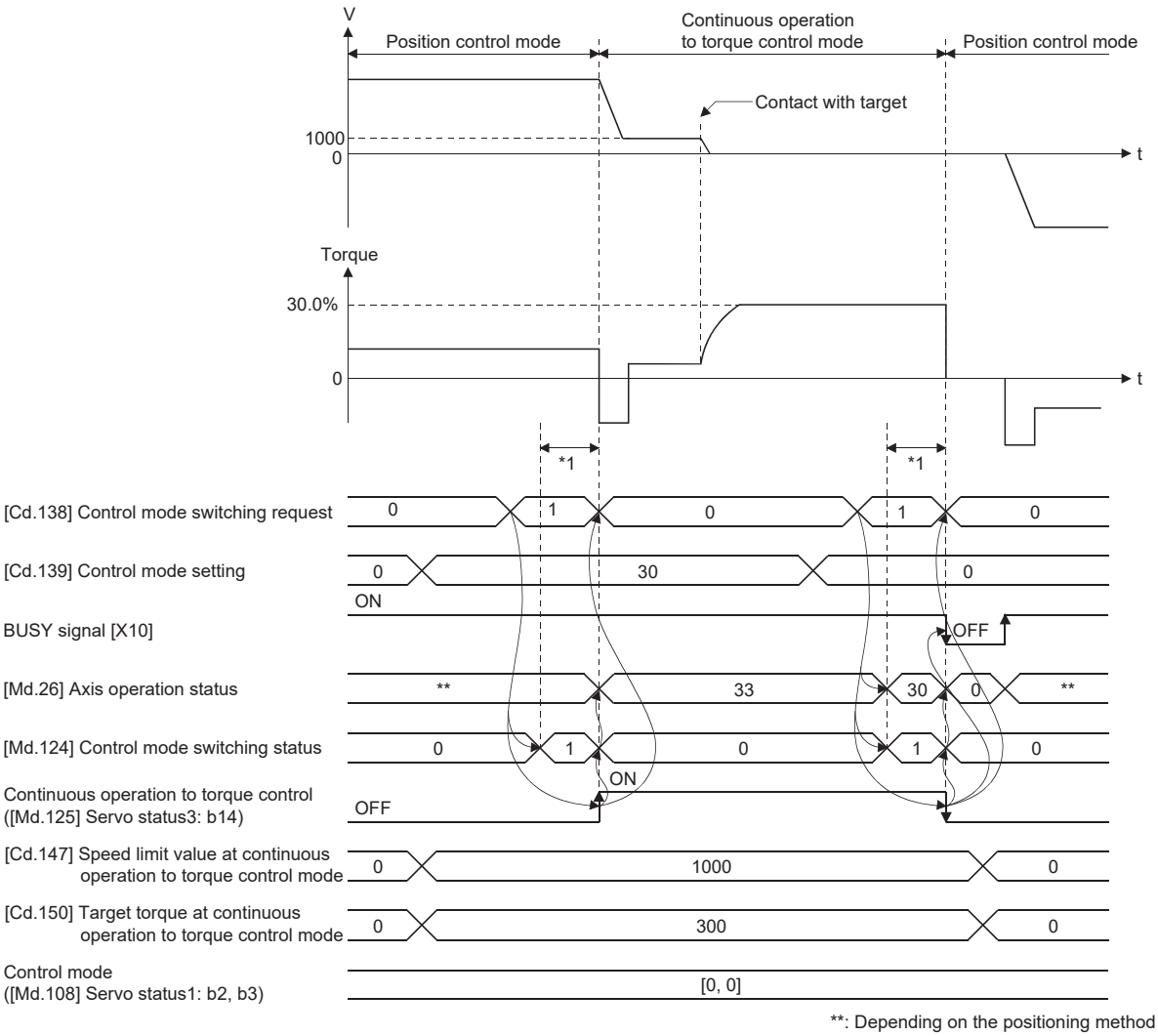
Torque initial value selection ([Pr.90]: b4 to b7)	Command torque to servo amplifier immediately after switching from position control mode to continuous operation to torque control mode
0: Command torque	The value of "[Cd.150] Target torque at continuous operation to torque control mode" at switching.
1: Feedback torque	Motor torque value at switching.

Speed initial value selection ([Pr.90]: b8 to b11)	Command speed to servo amplifier immediately after switching from position control mode to continuous operation to torque control mode
0: Command speed	Speed that the position command at switching is converted into the motor rotation speed. (When the positioning does not start at switching, the speed to servo amplifier immediately after switching is "0".)
1: Feedback speed	Motor rotation speed received from servo amplifier at switching.
2: Automatic selection	The lower speed between speed that position command at switching is converted into the motor rotation speed and motor rotation speed received from servo amplifier at switching.

Point

When the mode is switched to continuous operation to torque control mode in cases where command speed and actual speed are different such as during acceleration/deceleration or when the speed does not reach command speed due to torque limit, set "1: Feedback speed" in "Speed initial value selection (b8 to b11)".

The following chart shows the operation timing for axis 1.



*1 The switching time differs by the specification of the servo amplifier. When "ZSP disabled selection at control switching" of the servo parameter "Function selection C-E (PC76)" is set to "0: Enabled", the control mode switches after the motor speed becomes zero. When the control mode of the servo amplifier does not change within 1 second, "Control mode switching error" (error code: 1F04H) occurs.

■Operation for "Speed control mode ⇔ Continuous operation to torque control mode switching"

To switch to the continuous operation to torque control mode, set the control data used in the control mode before setting "1" in "[Cd.138] Control mode switching request".

When the switching condition is satisfied at control mode switching request, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "[Md.124] Control mode switching status" and the BUSY signal turns ON. (When the control mode switching request is executed while the BUSY signal is ON, the BUSY signal does not turn OFF but stays ON at control mode switching.)

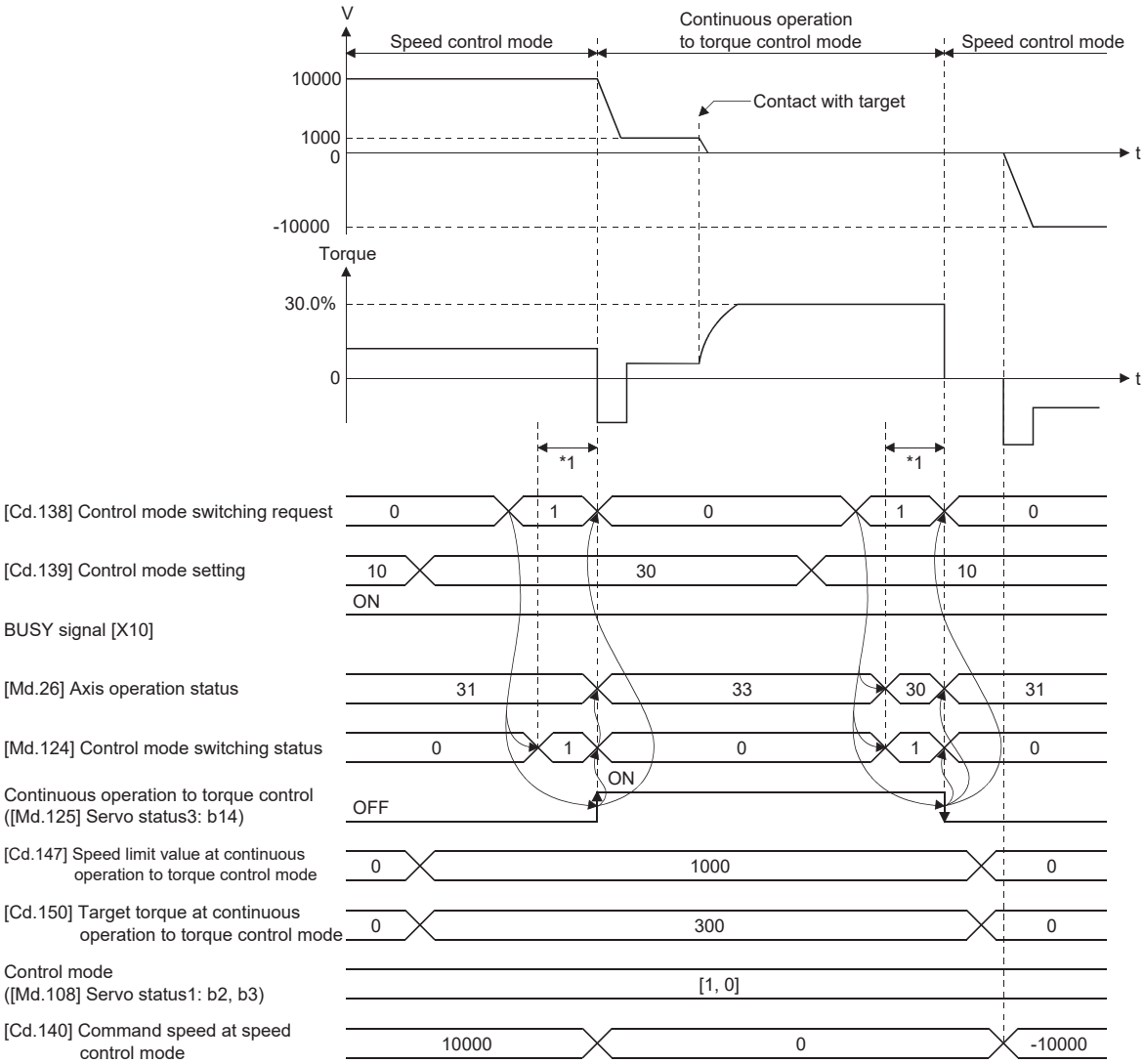
"0" is automatically stored in "[Cd.138] Control mode switching request" and "[Md.124] Control mode switching status" after completion of switching.

When the speed control mode is switched to the continuous operation to torque control mode, the command torque and command speed immediately after the switching is the value set in "Torque initial value selection (b4 to b7)" and "Speed initial value selection (b8 to b11)" of "[Pr.90] Operation setting for speed-torque control mode".

Torque initial value selection ([Pr.90]: b4 to b7)	Command torque to servo amplifier immediately after switching from speed control mode to continuous operation to torque control mode
0: Command torque	The value of "[Cd.150] Target torque at continuous operation to torque control mode" at switching.
1: Feedback torque	Motor torque value at switching.

Speed initial value selection ([Pr.90]: b8 to b11)	Command speed to servo amplifier immediately after switching from speed control mode to continuous operation to torque control mode
0: Command speed	The speed commanded to the servo amplifier immediately after switching is the currently commanded speed.
1: Feedback speed	Motor rotation speed received from servo amplifier at switching.
2: Automatic selection	The speed at switching is the lower speed between the currently commanded speed converted into the motor rotation speed and the motor rotation speed received from servo amplifier.

The following chart shows the operation timing for axis 1.



*1 The switching time differs by the specification of the servo amplifier. When "ZSP disabled selection at control switching" of the servo parameter "Function selection C-E (PC76)" is set to "0: Enabled", the control mode switches after the motor speed becomes zero. When the control mode of the servo amplifier does not change within 1 second, "Control mode switching error" (error code: 1F04H) occurs.

■Operation for switching from "Position control mode" to "Continuous operation to torque control mode" automatically

To switch to the continuous operation to torque control mode automatically when the conditions set in "[Cd.153] Control mode auto-shift selection" and "[Cd.154] Control mode auto-shift parameter" are satisfied, set the control data necessary in the continuous operation to torque control mode, "[Cd.153] Control mode auto-shift selection", and "[Cd.154] Control mode auto-shift parameter", and then set "30: Continuous operation to torque control mode" in "[Cd.139] Control mode setting" and "1: Switching request" in "[Cd.138] Control mode switching request".

In this case, the current control is continued until the setting condition is satisfied after control mode switching request, and "2: Waiting for the completion of control mode switching condition" is set in "[Md.124] Control mode switching status". When the set condition is satisfied, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "[Md.124] Control mode switching status".

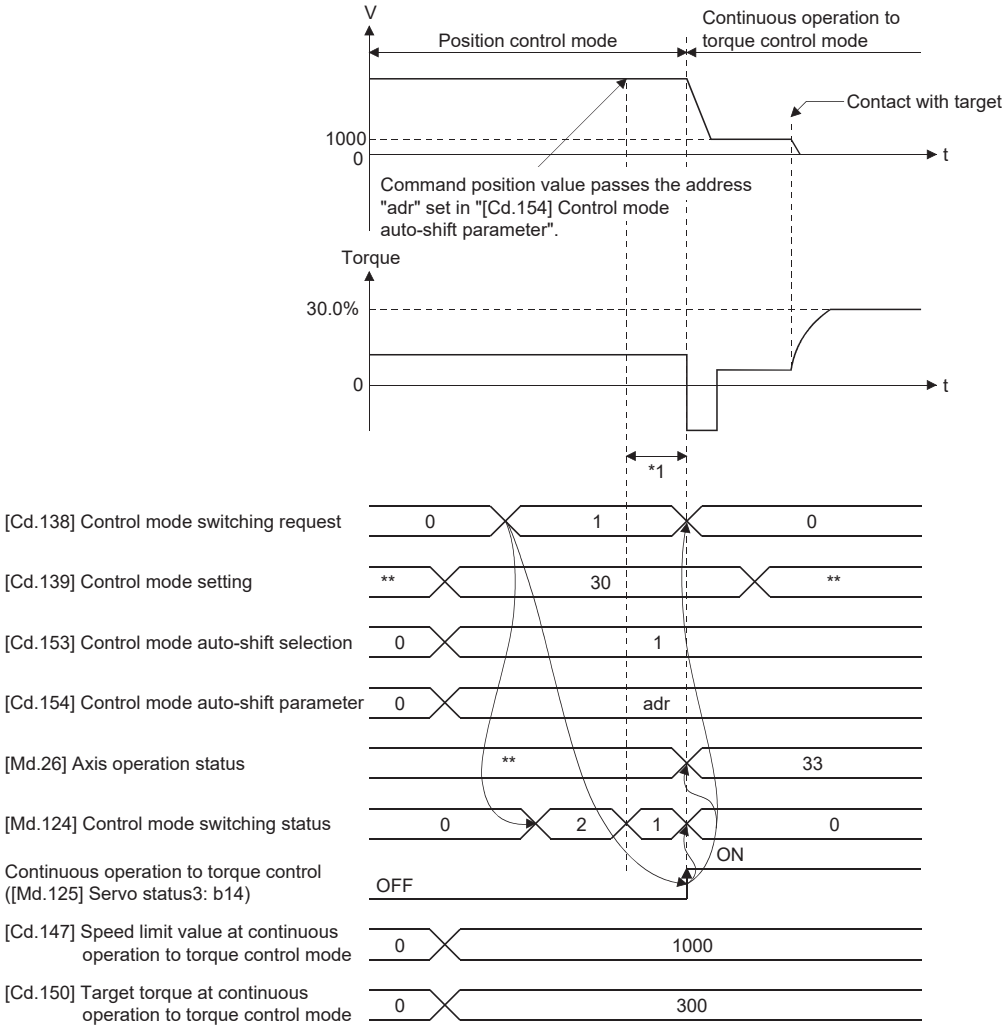
"0" is stored in "[Cd.138] Control mode switching request" and "[Md.124] Control mode switching status" after completion of switching.

If "[Cd.154] Control mode auto-shift parameter" is outside the setting range, "Outside control mode auto-shift switching parameter range" (error code: 1AE4H) occurs at control mode switching request, and the current processing stops. (In the positioning control, the operation stops according to the setting of "[Pr.39] Stop group 3 rapid stop selection". In the speed control, the mode switches to the position control, and the operation immediately stops.)

Point

- Automatic switching is valid only when the control mode is switched from the position control mode to the continuous operation to torque control mode. When the mode is switched from speed control mode to continuous operation to torque control mode or from continuous operation to torque control mode to other control modes, even if the automatic switching is set, the state is not waiting for the completion of condition, and control mode switching is executed immediately.
- When the mode switching request is executed after setting the switching condition, the state of waiting for the completion of control mode switching condition continues until the setting condition is satisfied. Therefore, if the positioning by automatic switching is interrupted, unexpected control mode switching may be executed in other positioning operations. Waiting for the completion of control mode switching condition can be cancelled by setting "Other than 1: Not request" in "[Cd.138] Control mode switching request" or by turning the axis stop signal ON. When an error occurs, waiting for the completion of control mode switching condition is also cancelled. (In both cases, "0" is stored in "[Cd.138] Control mode switching request".)
- In the state of waiting for the completion of control mode switching condition, if the current values are updated by the current value changing, the fixed-feed control or the speed control (when "2: Clear command position value to zero" is set in "[Pr.21] Command position value during speed control"), an auto-shift judgment is executed based on the updated current value. Therefore, depending on the setting condition, the mode may be switched to the continuous operation to torque control mode immediately after the positioning starts. To avoid this switching, set "1: Switching request" in "[Cd.138] Control mode switching request".

The following chart shows the operation when "1: Command position value pass" is set in "[Cd.153] Control mode auto-shift selection".



**: Depending on the control mode.

*1 The switching time differs by the specification of the servo amplifier. When "ZSP disabled selection at control switching" of the servo parameter "Function selection C-E (PC76)" is set to "0: Enabled", the control mode switches after the motor speed becomes zero. When the control mode of the servo amplifier does not change within 1 second, "Control mode switching error" (error code: 1F04H) occurs.

Speed control mode

■Operation for speed control mode

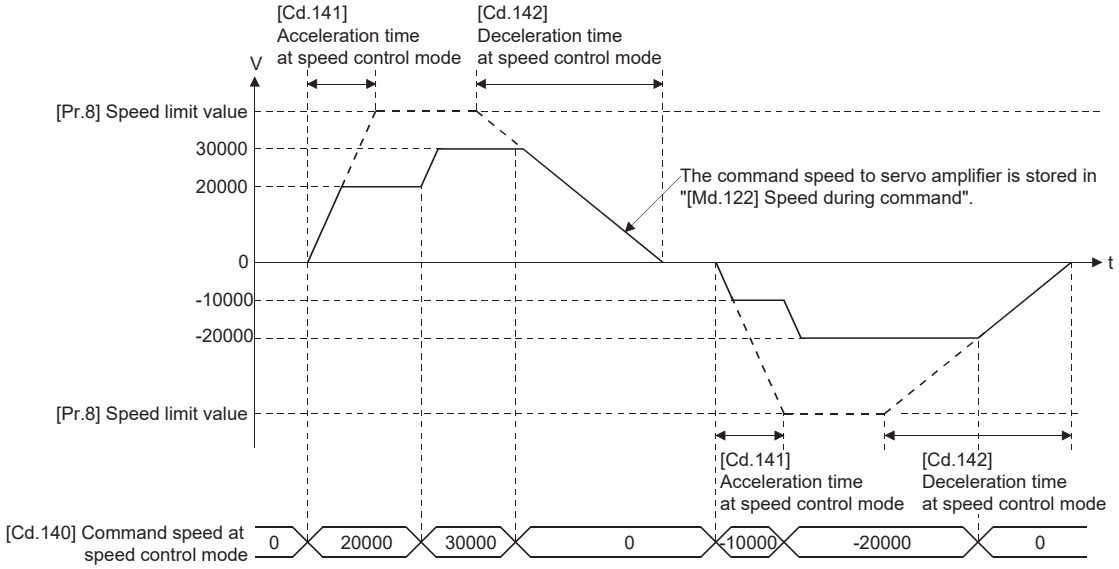
The speed control is executed at the speed set in "[Cd.140] Command speed at speed control mode" in the speed control mode.

Set a positive value for forward rotation and a negative value for reverse rotation. "[Cd.140]" can be changed any time during the speed control mode.

Acceleration/deceleration is performed based on a trapezoidal acceleration/deceleration processing. Set acceleration/deceleration time toward "[Pr.8] Speed limit value" in "[Cd.141] Acceleration time at speed control mode" and "[Cd.142] Deceleration time at speed control mode". The value at speed control mode switching request is valid for "[Cd.141]" and "[Cd.142]".

The command speed during the speed control mode is limited with "[Pr.8] Speed limit value". If the speed exceeding the speed limit value is set, "Speed limit value over" (warning code: 0D51H) occurs, and the operation is controlled with the speed limit value.

Confirm the command speed to servo amplifier with "[Md.122] Speed during command".



■Command position value during speed control mode

"[Md.20] Command position value", "[Md.21] Machine feed value" and "[Md.101] Actual position value" are updated even in the speed control mode.

If the command position value exceeds the software stroke limit, "Software stroke limit +" (error code: 1A93H) or "Software stroke limit -" (error code: 1A95H) occurs and the operation switches to the position control mode. Invalidate the software stroke limit to execute one-way feed.

■Stop cause during speed control mode

The operation for stop cause during speed control mode is shown below.

Item	Operation during speed control mode
"[Cd.180] Axis stop" turned ON.	The motor decelerates to speed "0" according to the setting value of "[Cd.142] Deceleration time at speed control mode". The mode switches to the position control mode when "Zero speed" of "[Md.119] Servo status2" turns ON, and the operation stops.
Stop signal of "[Cd.44] External input signal operation device" turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is not executed during the speed control mode. The command status when the mode is switched to the position control mode becomes valid.
"[Cd.100] Servo OFF command" turned ON.	
The current value reached the software stroke limit.	An error (error code: 1A00H, 1A04H to 1A07H, 1A93H, 1A95H, 1BE6H) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.)
The position of the motor reached the hardware stroke limit.	
The PLC READY [Y0] turned OFF.	
Command discard was detected on the servo amplifier.	
The forced stop input to Motion module.	The mode switches to the position control mode when the servo OFF (Servo ON of "[Md.108] Servo status1" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servo motor immediately stops.)
The emergency stop input to servo amplifier.	
The servo alarm occurred.	
The servo amplifier's power supply turned OFF.	An immediate stop will be performed as the stop processing of the controller. (The mode is set to the position control mode at the servo amplifier's power supply ON again.)

Torque control mode

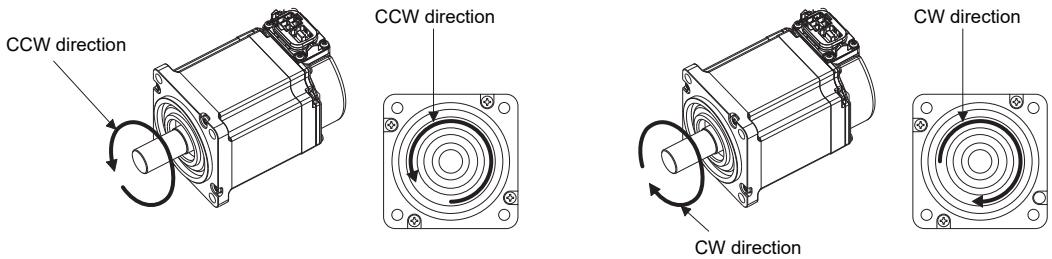
■Operation for torque control mode

The torque control is executed at the command torque set in "[Cd.143] Command torque at torque control mode" in the torque control mode.

"[Cd.143] Command torque at torque control mode" can be changed any time during torque control mode. The relation between the setting of command torque and the torque generation direction of servo motor varies depending on the setting of servo parameters "Travel direction selection (PA14)" and "Function selection C-B Torque POL reflection selection (PC29.3)".

"Function selection C-B Torque POL reflection selection (PC29.3)"	"Travel direction selection (PA14)"	"[Cd.143] Command torque at torque control mode"	Torque generation direction of servo motor*1
0: Enabled	0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction
	1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CW direction
		Negative value (Reverse direction)	CCW direction
1: Disabled	0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction
	1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction

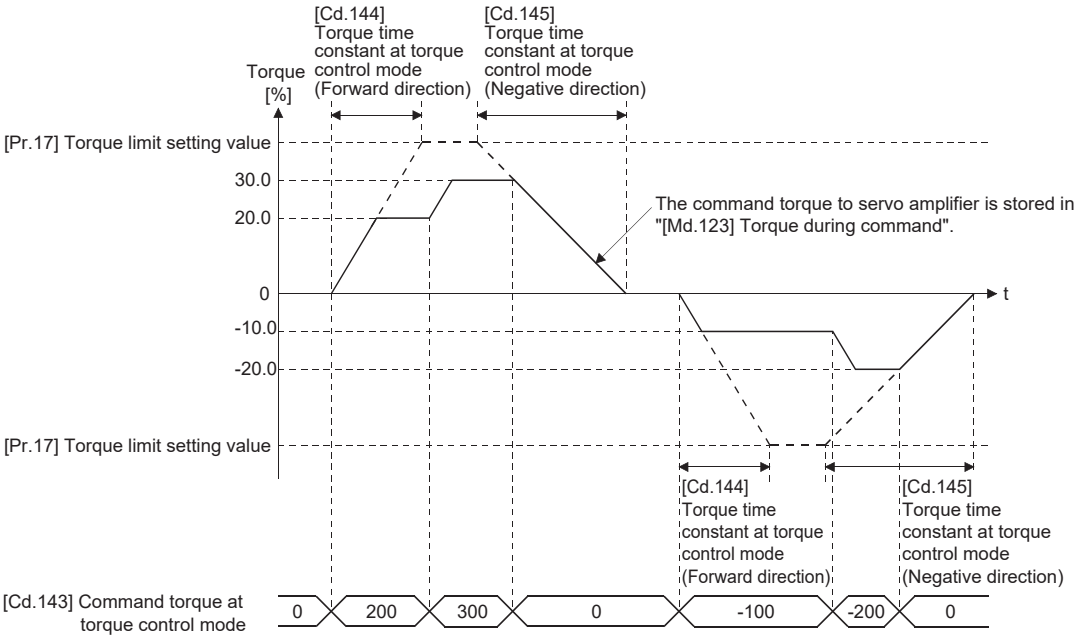
*1 Refer to the following diagram.



Set time for the command torque to increase from 0% to "[Pr.17] Torque limit setting value" in "[Cd.144] Torque time constant at torque control mode (Forward direction)" and for the command torque to decrease from "[Pr.17] Torque limit setting value" to 0% in "[Cd.145] Torque time constant at torque control mode (Negative direction)". The value at torque control mode switching request is valid for "[Cd.144]" and "[Cd.145]".

The command torque during the torque control mode is limited with "[Pr.17] Torque limit setting value". If the torque exceeding the torque limit setting value is set, "Torque limit value over" (warning code: 0DA4H) occurs, and the operation is controlled with the torque limit setting value.

Confirm the command torque to servo amplifier with "[Md.123] Torque during command".



■Speed during torque control mode

The speed during the torque control mode is controlled with "[Cd.146] Speed limit value at torque control mode". At this time, "Speed limit" ([Md.119] Servo status2: b4) turns ON.

n: Axis No. - 1

Monitor item	Buffer memory address
	Axis 1 to axis 16
[Md.119] Servo status2: b4	2476+100n

"[Cd.146] Speed limit value at torque control mode" is set to a positive value regardless of the rotation direction. (Controlled by the same value for forward and reverse directions.)

In addition, "[Cd.146] Speed limit value at torque control mode" is limited with "[Pr.8] Speed limit value". If the speed exceeding the speed limit value is set, "Speed limit value over" (warning code: 0D51H) occurs, and the operation is controlled with the speed limit value.

The acceleration/deceleration processing is invalid for "[Cd.146] Speed limit value at torque control mode".

Point

The actual motor speed may not reach the speed limit value depending on the machine load situation during the torque control.

■Command position value during torque control mode

"[Md.20] Command position value", "[Md.21] Machine feed value" and "[Md.101] Actual position value" are updated even in the torque control mode.

If the command position value exceeds the software stroke limit, "Software stroke limit +" (error code: 1A93H) or "Software stroke limit -" (error code: 1A95H) occurs and the operation switches to the position control mode. Invalidate the software stroke limit to execute one-way feed.

■Stop cause during torque control mode

The operation for stop cause during torque control mode is shown below.

Item	Operation during torque control mode
"[Cd.180] Axis stop" turned ON.	The speed limit value commanded to servo amplifier is "0" regardless of the setting value of "[Cd.146] Speed limit value at torque control mode". The mode switches to the position control mode when "Zero speed" of "[Md.119] Servo status2" turns ON, and the operation immediately stops. (Deceleration processing is not executed.) The value of command torque is not changed. It might take time to reach the speed "0" depending on the current torque command value.
Stop signal of "[Cd.44] External input signal operation device" turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is not executed during the torque control mode. The command status when the mode is switched to the position control mode becomes valid.
"[Cd.100] Servo OFF command" turned ON.	
The current value reached the software stroke limit.	An error (error code: 1A00H, 1A04H to 1A07H, 1A93H, 1A95H, 1BE6H) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.)
The position of the motor reached the hardware stroke limit.	
The PLC READY [Y0] turned OFF.	
Command discard was detected on the servo amplifier.	
The forced stop input to Motion module.	The mode switches to the position control mode when the servo OFF (Servo ON of "[Md.108] Servo status1" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servo motor immediately stops.)
The emergency stop input to servo amplifier.	
The servo alarm occurred.	
The servo amplifier's power supply turned OFF.	An immediate stop will be performed as the stop processing of the controller. (The mode is set to the position control mode at the servo amplifier's power supply ON again.)

Continuous operation to torque control mode

■Operation for continuous operation to torque control mode

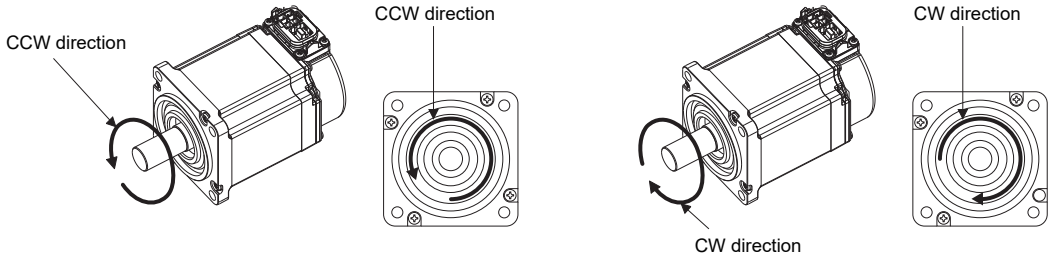
In continuous operation to torque control, the torque control can be executed without stopping the operation during the positioning in position control mode or speed command in speed control mode.

During the continuous operation to torque control mode, the torque control is executed at the command torque set in "[Cd.150] Target torque at continuous operation to torque control mode" while executing acceleration/deceleration to reach the speed set in "[Cd.147] Speed limit value at continuous operation to torque control mode".

"[Cd.147] Speed limit value at continuous operation to torque control mode" and "[Cd.150] Target torque at continuous operation to torque control mode" can be changed any time during the continuous operation to torque control mode. The relation between the setting value of command torque and the torque generation direction of servo motor varies depending on the setting of servo parameters "Travel direction selection (PA14)" and "Function selection C-B Torque POL reflection selection (PC29.3)".

"Function selection C-B Torque POL reflection selection (PC29.3)"	"Travel direction selection (PA14)"	"[Cd.150] Target torque at continuous operation to torque control mode"	Torque generation direction of servo motor*1
0: Enabled	0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction
	1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CW direction
		Negative value (Reverse direction)	CCW direction
1: Disabled	0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction
	1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction
		Negative value (Reverse direction)	CW direction

*1 Refer to the following diagram.



Point

Speed is not limited for reverse torque generation direction.

■Torque command setting method

During the continuous operation to torque control mode, set time for the command torque to increase from 0% to "[Pr.17] Torque limit setting value" in "[Cd.151] Torque time constant at continuous operation to torque control mode (Forward direction)" and for the command torque to decrease from "[Pr.17] Torque limit setting value" to 0% in "[Cd.152] Torque time constant at continuous operation to torque control mode (Negative direction)". The value at continuous operation to torque control mode switching request is valid for "[Cd.151]" and "[Cd.152]".

The command torque during the continuous operation to torque control mode is limited with "[Pr.17] Torque limit setting value".

If torque exceeding the torque limit setting value is commanded, "Torque limit value over" (warning code: 0DA4H) occurs, and the operation is controlled with the torque limit setting value.

Confirm the command torque to servo amplifier with "[Md.123] Torque during command".

During the continuous operation to torque control mode, "Torque limit" ([Md.108] Servo status1: b13) does not turn ON.

Confirm the current torque value in "[Md.104] Motor current value".

n: Axis No. - 1

Monitor item	Buffer memory address
	Axis 1 to axis 16
[Md.108] Servo status1: b13	2477+100n

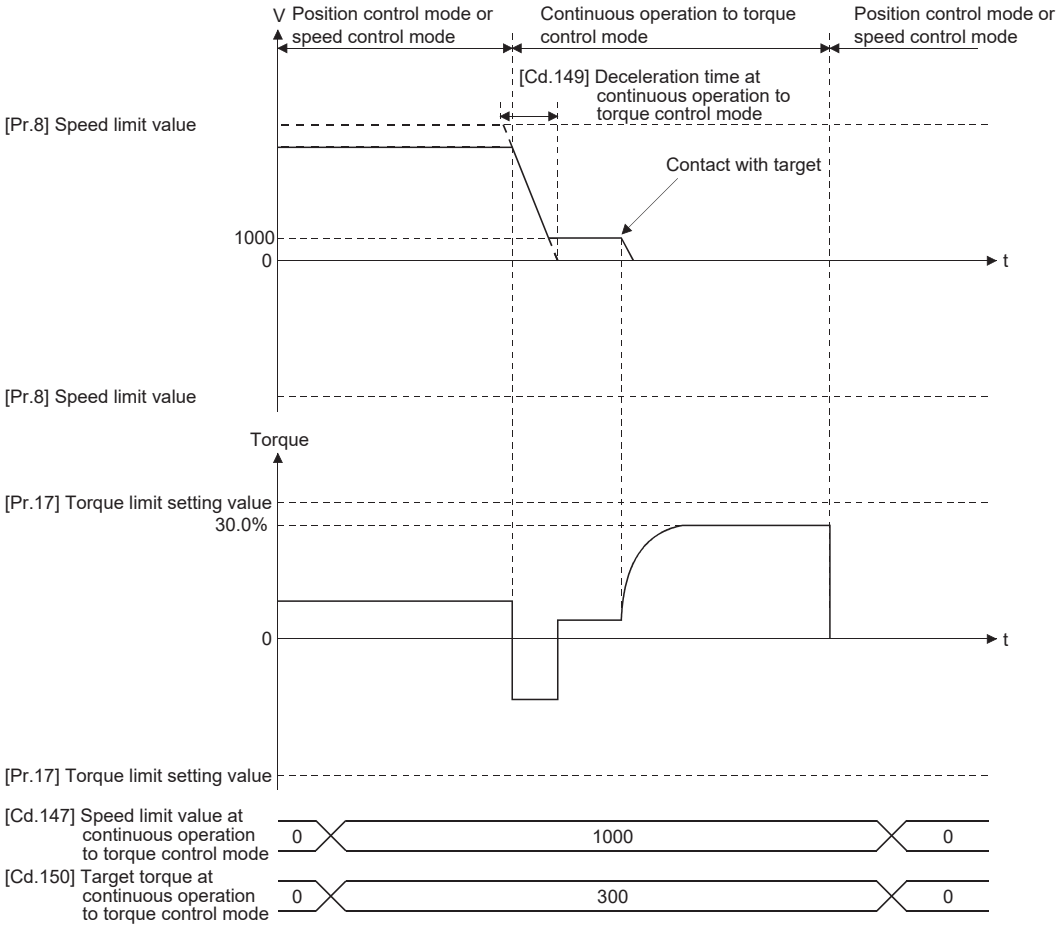
■Speed limit value setting method

Acceleration/deceleration is performed based on a trapezoidal acceleration/deceleration processing.

Set acceleration/deceleration time toward "[Pr.8] Speed limit value" in "[Cd.148] Acceleration time at continuous operation to torque control mode" and "[Cd.149] Deceleration time at continuous operation to torque control mode". The value at continuous operation to torque control mode switching is valid for "[Cd.148]" and "[Cd.149]".

"[Cd.147] Speed limit value at continuous operation to torque control mode" is limited with "[Pr.8] Speed limit value". If the speed exceeding the speed limit value is commanded, "Speed limit value over" (warning code: 0D51H) occurs, and the operation is controlled with the speed limit value.

Confirm the command speed to servo amplifier with "[Md.122] Speed during command".



■Precautions at continuous operation to torque control mode

For functions of the servo amplifier that are not available during the continuous operation to torque control mode, refer to the manual of the servo amplifier to be connected.

Point

If vibration occurs during the continuous operation to torque control, lower the value of the servo parameter "Torque feedback loop gain (PB03)" and check if the issue is solved.

Restriction

Set the system configuration with an unlimited operation range during the continuous operation to torque control mode as a stroke limit signal of the servo amplifier cannot be used during the continuous operation to torque control mode.
Use the software stroke limit function on the Motion module side to restrict the set position.

■Speed during continuous operation to torque control mode

The speed during the continuous operation to torque control mode is controlled with an absolute value of the value set in "[Cd.147] Speed limit value at continuous operation to torque control mode" as command speed. When the speed reaches the absolute value of "[Cd.147] Speed limit value at continuous operation to torque control mode", "Speed limit" ([Md.119] Servo status2: b4) turns ON.
n: Axis No. - 1

Monitor item	Buffer memory address
	Axis 1 to axis 16
[Md.119] Servo status2: b4	2476+100n

In addition, "[Cd.147] Speed limit value at continuous operation to torque control mode" is limited with "[Pr.8] Speed limit value". If the command speed exceeding the speed limit value is set, "Speed limit value over" (warning code: 0D51H) occurs, and the operation is controlled with the speed limit value.

Point

The actual motor speed may not reach the command speed depending on the machine load situation during the continuous operation to torque control mode.

■Command position value during continuous operation to torque control mode

"[Md.20] Command position value", "[Md.21] Machine feed value" and "[Md.101] Actual position value" are updated even in the continuous operation to torque control mode.
If the command position value exceeds the software stroke limit, "Software stroke limit +" (error code: 1A93H) or "Software stroke limit -" (error code: 1A95H) occurs and the operation switches to the position control mode. Invalidate the software stroke limit to execute one-way feed.

■Stop cause during continuous operation to torque control mode

The operation for stop cause during continuous operation to torque control mode is shown below.

Item	Operation during continuous operation to torque control mode
"[Cd.180] Axis stop" turned ON.	The speed limit value commanded to servo amplifier is "0" regardless of the setting value of "[Cd.147] Speed limit value at continuous operation to torque control mode". The mode switches to the position control mode when "Zero speed" of "[Md.119] Servo status2" turns ON, and the operation immediately stops. (Deceleration processing is not executed.) The value of command torque is not changed. It might take time to reach the speed "0" depending on the current torque command value.
Stop signal of "[Cd.44] External input signal operation device" turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is not executed during the continuous operation to torque control mode. The command status when the mode is switched to the position control mode becomes valid.
"[Cd.100] Servo OFF command" turned ON.	
The current value reached the software stroke limit.	An error (error code: 1A00H, 1A04H to 1A07H, 1A93H, 1A95H, 1BE6H) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.)*1 When the operation immediately stops, the motor may start hunting depending on the motor speed. Therefore, be sure not to reach the limit in high speed and not to turn OFF PLC READY [Y0].
The position of the motor reached the hardware stroke limit.	
The PLC READY [Y0] turned OFF.	
Command discard was detected on the servo amplifier.	
The forced stop input to Motion module.	The mode switches to the position control mode when the servo OFF (Servo ON of "[Md.108] Servo status1" turns OFF) is executed.*1 (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servo motor immediately stops.)
The emergency stop input to servo amplifier.	
The servo alarm occurred.	
The servo amplifier's power supply turned OFF.	An immediate stop will be performed as the stop processing of the controller. (The mode is set to the position control mode at the servo amplifier's power supply ON again.)

*1 When the mode has switched from the speed control mode to the continuous operation to torque control mode, the mode switches to the position control mode after switching the speed control mode once. Therefore, it takes the following time to switch to the position control mode.
Switching time for the speed control mode + Switching time for the position control mode

Servo OFF command valid function during speed-torque control

"Servo OFF command valid function" enables acceptance of "[Cd.100] Servo OFF command" and All axis servo ON [Y1] during the speed control mode, torque control mode, and continuous operation to torque control mode.
This function enables the servo OFF without braking the servo amplifier by a dynamic brake.
By selecting "[Pr.112] Servo OFF command valid/invalid setting", whether to enable or disable "[Cd.100] Servo OFF command" and All axis servo ON [Y1] during the speed control mode, torque control mode, and continuous operation to torque control mode can be selected. When "1: Servo OFF command valid during speed-torque control" is selected for "[Pr.112] Servo OFF command valid/invalid setting", the servo OFF command becomes valid, and when "0: Servo OFF command invalid" is selected for "[Pr.112] Servo OFF command valid/invalid setting", the servo OFF command becomes invalid. The setting value of "[Pr.112] Servo OFF command valid/invalid setting" becomes valid when the control mode is switched.
When the servo OFF command is valid and "1: Servo OFF" is set in "[Cd.100] Servo OFF command" or All axis servo ON [Y1] is set to OFF, the servo OFF of the target axis is performed. The control mode when the servo OFF command is executed is used during the servo OFF.

Precautions

For safe use, when using this function, execute "[Cd.100] Servo OFF command" when the servo amplifier is not braked by the dynamic brake and there is no problem even if the servo OFF is performed.

Related buffer memory

■Detailed parameters 2

n: Axis No. - 1

Setting item	Setting value		Buffer memory address
			Axis 1 to axis 16
[Pr.112] Servo OFF command valid/invalid setting*1	bit0	0: Servo OFF command invalid 1: Servo OFF command valid during speed-torque control	112+150n
	bit1 or later	Use prohibited*2	

*1 This parameter is saved in the flash ROM by "[Cd.1] Flash ROM write request" or writing to the flash ROM with an engineering tool.
*2 When a bit other than bit0 is turned ON, it operates with the setting of "0: Servo OFF command invalid".

■Axis control data

n: Axis No. - 1

Setting item		Setting details	Buffer memory address
			Axis 1 to axis 16
[Y1]	All axis servo ON	0: Servo OFF 1: Servo ON	—
[Cd.100]	Servo OFF command	0: Servo ON 1: Servo OFF	4351+100n

Stop cause

When "1: Servo OFF command valid during speed-torque control" is selected for "[Pr.112] Servo OFF command valid/invalid setting", the operations at stop cause occurrence are shown below.

■Stop cause during speed control mode

Item	Operation during speed control mode
"[Cd.180] Axis stop" turned ON.	The motor decelerates to speed "0" according to the setting value of "[Cd.142] Deceleration time at speed control mode". The mode switches to the position control mode when "Zero speed" of "[Md.119] Servo status2" turns ON, and the operation stops. While the servo amplifier is servo OFF, even if "[Cd.180] Axis stop" is turned ON, the stop signal is not accepted.
Stop signal of "[Cd.44] External input signal operation device" turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is executed and the speed control mode continues. At the stop due to servo OFF, it is braked by the dynamic brake. After the servo ON, the speed control mode can be continued.
"[Cd.100] Servo OFF command" turned ON.	The servo OFF is executed and the speed control mode continues. At the stop due to servo OFF, it is not braked by the dynamic brake. After the servo ON, the speed control mode can be continued.
The current value reached the software stroke limit.	An error (error code: 1A00H, 1A04H to 1A07H, 1A93H, 1A95H, 1BE6H) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.) While the servo amplifier is servo OFF, an error does not occur even if any operation on the left is performed.
The position of the motor reached the hardware stroke limit.	
The PLC READY [Y0] turned OFF.	
Command discard was detected on the servo amplifier.	
The forced stop input to Motion module.	An immediate stop will be performed as the stop processing of the controller. (The speed control mode continues. After eliminating the cause, the speed control mode can be continued.)
The emergency stop input to servo amplifier.	
The servo alarm occurred.	The mode switches to the position control mode when the servo OFF (Servo ON of "[Md.108] Servo status1" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servo motor immediately stops.)
The servo amplifier's power supply turned OFF.	An immediate stop will be performed as the stop processing of the controller. (The mode is set to the position control mode at the servo amplifier's power supply ON again.)

■Stop cause during torque control mode

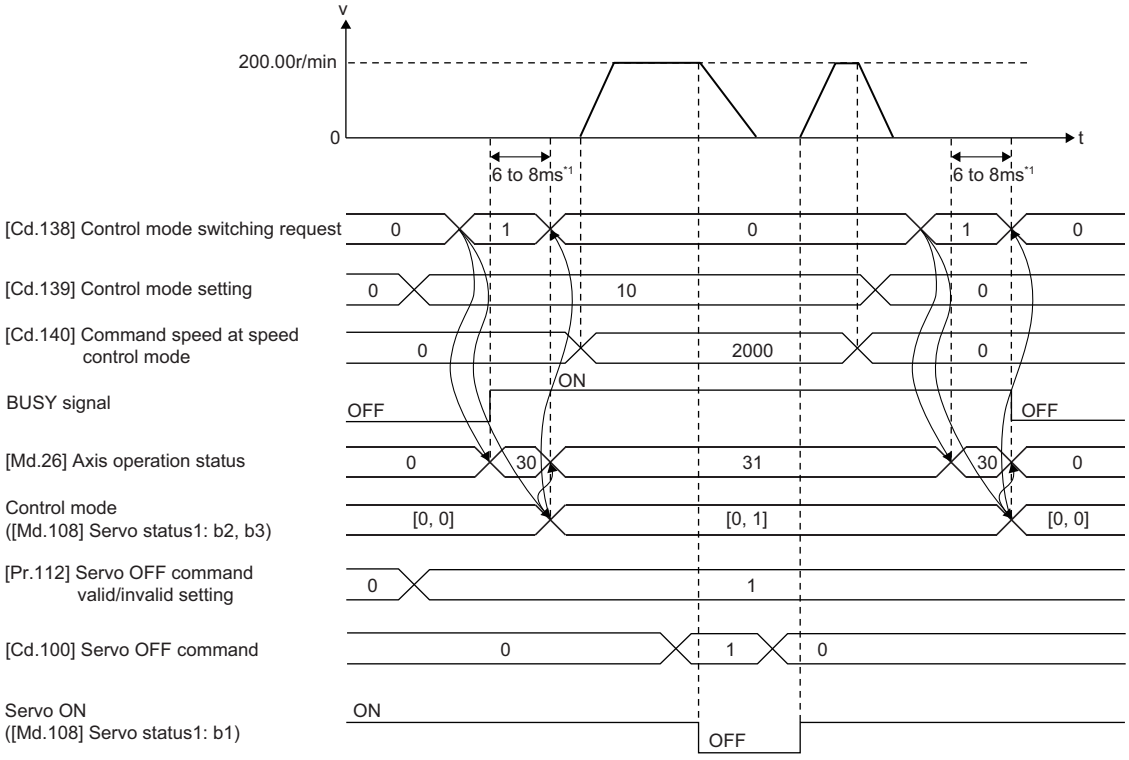
Item	Operation during torque control mode
"[Cd.180] Axis stop" turned ON.	The speed limit value to be commanded to the servo amplifier is "0" regardless of the setting value of "[Cd.146] Speed limit value at torque control mode". The mode switches to the position control mode when "Zero speed" of "[Md.119] Servo status2" turns ON, and the operation immediately stops. (Deceleration processing is not executed.) The value of command torque is not changed. It might take time to reach the speed "0" depending on the current torque command value. While the servo amplifier is servo OFF, even if "[Cd.180] Axis stop" is turned ON, the stop signal is not accepted.
Stop signal of "[Cd.44] External input signal operation device" turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is executed and the torque control mode continues. At the stop due to servo OFF, it is braked by the dynamic brake. After the servo ON, the torque control mode can be continued.
"[Cd.100] Servo OFF command" turned ON.	The servo OFF is executed and the torque control mode continues. At the stop due to servo OFF, it is not braked by the dynamic brake. After the servo ON, the torque control mode can be continued.
The current value reached the software stroke limit.	An error (error code: 1A00H, 1A04H to 1A07H, 1A93H, 1A95H, 1BE6H) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.) While the servo amplifier is servo OFF, an error does not occur even if any operation on the left is performed.
The position of the motor reached the hardware stroke limit.	
The PLC READY [Y0] turned OFF.	
Command discard was detected on the servo amplifier.	
The forced stop input to Motion module.	An immediate stop will be performed as the stop processing of the controller. (The torque control mode continues. After eliminating the cause, the torque control mode can be continued.)
The emergency stop input to servo amplifier.	
The servo alarm occurred.	The mode switches to the position control mode when the servo OFF (Servo ON of "[Md.108] Servo status1" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servo motor immediately stops.)
The servo amplifier's power supply turned OFF.	An immediate stop will be performed as the stop processing of the controller. (The mode is set to the position control mode at the servo amplifier's power supply ON again.)

■Stop cause during continuous operation to torque control mode

Item	Operation during continuous operation to torque control mode
"[Cd.180] Axis stop" turned ON.	The speed limit value to be commanded to the servo amplifier is "0" regardless of the setting value of "[Cd.147] Speed limit value at continuous operation to torque control mode". The mode switches to the position control mode when "Zero speed" of "[Md.119] Servo status2" turns ON, and the operation immediately stops. (Deceleration processing is not executed.) The value of command torque is not changed. It might take time to reach the speed "0" depending on the current torque command value.
Stop signal of "[Cd.44] External input signal operation device" turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is executed and the continuous operation to torque control mode continues. At the stop due to servo OFF, it is braked by the dynamic brake. After the servo ON, the continuous operation to torque control mode can be continued.
"[Cd.100] Servo OFF command" turned ON.	The servo OFF is executed and the continuous operation to torque control mode continues. At the stop due to servo OFF, it is not braked by the dynamic brake. After the servo ON, the continuous operation to torque control mode can be continued.
The current value reached the software stroke limit.	An error (error code: 1A00H, 1A04H to 1A07H, 1A93H, 1A95H, 1BE6H) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.) When the operation immediately stops, the motor may start hunting depending on the motor speed. Therefore, be sure not to reach the limit in high speed and not to turn OFF PLC READY [Y0]. While the servo amplifier is servo OFF, an error does not occur even if any operation on the left is performed.
The position of the motor reached the hardware stroke limit.	
The PLC READY [Y0] turned OFF.	
Command discard was detected on the servo amplifier.	
The forced stop input to Motion module.	An immediate stop will be performed as the stop processing of the controller. (The continuous operation to torque control mode continues. After eliminating the cause, the continuous operation to torque control mode can be continued.)
The emergency stop input to servo amplifier.	
The servo alarm occurred.	The mode switches to the position control mode when the servo OFF (Servo ON of "[Md.108] Servo status1" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servo motor immediately stops.)
The servo amplifier's power supply turned OFF.	An immediate stop will be performed as the stop processing of the controller. (The mode is set to the position control mode at the servo amplifier's power supply ON again.)

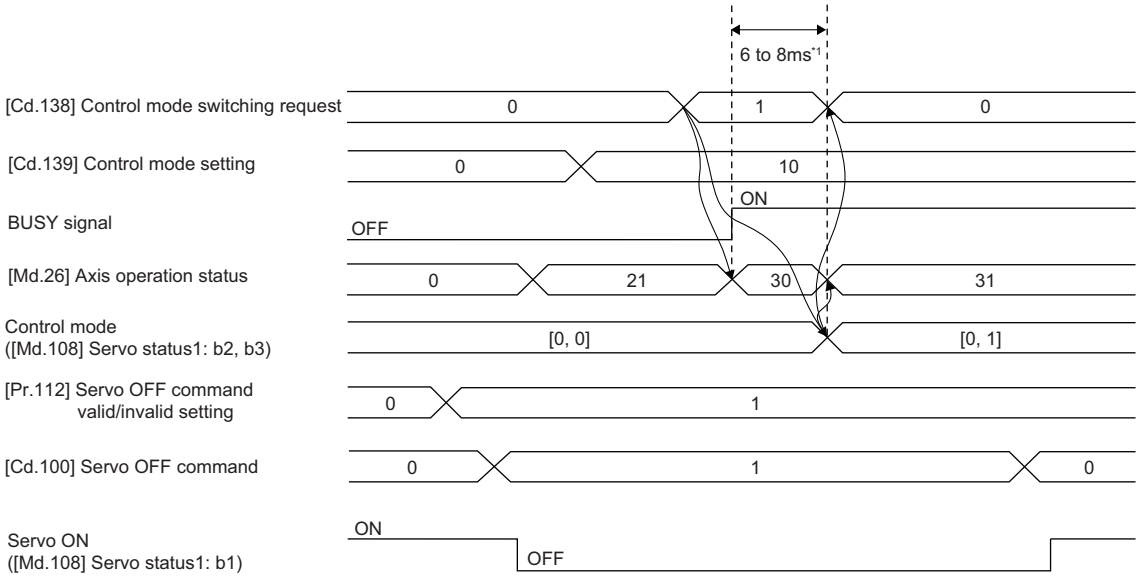
Operation timing

- The following shows the operation in the speed control mode when "1: Servo OFF command valid during speed-torque control" is set for "[Pr.112] Servo OFF command valid/invalid setting". The operation is the same in the torque control mode and continuous operation to torque control mode.



*1 The switching time depends on the servo amplifier specifications.

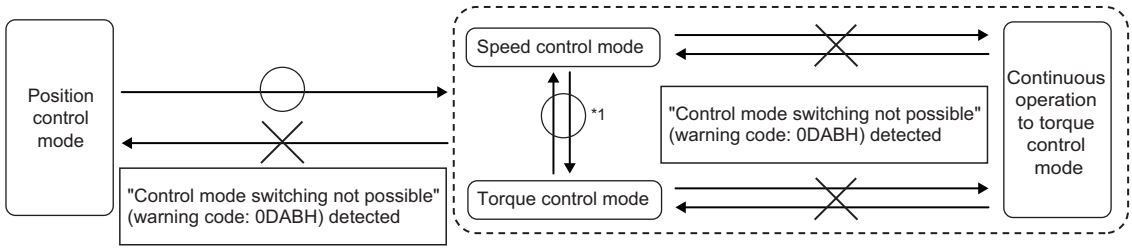
- The following shows the operation when the position control mode is switched to the speed control mode while the servo OFF command is issued. The operation is the same when the position control mode is switched to the torque control mode/ continuous operation to torque control mode.



*1 The switching time depends on the servo amplifier specifications.

Control mode switching during servo OFF

When "1: Servo OFF command valid during speed/torque control" is set for "[Pr.112] Servo OFF command valid/invalid setting", the position control mode can be switched to the speed control mode, torque control mode, continuous operation to torque control mode, and the speed control mode ⇔ torque control mode switching*1 can be performed during servo OFF. The control mode cannot be switched in the continuous operation to torque control mode.



*1 The operation differs depending on the Add-on SimpleMotion version.

Add-on SimpleMotion version	Operation
"Ver.1.29" or later	The speed control mode ⇔ torque control mode switching during servo OFF is possible.
"Ver.1.27" or earlier	For the speed control mode ⇔ torque control mode switching during servo OFF, "Control mode switching not possible" (warning code: 0DABH) is detected.

Precautions during control

- In the speed-torque control, the mode cannot be switched to the continuous operation to torque control mode or position control mode during servo OFF. When "1: Switching request" is set for "[Cd.138] Control mode switching request" during servo OFF, "Control mode switching not possible" (warning code: 0DABH) is detected. However, when the following conditions are satisfied, the speed control mode can be switched to the continuous operation to torque control mode during servo OFF.

  - "[Md.26] Axis operation status" is standby or stopped.
  - "[Cd.180] Axis stop" is OFF.
  - No error has occurred.

- In the continuous operation to torque control mode, the control mode cannot be switched during servo OFF. When "1: Switching request" is set for "[Cd.138] Control mode switching request" during servo OFF, "Control mode switching not possible" (warning code: 0DABH) is detected. However, when the following conditions are satisfied, the continuous operation to torque control mode can be switched to the position control mode.

  - The current mode is the continuous operation to torque control mode and the previous control mode is the position control mode.
  - Zero speed ([Md.119] Servo status2: b3) is OFF.
  - The servo amplifier is being connected.
  - There is no immediate stop cause.
  - When "Condition selection at mode switching (b12 to b15)" of "[Pr.90] Operation setting for speed-torque control mode" is set to "1: According to the servo amplifier specification" and "ZSP disabled selection at control switching" of the MR-J5-G servo parameter "Function selection C-E (PC76)" is set to "1: Disabled"

- Only when "[Md.26] Axis operation status" is set to "30: Control mode switching" or "[Md.124] Control mode switching status" is set to "0: Not during control mode switching", the servo OFF command is accepted. Request the servo OFF command after the control mode switching is completed.
- When "[Pr.112] Servo OFF command valid/invalid setting" is set to a value other than "0: Servo OFF command invalid" or "1: Servo OFF command valid during speed-torque control", the operation will be processed as "0: Servo OFF command invalid".
- Immediate stop or others cannot be accepted after the servo OFF. However, if the stop cause that has occurred involves switching to the position control mode, the control mode switches to the position control mode.
- If a servo OFF stop is executed in the speed control mode, torque control mode, and continuous operation to torque control mode, the operation in each control mode is resumed when the stop cause is eliminated.
- When "[Pr.112] Servo OFF command valid/invalid setting" is set to "1: Servo OFF command valid during speed-torque control" and servo OFF is executed by "[Cd.100] Servo OFF command", it is not braked by the dynamic brake. For safe use, execute "[Cd.100] Servo OFF command" in a situation where there is no problem even if the servo motor is not braked by the dynamic brake.

7.2 Advanced synchronous control

"Advanced synchronous control" can be achieved using software instead of controlling mechanically with gear, shaft, speed change gear or cam, etc.
"Advanced synchronous control" synchronizes movement with the input axis (servo input axis, command generation axis, or synchronous encoder axis), by setting "advanced synchronous control parameters" and starting synchronous control on each output axis.
Refer to the following for details of advanced synchronous control.
📖MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

8 CONTROL SUB FUNCTIONS

The details and usage of the "sub functions" added and used in combination with the main functions are explained in this chapter.
A variety of sub functions are available, including functions specifically for machine home position return and generally related functions such as control compensation, etc. More appropriate, finer control can be carried out by using these sub functions. Each sub function is used together with a main function by creating matching parameter settings and programs. Read the execution procedures and settings for each sub function, and set as required.

8.1 Outline of Sub Functions

"Sub functions" are functions that compensate, limit, add functions, etc., to the control when the main functions are executed. These sub functions are executed by parameter settings, operation from the engineering tool, sub function programs, etc.

Outline of sub functions

The following table shows the types of sub functions available.

Sub function		Details
Functions that compensate control	Backlash compensation function	This function compensates the mechanical backlash. Feed command equivalent to the set backlash amount are output each time the movement direction changes.
	Electronic gear function	By setting the movement amount per pulse, this function can freely change the machine movement amount per commanded pulse. When the movement amount per pulse is set, a flexible positioning system that matches the machine system can be structured.
	Near pass function[*1]	This function suppresses the machine vibration when the speed is changed during continuous path control in the interpolation control.
Functions that limit control	Speed limit function	If the command speed exceeds "[Pr.8] Speed limit value" during control, this function limits the commanded speed to within "[Pr.8] Speed limit value" setting range.
	Torque limit function	If the torque generated by the servo motor exceeds "[Pr.17] Torque limit setting value" during control, this function limits the generated torque to within "[Pr.17] Torque limit setting value" setting range.
	Software stroke limit function	If a command outside of the upper/lower limit stroke limit setting range, set in the parameters, is issued, this function will not execute positioning for that command.
	Hardware stroke limit function	This function carries out deceleration stop with the hardware stroke limit switch.
	Forced stop function	This function stops all axes of the servo amplifier with the forced stop signal.
Functions that change control details	Speed change function	This function changes the speed during positioning. Set the changed speed in the speed change buffer memory ([Cd.14] New speed value), and change the speed with the speed change request ([Cd.15] Speed change request).
	Override function	This function changes the speed within a percentage of 0 to 300% during positioning. This is executed using "[Cd.13] Positioning operation speed override".
	Acceleration/deceleration time change function	This function changes the acceleration/deceleration time during speed change.
	Torque change function	This function changes the "torque limit value" during control.
	Target position change function	This function changes the target position during the execution of positioning. At the same time, this also can change the speed.
Functions related to positioning start	Pre-reading start function	This function shortens the virtual start time.
Absolute position system function		This function restores the absolute position of designated axis.
Functions related to positioning stop	Stop command processing for deceleration stop function	This function selects a deceleration curve when a stop cause occurs during deceleration stop processing to speed 0.
	Continuous operation interrupt function	This function interrupts continuous operation. When this request is accepted, the operation stops when the execution of the current positioning data is completed.
	Step function	This function temporarily stops the operation to confirm the positioning operation during debugging, etc. The operation can be stopped at each "automatic deceleration" or "positioning data".

Sub function		Details
Other functions	Skip function	This function stops the positioning being executed (decelerates to a stop) when the skip signal is input, and carries out the next positioning.
	M code output function	This function issues a command for a sub work (clamp or drill stop, tool change, etc.) according to the code No. (0 to 65535) that can be set for each positioning data. The M code output timing can be set for each positioning data.
	Teaching function	This function stores the address positioned with manual control into the positioning address ([Da.6] Positioning address/movement amount) having the designated positioning data No.
	Command in-position function	This function calculates the remaining distance for the Motion module to reach the positioning stop position, and when the value is less than the set value, sets the "command in-position flag" to 1. When using another sub work before ending the control, use this function as a trigger for the sub work.
	Acceleration/deceleration processing function	This function adjusts the control acceleration/deceleration.
	Deceleration start flag function	This function turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control, whose operation pattern is "Positioning complete", to make the stop timing known.
	Speed control 10 × multiplier setting for degree axis function	This function executes the positioning control by the 10 × speed of the command speed and the speed limit value when the setting unit is "degree".
	Operation setting for incompletion of home position return function	This function is provided to select whether positioning control is operated or not when the home position return request flag is ON.
Servo ON/OFF	Servo ON/OFF	This function executes servo ON/OFF of the servo amplifiers connected to the Motion module.
	Follow-up function	This function monitors the motor rotation amount with the servo turned OFF, and reflects it on the command position value.

*1 The near pass function is featured as standard and is valid only for setting continuous path control for position control. It cannot be set to be invalid with parameters.

8.2 Functions for Compensating the Control

The sub functions for compensating the control include the "backlash compensation function", "electronic gear function", and "near pass function". Each function is executed by parameter setting or program creation and writing.

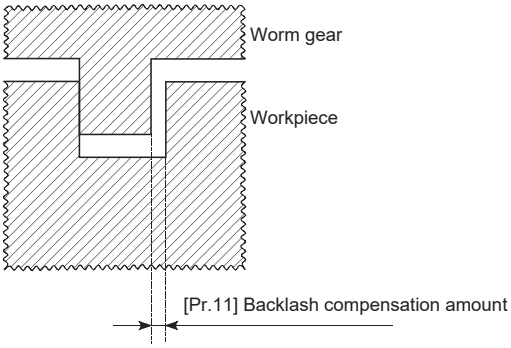
Backlash compensation function

The "backlash compensation function" compensates the backlash amount in the mechanical system.

Control details

When the backlash compensation amount is set, an extra amount of command equivalent to the set backlash amount is output every time the movement direction changes.

The following drawing shows the operation of the backlash compensation function.



Precautions during control

- The feed command of the backlash compensation amount are not added to "[Md.20] Command position value" or "[Md.21] Machine feed value".
- Always carry out a machine home position return before starting the control when using the backlash compensation function (when "[Pr.11] Backlash compensation amount" is set). The backlash in the mechanical system cannot be correctly compensated if a machine home position return is not carried out.
- Backlash compensation, which includes the movement amount and "[Pr.11] Backlash compensation amount", is output the moment at the moving direction changes.
  For details on the setting, refer to the following.
  ☞ Page 461 [Pr.11] Backlash compensation amount
- Backlash compensation cannot be made in the speed control mode, torque control mode, or continuous operation to torque control mode.
- In an axis operation such as positioning after home position return, whether the backlash compensation is necessary or not is judged from "[Pr.44] Home position return direction" of the Motion module. When the positioning is executed in the same direction as "[Pr.44] Home position return direction", the backlash compensation is not executed. However, when the positioning is executed in the reverse direction against "[Pr.44] Home position return direction", the backlash compensation is executed.

Setting method

To use the "backlash compensation function", set the "backlash compensation amount" in the parameter shown in the following table, and write it to the Motion module.

The set data is made valid on the rising edge (OFF to ON) of PLC READY [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.11]	Backlash compensation amount	→	Set the backlash compensation amount.	0
[Pr.44]	Home position return direction	→	Set the same direction as the last home position return direction of the servo amplifier when using the driver home position return method.	0

Refer to the following for the setting details.

☞ Page 448 Basic Setting

Point

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

Electronic gear function

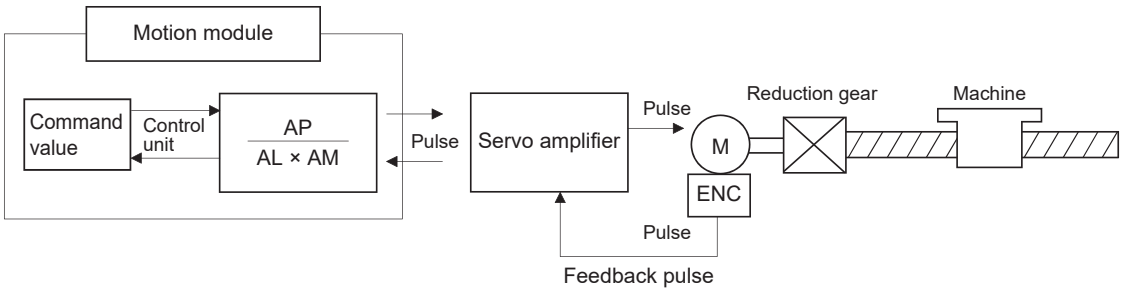
The "electronic gear function" adjusts the actual machine movement amount and number of pulse output to servo amplifier according to the parameters set in the Motion module.
The "electronic gear function" has the following three functions ([A] to [C]).
[A] During machine movement, the function increments in the Motion module values less than one pulse that could not be output, and outputs the incremented amount when the total incremented value reached one pulse or more.
[B] When machine home position return is completed, current value changing is completed, speed control is started (except when command position value is updated), or fixed-feed control is started, the function clears to "0" the cumulative values of less than one pulse which could not be output. (If the cumulative value is cleared, an error will occur by a cleared amount in the feed machine value. Control can be constantly carried out at the same machine movement amount, even when the fixed-feed control is continued.)
[C] The function compensates the mechanical system error of the command movement amount and actual movement amount by adjusting the "electronic gear". (The "movement amount per pulse" value is defined by "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)" and "[Pr.4] Unit magnification (AM)".)
The Motion module automatically carries out the processing for [A] and [B].
The "electronic gear function" in this section is different from the "electronic gear function" of the servo amplifier. For the "electronic gear function" of the servo amplifier, refer to the manual of the servo amplifier.

Precautions

Depending on the resolution of the encoder, there may be limitations in the electronic gear setting of servo amplifier. For details, refer to the following.
☞ Page 702 Devices Compatible with CC-Link IE TSN

Basic concept of the electronic gear

The electronic gear is an item which determines how many rotations (rotations by how many pulses) the motor must make in order to move the machine according to the programmed movement amount.



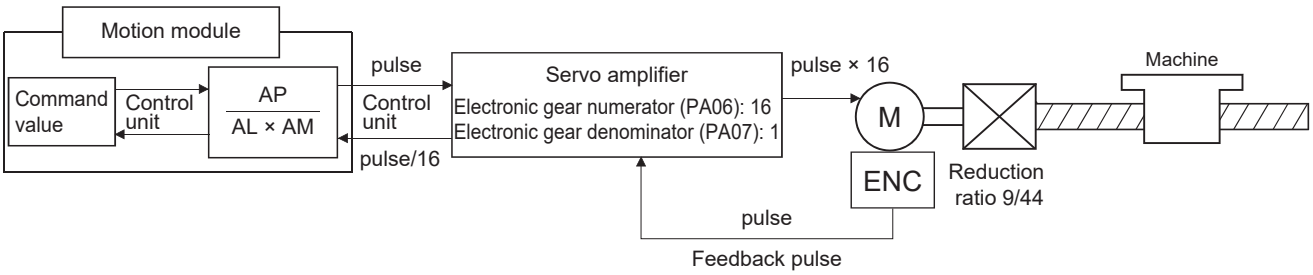
The basic concept of the electronic gear is represented by the following expression.
[Pr.2] (Number of pulses per rotation) = AP
[Pr.3] (Movement amount per rotation) = AL
[Pr.4] (Unit magnification) = AM
Movement amount per rotation that considered unit magnification = ΔS

$$\text{Electronic gear} = \frac{AP}{\Delta S} = \frac{AP}{AL \times AM} \quad \ldots (1)$$

Set values for AP, AL and AM so that this related equation is established.
However, because values to be set for AP, AL and AM have the settable range, values calculated (reduced) from the above related equation must be contained in the setting range for AP, AL and AM.

■For "Ball screw" + "Reduction gear"

When the ball screw pitch is 10mm, the motor is the HK-KT (67108864pulses/rev), and the reduction ratio is 9/44



First, find how many millimeters the load (machine) will travel (ΔS) when the motor turns one revolution (AP).

AP (Number of pulses per rotation) = 67108864 [pulse] × 1/16

= 4194304 [pulse]

ΔS (Movement amount per rotation) = Ball screw pitch × Reduction ratio

= 10 [mm] × 9/44

= 10000.0 [μm] × 9/44

When the control unit is "mm", the minimum command unit is 0.1μm.

Point

To control the motor HK-KT, set the servo parameters of MR-J5(W)-G as follows.

Electrical gear numerator (PA06): 16

Electrical gear denominator (PA07): 1

Substitute this for the above expression (1).

At this time, make calculation with the reduction ratio 9/44 remaining as a fraction.

$$\frac{AP}{\Delta S} = \frac{4194304\ [pulse]}{10000.0\ [\mu m] \times 9/44}$$

$$= \frac{4194304 \times 44}{10000.0 \times 9}$$

$$= \frac{184549376}{90000.0}$$

$$= \frac{23068672}{11250.0} = \frac{23068672\ (AP)}{11250.0\ (AL) \times 1\ (AM)}$$

$$= \frac{23068672\ (AP)}{1125.0\ (AL) \times 10\ (AM)}$$

Thus, AP, AL, and AM to be set are as follows. These two examples of settings are only examples. There are settings other than these examples.

Setting value	Setting item
AP = 23068672	[Pr.2]
AL = 11250.0	[Pr.3]
AM = 1	[Pr.4]

or

Setting value	Setting item
AP = 23068672	[Pr.2]
AL = 1125.0	[Pr.3]
AM = 10	[Pr.4]

■When "pulse" is set as the control unit

When using pulse as the control unit, set the electronic gear as follows.

AP = "Number of pulses per rotation"

AL = "Movement amount per rotation"

AM = 1

Ex.

When the motor is the HK-KT (67108864pulses/rev)

Setting value	Setting item
AP = 4194304	[Pr.2]
AL = 4194304	[Pr.3]
AM = 1	[Pr.4]

Point

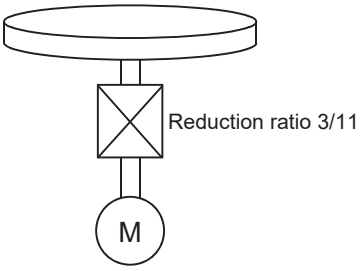
To control the motor HK-KT, set the servo parameters of MR-J5(W)-G as follows.

Electrical gear numerator (PA06): 16

Electrical gear denominator (PA07): 1

■When "degree" is set as the control unit for a rotary axis

When the rotary axis is used, the motor is HK-KT (67108864pulses/rev), and the reduction ratio is 3/11



First, find how many degrees the load (machine) will travel (ΔS) when the motor turns one revolution (AP).

AP (Number of pulses per rotation) = 67108864 [pulse] × 1/16 = 4194304 [pulse]

ΔS (Movement amount per rotation)

= 360.00000 [degree] × Reduction ratio

= 360.00000 × 3/11

Point

To control the motor HK-KT, set the servo parameters of MR-J5(W)-G as follows.

Electrical gear numerator (PA06): 16

Electrical gear denominator (PA07): 1

Substitute this for the above expression (1).

At this time, make calculation with the reduction ratio 3/11 remaining as a fraction.

$$\frac{AP}{\Delta S} = \frac{4194304\ [pulse]}{360.00000\ [degree] \times 3/11}$$

$$= \frac{4194304\ [pulse] \times 11}{360.00000\ [degree] \times 3}$$

$$= \frac{46137344}{1080.00000}$$

$$= \frac{2883584}{67.50000} = \frac{2883584\ (AP)}{67.50000\ (AL) \times 1\ (AM)}$$

$$= \frac{2883584\ (AP)}{0.06750\ (AL) \times 1000\ (AM)}$$

Thus, AP, AL, and AM to be set are as follows. These two examples of settings are only examples. There are settings other than these examples.

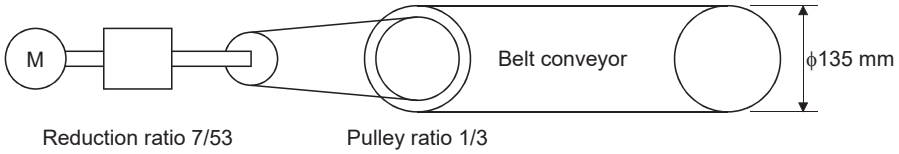
Setting value	Setting item
AP = 2883584	[Pr.2]
AL = 67.50000	[Pr.3]
AM = 1	[Pr.4]

or

Setting value	Setting item
AP = 2883584	[Pr.2]
AL = 0.06750	[Pr.3]
AM = 1000	[Pr.4]

■When "mm" is set as the control unit for conveyor drive (calculation including π)

When the belt conveyor drive is used, the conveyor diameter is 135mm, the pulley ratio is 1/3, the motor is the HK-KT (67108864pulses/rev), and the reduction ratio is 7/53



As the travel value of the conveyor is used to exercise control, set "mm" as the control unit.

First, find how many millimeters the load (machine) will travel (ΔS) when the motor turns one revolution (AP).

AP (Number of pulses per rotation) = 67108864 [pulse] × 1/16 = 4194304 [pulse]

ΔS (Movement amount per rotation)

= 135000.0 [μm] × π × Reduction ratio

= 135000.0 [μm] × π × 7/53 × 1/3

Point

To control the motor HK-KT, set the servo parameters of MR-J5(W)-G as follows.

Electrical gear numerator (PA06): 16

Electrical gear denominator (PA07): 1

Substitute this for the above expression (1).

At this time, make calculation with the reduction ratio 7/53 × 1/3 remaining as a fraction.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{4194304\ [pulse]}{135000.0\ [\mu m] \times \pi \times 7/53 \times 1/3}$$

$$= \frac{4194304 \times 53 \times 3}{135000.0 \times \pi \times 7}$$

$$= \frac{166723584}{236250 \times \pi}$$

Here, make calculation on the assumption that π is equal to 3.141592654.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{166723584}{742201.2645075}$$

AL has a significant number to first decimal place, round down numbers to two decimal places.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{166723584}{742201.2} = \frac{166723584\ (AP)}{742201.2\ (AL) \times 1\ (AM)}$$

Thus, AP, AL, and AM to be set are as follows.

Setting value	Setting item
AP = 166723584	[Pr.2]
AL = 742201.2	[Pr.3]
AM = 1	[Pr.4]

This setting will produce an error for the true machine value, but it cannot be helped.

This error is as follows.

$$\left[\frac{7422012/166723584}{2362500\pi/166723584} - 1 \right] \times 100 = -8.69 \times 10^{-6}\ [\%]$$

AP (Number of pulses per rotation) = 4194304 [pulse]

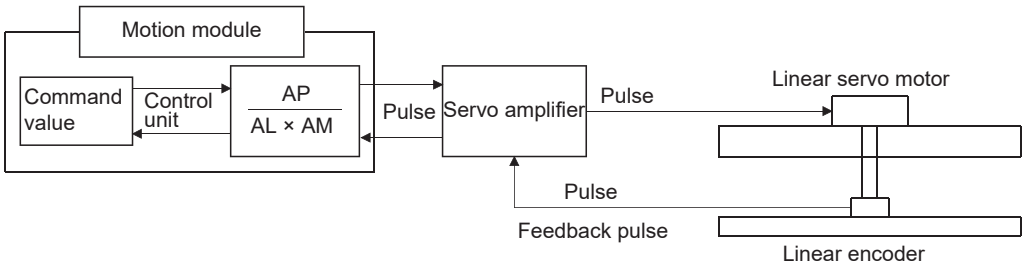
ΔS (Movement amount per rotation)

= 135000.0 [μm] × π × Reduction ratio

= 135000.0 [μm] × π × 7/53 × 1/3

It is equivalent to an about 86.9 [μm] error in continuous 1km feed.

■Number of pulses/movement amount at linear servo use



Calculate the number of pulses (AP) and movement amount (AL × AM) for the linear encoder in the following conditions.

$$\text{Linear encoder resolution} = \frac{\text{Number of pulses (AP)}}{\text{Movement amount (AL} \times \text{AM)}}$$

Ex.

Linear encoder resolution: 0.05 [μm] per pulse

$$\frac{1\ [\text{pulse}]}{0.05\ [\mu\text{m}]} = \frac{\text{Number of pulses (AP) [pulse]}}{\text{Movement amount (AL} \times \text{AM) [}\mu\text{m]}} = \frac{20}{1.0}$$

Set the number of pulses in "[Pr.2] Number of pulses per rotation (AP)", the movement amount in "[Pr.3] Movement amount per rotation (AL)", and the unit magnification in "[Pr.4] Unit magnification (AM)" in the actual setting.

Set the same value in AP, AL, and AM as the value set in the servo parameters "Electronic gear numerator (PA06)", "Electronic gear denominator (PA07)", "Linear encoder resolution - Numerator (PL02)", and "Linear encoder resolution - Denominator (PL03)". Refer to each servo amplifier instruction manual for details.

When "Linear encoder resolution - Numerator (PL02)" is set to 1 [μm], "Linear encoder resolution - Denominator (PL03)" is set to 20 [μm], "Electronic gear numerator (PA06)" is set to "1", and "Electronic gear denominator (PA07)" is set to "1", the values of AP, AL, and AM are shown below.

Setting value	Setting item
AP = 20	[Pr.2]
AL = 1.0	[Pr.3]
AM = 1	[Pr.4]

The method for compensating the error

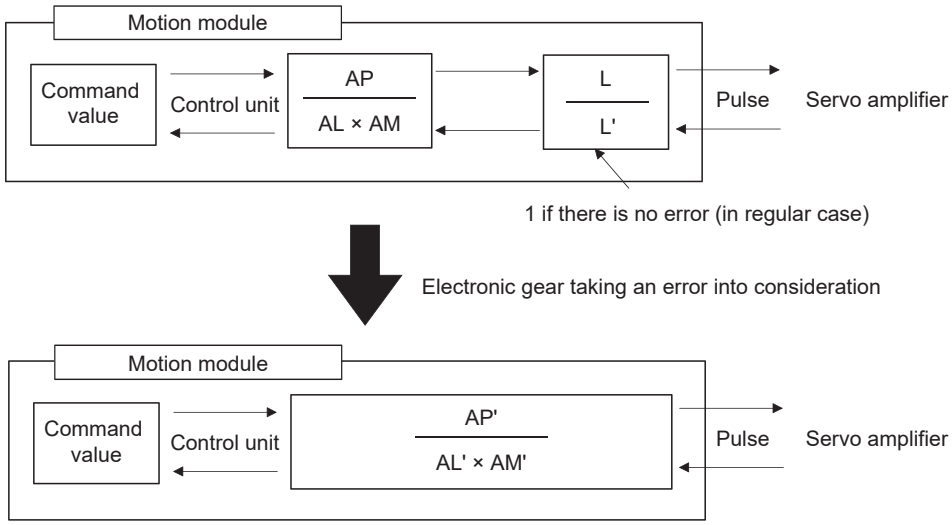
When the position control is carried out using the "Electronic gear" set in a parameter, this may produce an error between the command movement amount (L) and the actual movement amount (L'). With Motion module, this error is compensated by adjusting the electronic gear.

The "Error compensation amount", which is used for error compensation, is defined as follows:

$$\text{Error compensation amount} = \frac{\text{Command movement amount (L)}}{\text{Actual movement amount (L')}}$$

The electronic gear including an error compensation amount is shown below.

$$\frac{AP}{AL \times AM} \times \frac{L}{L'} = \frac{AP'}{AL' \times AM'}$$



■Calculation example

(Conditions)

Number of pulses per rotation (AP) : 4194304 [pulse]
Movement amount per rotation (AL) : 5000.0 [μm]
Unit magnification (AM) : 1

(Positioning results)

Command movement amount (L) : 100 [mm]
Actual movement amount (L') : 101 [mm]

[Compensation value]

$$\frac{AP}{AL \times AM} \times \frac{L}{L'} = \frac{4194304}{5000.0 \times 1} \times \frac{100}{101} = \frac{4194304\ (AP')}{5050\ (AL') \times 1\ (AM')}$$

Number of pulses per rotation (AP') : 4194304 … [Pr.2]
Movement amount per rotation (AL') : 5050.0 … [Pr.3]
Unit magnification (AM') : 1 … [Pr.4]

Set the post-compensation "[Pr.2] Number of pulses per rotation (AP')", "[Pr.3] Movement amount per rotation (AL')", and "[Pr.4] Unit magnification (AM')" in the parameters, and write them to the Motion module. The set data is made valid on the rising edge (OFF to ON) of PLC READY [Y0].

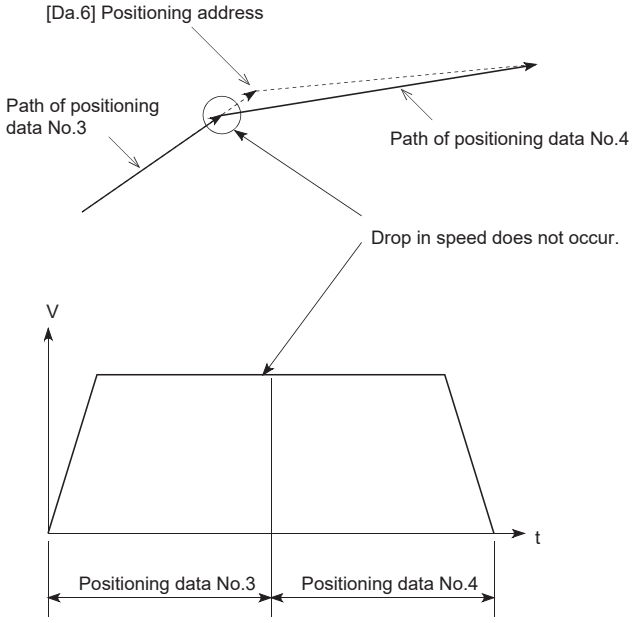
Near pass function

When continuous pass control is carried out using interpolation control, the near pass function is carried out.
The "near pass function" is a function to suppress the mechanical vibration that occurs at the time of switching the positioning data when continuous pass control is carried out by interpolation control.
[Near pass function]
The extra movement amount occurring at the end of each positioning data unit being continuously executed is carried over to the next positioning data unit. Alignment is not carried out, and thus the output speed drops are eliminated, and the mechanical vibration occurring during speed changes can be suppressed.
Because alignment is not carried out, the operation is controlled on a path that passes near the position set in "[Da.6] Positioning address/movement amount".

Control details

The following drawing shows the path of the continuous path control by the 2-axis linear interpolation control.

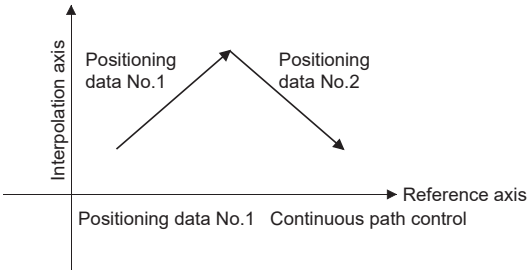
■The path of the near pass



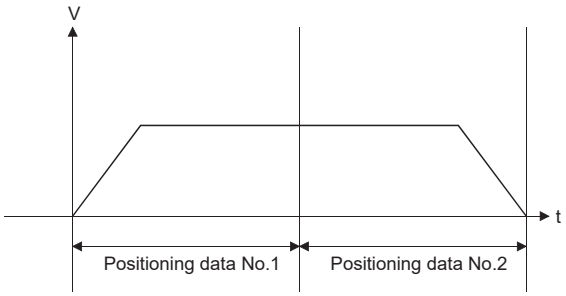
Precautions during control

- If the movement amount designated by the positioning data is small when the continuous path control is executed, the output speed may not reach the designated speed.
- The movement direction is not checked during interpolation operation. Therefore, a deceleration stops are not carried out even if the movement direction changes. (See below) For this reason, the output will rapidly reverse when the reference axis movement direction changes. To prevent the rapid output reversal, assign not the continuous path control "11", but the continuous positioning control "01" to the positioning data of the passing point.

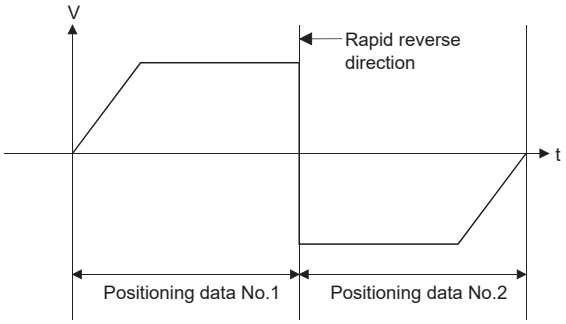
■Positioning by interpolation



■Operation of reference axis



■Operation of partner axis for interpolation



8.3 Functions to Limit the Control

Functions to limit the control include the "speed limit function", "torque limit function", "software stroke limit function", "hardware stroke limit function", and "forced stop function". Each function is executed by parameter setting or program creation and writing.

Speed limit function

The speed limit function limits the command speed to a value within the "speed limit value" setting range when the command speed during control exceeds the "speed limit value".

Relation between the speed limit function and various controls

The following table shows the relation of the "speed limit function" and various controls.

◎: Always set

—: Setting not required (Use the initial value or a value within the setting range.)

Control type			Speed limit function	Speed limit value
Home position return control	Machine home position return control		◎	[Pr.8] Speed limit value The speed limit value follows the specifications of the servo amplifier when using the driver home position return method.
	Fast home position return control		◎	[Pr.8] Speed limit value
Major positioning control	Position control	1-axis linear control	◎	
		2 to 4-axis linear interpolation control	◎	
		1-axis fixed-feed control	◎	
		2 to 4-axis fixed-feed control (interpolation)	◎	
		2-axis circular interpolation control	◎	
		3-axis helical interpolation control	◎	
	1 to 4-axis speed control		◎	
	Speed-position switching control, Position-speed switching control		◎	
	Other control	Current value changing	—	Setting value invalid
		JUMP instruction, NOP instruction, LOOP to LEND	—	
Manual control	JOG operation, Inching operation		◎	[Pr.31] JOG speed limit value
	Manual pulse generator operation		—	Setting is invalid
Expansion control	Speed-torque control		◎	[Pr.8] Speed limit value

Precautions during control

- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis speed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated are suppressed by the command speed ratio.
- If the reference axis exceeds "[Pr.8] Speed limit value" during 2-axis circular interpolation control, the reference axis is controlled with the speed limit value. (The speed limit does not function on the interpolation axis side.)
- If any axis exceeds "[Pr.8] Speed limit value" during 2- to 4-axis linear interpolation control or 2- to 4-axis fixed-feed control, the axis exceeding the speed limit value is controlled with the speed limit value. The speeds of the other axes being interpolated are suppressed by the movement amount ratio.
- In the 3-axis helical interpolation control, the composite speed of the circular interpolation axis or the speed of the linear interpolation axis is controlled not to exceed "[Pr.8] Speed limit value". (However, when the movement amount of the linear interpolation axis is more than the composite movement amount of the circular interpolation axis, such as when the number of pitches ("[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches") set in the linear interpolation axis is less, the speed of the linear interpolation axis cannot be suppressed with "[Pr.8] Speed limit value".)

Point

When the "reference axis speed" is set during interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed "[Pr.8] Speed limit value".

Setting method

To use the "speed limit function", set the "speed limit value" in the parameters shown in the following table, and write them to the Motion module.

The set details are validated at the next start after they are written to the Motion module.

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.8]	Speed limit value	→	Set the speed limit value (max. speed during control).	200000
[Pr.31]	JOG speed limit value	→	Set the speed limit value during JOG operation (max. speed during control). (Note that "[Pr.31] JOG speed limit value" shall be less than or equal to "[Pr.8] Speed limit value".)	20000

Refer to the following for the setting details.

☞ Page 448 Basic Setting

Point

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

Torque limit function

The "torque limit function" limits the generated torque to a value within the "torque limit value" setting range when the torque generated in the servo motor exceeds the "torque limit value".
The "torque limit function" protects the deceleration function, limits the power of the operation pressing against the stopper, etc. It controls the operation so that unnecessary force is not applied to the load and machine.

Relation between the torque limit function and various controls

The following table shows the relation of the "torque limit function" and various controls.
○: Set when required (Set to "—" when not used.)
—: Setting not required (Use the initial value or a value within the setting range.)

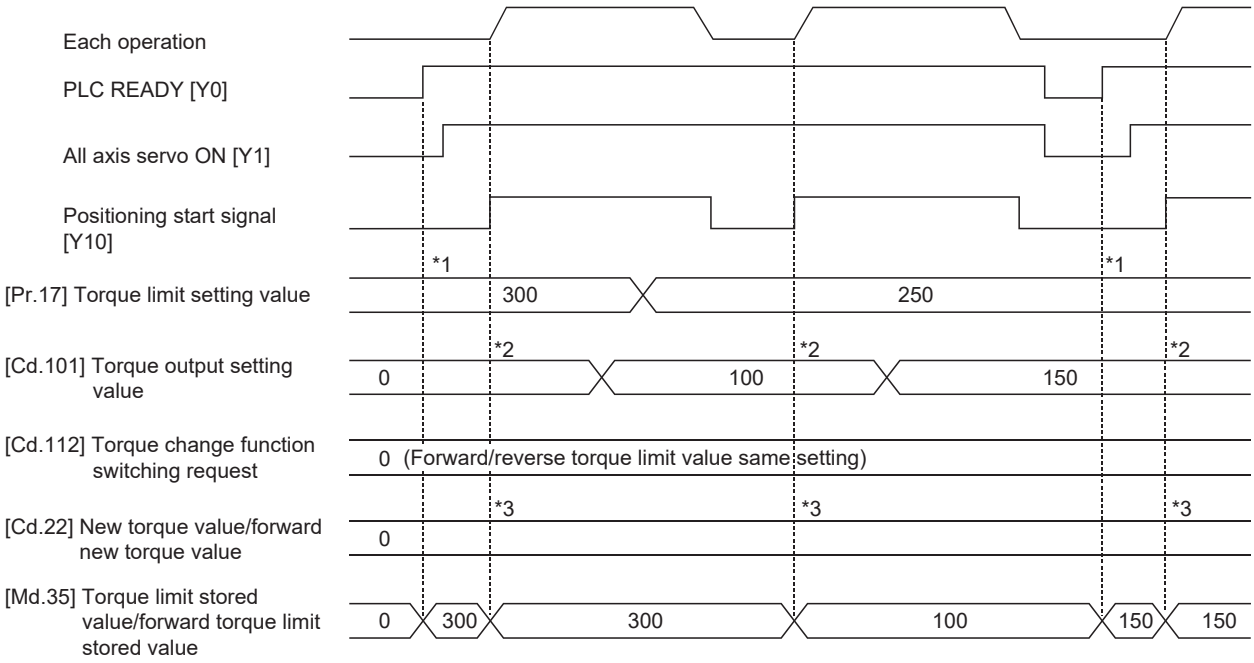
Control type			Torque limit function	Torque limit value*1
Home position return control	Machine home position return control		○	"[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value".*2 The home position return method that can change the torque limit value during the home position return is set in home position return parameters of the servo amplifier.*3
	Fast home position return control		○	"[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value".
Major positioning control	Position control	1-axis linear control	○	
		2 to 4-axis linear interpolation control	○	
		1-axis fixed-feed control	○	
		2 to 4-axis fixed-feed control (interpolation)	○	
		2-axis circular interpolation control	○	
		3-axis helical interpolation control	○	
	1 to 4-axis speed control		○	
	Speed-position switching control, Position-speed switching control		○	
	Other control	Current value changing	—	Setting value is invalid.
		JUMP instruction, NOP instruction, LOOP to LEND	—	
Manual control	JOG operation, Inching operation		○	"[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value".
	Manual pulse generator operation		○	
Expansion control	Speed-torque control		○	Torque limit value is continued after control mode switching.

*1 Shows the torque limit value when "[Cd.22] New torque value/forward new torque value" or "[Cd.113] Reverse new torque value" is set to "0".
*2 Valid for the value set at start only. It cannot be changed during the home position return.
*3 For the setting method, refer to the servo amplifier manuals.
For MR-J5(W)-G: MR-J5-G/MR-J5W-G User's Manual (Parameters)

Control details

The following drawing shows the operation of the torque limit function.

■Operation example



*1 The torque limit setting value or torque output setting value becomes effective at PLC READY [Y0] rising edge. (however, after the servo is turned ON.)
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*2 The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge.
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*3 The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.

Precautions during control

- When limiting the torque at "[Pr.17] Torque limit setting value", confirm that "[Cd.22] New torque value/forward new torque value" or "[Cd.113] New reverse torque value" is set to "0". If this parameter is set to a value besides "0", the setting value will be validated, and the torque will be limited at that value. (Refer to ☞ Page 266 Torque change function for details about the "new torque value".)
- When the operation is stopped by torque limiting, the droop pulse will remain in the deviation counter. If the load torque is eliminated, operation for the amount of droop pulses will be carried out. Note that the movement might start rapidly as soon as the load torque is eliminated.

Setting method

• To use the "torque limit function", set the "torque limit value" in the parameters shown in the following table, and write them to the Motion module.

The set data is made valid on the rising edge (OFF to ON) of PLC READY [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.17]	Torque limit setting value	→	Set the torque limit value*1 in 0.1% unit.	3000

The set details are validated at the rising edge (OFF → ON) of the positioning start signal [Y10].

Setting item		Setting value	Setting details	Factory-set initial value
[Cd.101]	Torque output setting value*2	→	Set the torque output value in 0.1% unit.	0

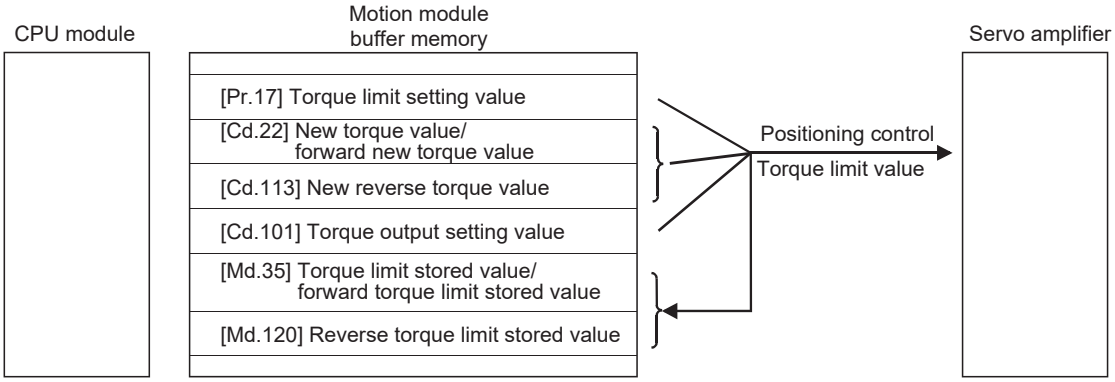
*1 Torque limit value: Will be an upper limit value of the torque change value. If a larger value has been mistakenly input for the torque change value, it is restricted within the torque limit setting values to prevent an erroneous entry. (Even if a value larger than the torque limit setting value has been input to the torque change value, the torque value is not changed.)

*2 Torque output setting value: Taken at the positioning start and used as a torque limit value. If the value is "0" or the torque limit setting value or larger, the parameter "torque limit setting value" is taken at the start.

Refer to the following for the setting details.

☞ Page 448 Basic Setting, ☞ Page 550 Control Data

• The "torque limit value" set in the Motion module is set in "[Md.35] Torque limit stored value/forward torque limit stored value" or "[Md.120] Reverse torque limit stored value".



• The following table shows the storage details of "[Md.35] Torque limit stored value/forward torque limit stored value" and "[Md.120] Reverse torque limit stored value".

n: Axis No. - 1

Monitor item		Monitor value	Storage details	Buffer memory address
				Axis 1 to axis 16
[Md.35]	Torque limit stored value/forward torque limit stored value	→	The "torque limit value/forward torque limit stored value" valid at that time is stored. ([Pr.17], [Cd.101], or [Cd.22])	2426+100n
[Md.120]	Reverse torque limit stored value	→	The "reverse torque limit stored value" is stored depending on the control status. ([Pr.17], [Cd.101], [Cd.22], or [Cd.113])	2491+100n

Refer to the following for information on the storage details.

☞ Page 515 Monitor Data

Point

• Parameters are set for each axis.

• It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

• Use "[Md.120] Reverse torque limit stored value" and "[Cd.113] New reverse torque value" only when "1: Forward/reverse torque limit value individual setting" is set in "[Cd.112] Torque change function switching request". (☞ Page 266 Torque change function)

Software stroke limit function

In the "software stroke limit function" the address established by a machine home position return is used to set the upper and lower limits of the moveable range of the workpiece. Movement commands issued to addresses outside that setting range will not be executed.

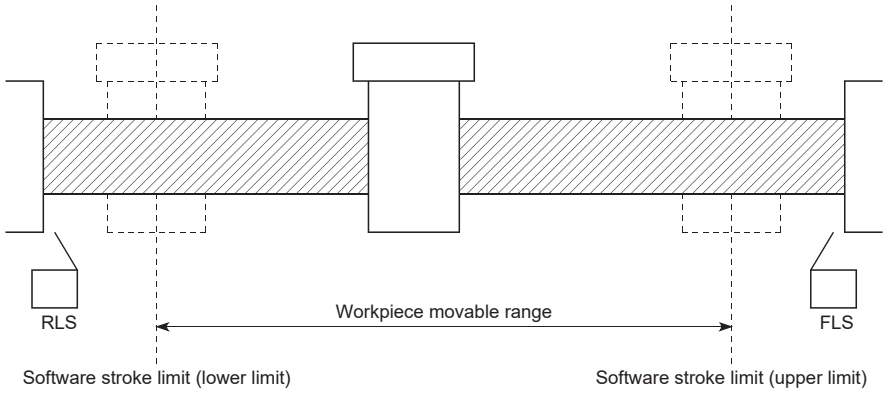
In the Motion module, the "command position value" and "machine feed value" are used as the addresses indicating the current position. However, in the "software stroke limit function", the address used to carry out the limit check is designated in "[Pr.14] Software stroke limit selection". Refer to the following for details on the "command position value" and "machine feed value".

☞ Page 54 Confirming the current value

The upper and lower limits of the moveable range of the workpiece are set in "[Pr.12] Software stroke limit upper limit value"/ "[Pr.13] Software stroke limit lower limit value".

Differences in the moveable range

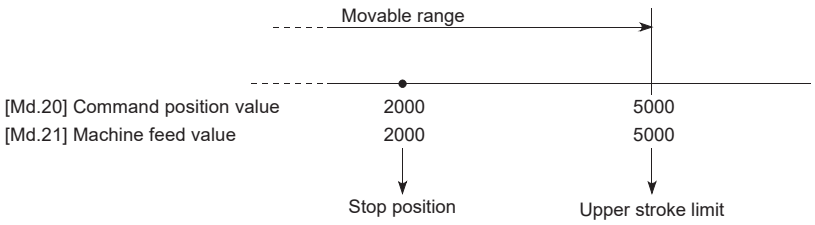
The following drawing shows the moveable range of the workpiece when the software stroke limit function is used.



The following drawing shows the differences in the operation when "[Md.20] Command position value" and "[Md.21] Machine feed value" are used in the moveable range limit check.

■Conditions

Assume the current stop position is 2000, and the upper stroke limit is set to 5000.

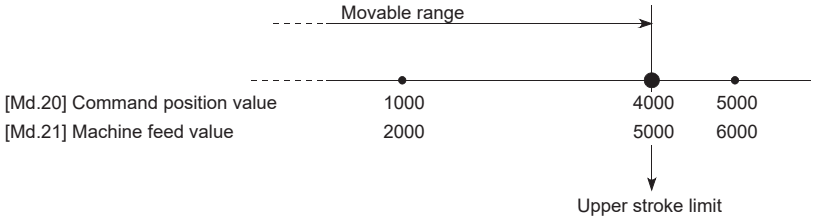


■Current value changing

When the current value is changed by a new current value command from 2000 to 1000, the command position value will change to 1000, but the machine feed value will stay the same at 2000.

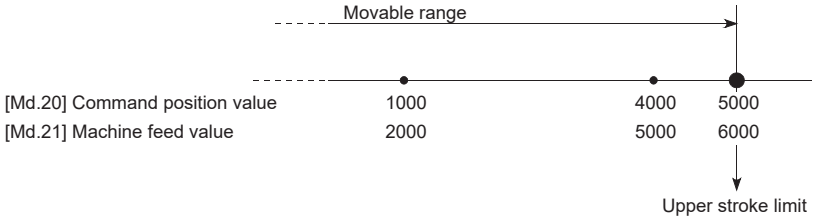
• When the machine feed value is set at the limit

The machine feed value of 5000 (command position value: 4000) becomes the upper stroke limit.



• When the command position value is set at the limit

The command position value of 5000 (machine feed value: 6000) becomes the upper stroke limit.



Point

When "machine feed value" is set in "[Pr.14] Software stroke limit selection", the moveable range becomes an absolute range referenced on the home position. When "command position value" is set, the moveable range is the relative range from the "command position value".

Software stroke limit check details

Check details		Processing when an error occurs
(1)	An error shall occur if the current value*1 is outside the software stroke limit range*2. (Check "[Md.20] Command position value" or "[Md.21] Machine feed value".)	"Software stroke limit +" (error code: 1A93H, 1B18H) or "Software stroke limit -" (error code: 1A95H, 1B1AH) will occur.
(2)	An error shall occur if the command address is outside the software stroke limit range. (Check "[Da.6] Positioning address/movement amount".)	

*1 Check whether "[Md.20] Command position value" or "[Md.21] Machine feed value" is set in "[Pr.14] Software stroke limit selection".

*2 Moveable range from "[Pr.12] Software stroke limit upper limit value" to "[Pr.13] Software stroke limit lower limit value".

Relation between the software stroke limit function and various controls

◎: Check valid

○: Check is not made when the command position value is not updated (☞ Page 466 Basic Setting) at the setting of "command position value" in "[Pr.14] Software stroke limit selection" during speed control.

—: Check not carried out (check invalid).

△: Valid only when "0: valid" is set in "[Pr.15] Software stroke limit valid/invalid setting".

Control type			Limit check	Processing at check
Home position return control	Machine home position return control	Data set method	◎	The home position return control will not be performed if the home position address is outside the software stroke limit range.
		Other than "Data set method"	—	Check not carried out.
	Fast home position return control		—	
Major positioning control	Position control	1-axis linear control	◎	Checks 1) and 2) in ☞ Page 245 Software stroke limit check details are carried out. For speed control: The axis decelerates to a stop when it exceeds the software stroke limit range. For position control: The axis comes to an immediate stop when it exceeds the software stroke limit range.
		2 to 4-axis linear interpolation control	◎	
		1-axis fixed-feed control	◎	
		2 to 4-axis fixed-feed control (interpolation)	◎	
		2-axis circular interpolation control	◎	
		3-axis helical interpolation control	◎	
	1 to 4-axis speed control		○*1*2	
	Speed-position switching control, Position-speed switching control		○*1*2	
	Other control	Current value changing	◎	The current value will not be changed if the new position value is outside the software stroke limit range.
		JUMP instruction, NOP instruction, LOOP to LEND	—	Check not carried out.
Manual control	JOG operation, Inching operation		△*3	Check 1) in ☞ Page 245 Software stroke limit check details is carried out. The machine will carry out a deceleration stop when the software stroke limit range is exceeded. If the address is outside the software stroke limit range, the operation can only be started toward the moveable range.
	Manual pulse generator operation		△*3	
Expansion control	Speed-torque control		◎	Check 1) in ☞ Page 245 Software stroke limit check details is carried out. The mode switches to the position control mode when the software stroke limit range is exceeded, and the operation immediately stops.

*1 The value in "[Md.20] Command position value" will differ according to "[Pr.21] Command position value during speed control" setting.

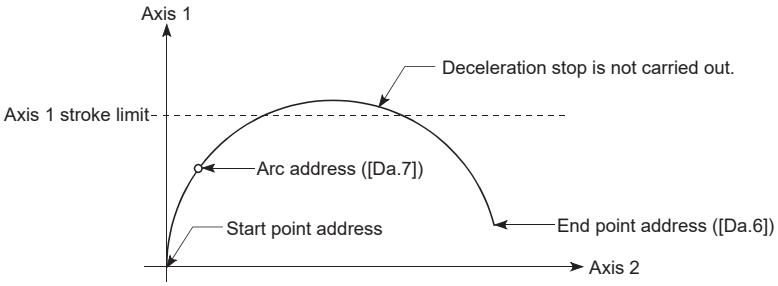
*2 When the unit is "degree", check is not made during speed control.

*3 When the unit is "degree", check is not carried out.

Precautions during software stroke limit check

- A machine home position return must be executed beforehand for the "software stroke limit function" to function properly.
- During interpolation control, a stroke limit check is carried out for the every current value of both the reference axis and the interpolation axis. Every axis will not start if an error occurs, even if it only occurs in one axis.
- During 2-axis circular interpolation control and 3-axis helical interpolation control (reference axis and interpolation axis), "[Pr.12] Software stroke limit upper limit value"/"[Pr.13] Software stroke limit lower limit value" may be exceeded. In this case, a deceleration stop will not be carried out even if the stroke limit is exceeded. Always install an external limit switch if there is a possibility the stroke limit will be exceeded.

Ex.



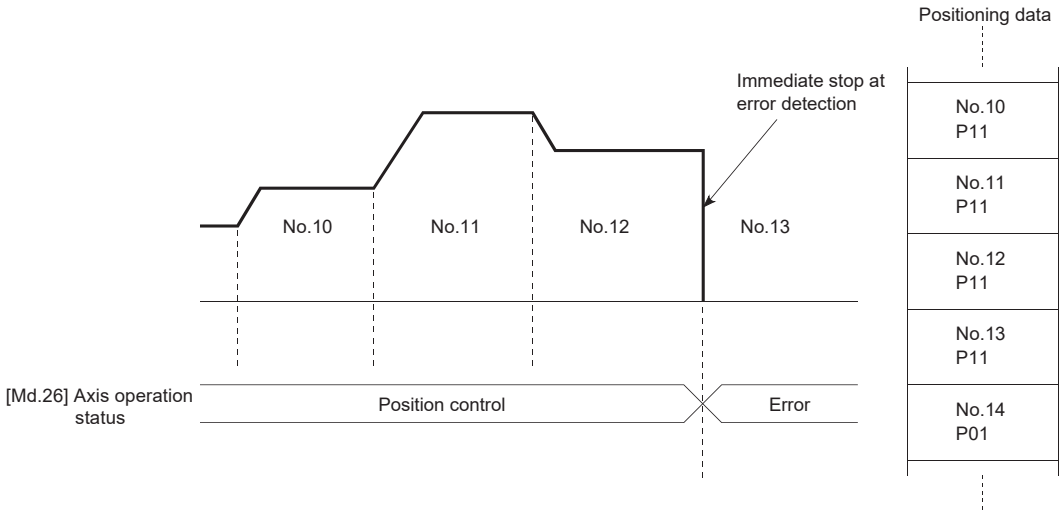
Point

The software stroke limit check is carried out for the following addresses during 2-axis circular interpolation control.
(Note that "[Da.7] Arc address" is carried out only for 2-axis circular interpolation control with sub point designation.)
Current value/end point address ([Da.6])/arc address ([Da.7])

- If an error is detected during continuous path control, the axis stops immediately on completion of execution of the positioning data located right before the positioning data in error.

Ex.

If the positioning address of positioning data No.13 is outside the software stroke limit range, the operation immediately stops after positioning data No.12 has been executed.



- During simultaneous start, a stroke limit check is carried out for the current values of every axis to be started. Every axis will not start if an error occurs, even if it only occurs in one axis.

Setting method

To use the "software stroke limit function", set the required values in the parameters shown in the following table, and write them to the Motion module.

The set data is made valid on the rising edge (OFF to ON) of PLC READY [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.12]	Software stroke limit upper limit value	→	Set the upper limit value of the moveable range.	2147483647
[Pr.13]	Software stroke limit lower limit value	→	Set the lower limit value of the moveable range.	-2147483648
[Pr.14]	Software stroke limit selection	→	Set whether to use "[Md.20] Command position value" or "[Md.21] Machine feed value" as the "current value".	0: Command position value
[Pr.15]	Software stroke limit valid/invalid setting	0: Valid	Set whether the software stroke limit is validated or invalidated during manual control (JOG operation, Inching operation, manual pulse generator operation).	0: Valid

Refer to the following for the setting details.

☞ Page 448 Basic Setting

Invalidating the software stroke limit

To invalidate the software stroke limit, set "[Pr.12] Software stroke limit upper limit value" and "[Pr.13] Software stroke limit lower limit value" to the same value, and write them to the Motion module. (Set the value within the setting range.)

(To invalidate only the manual operation, set "1: software stroke limit invalid" in "[Pr.15] Software stroke limit valid/invalid setting".)

The set data is made valid on the rising edge (OFF to ON) of PLC READY [Y0].

When the unit is "degree", the software stroke limit check is not performed during speed control (including speed control in speed-position switching control or position-speed switching control) or during manual control, independently of the values set in [Pr.12], [Pr.13] and [Pr.15].

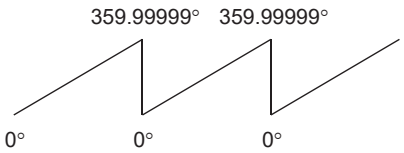
Point

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

Setting when the control unit is "degree"

■Current value address

"[Md.20] Command position value" address is a ring address between 0 and 359.99999°.

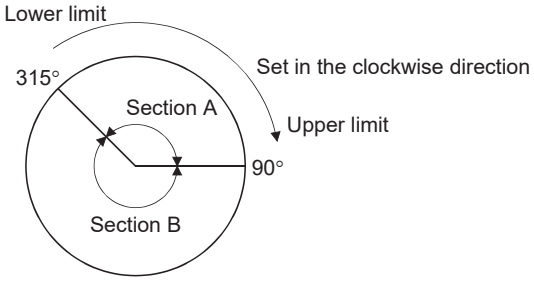


■Setting the software stroke limit

The upper limit value/lower limit value of the software stroke limit is a value between 0 and 359.99999°.

- Setting when the software stroke limit is to be validated.

When the software stroke limit is to be validated, set the upper limit value in a clockwise direction from the lower limit value.



Set as follows to set the movement range of section A or B in the above figure.

Section set as movement range	Software stroke limit lower limit value	Software stroke limit upper limit value
Section A	315.00000°	90.00000°
Section B	90.00000°	315.00000°

Hardware stroke limit function

⚠ WARNING

• When the hardware stroke limit is required to be wired, ensure to wire it in the negative logic using b-contact. If it is set in positive logic using a-contact, a serious accident may occur.

In the "hardware stroke limit function", limit switches are set at the upper/lower limit of the physical moveable range, and the control is stopped (by deceleration stop) by the input of a signal from the limit switch.

Damage to the machine can be prevented by stopping the control before the upper/lower limit of the physical moveable range is reached.

The hardware stroke limit is able to use the following signals. (☞ Page 467 [Pr.116] to [Pr.119] FLS/RLS/DOG/STOP signal selection)

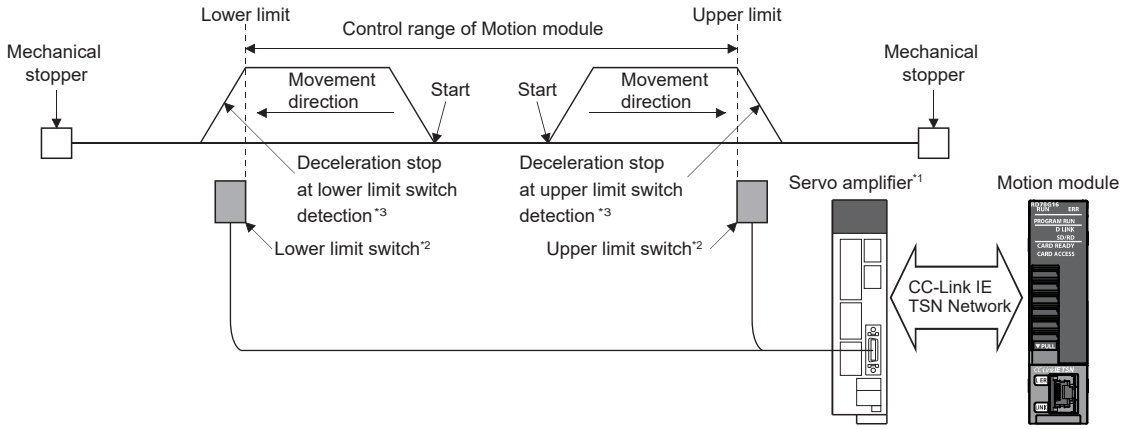
- External input signal of servo amplifier
- External input signal via CPU (buffer memory of the Motion module)
- Input signal on the CC-Link IE TSN network (link device)

Control details

The following drawing shows the operation of the hardware stroke limit function.

■External input signal of servo amplifier

For the operation when the servo amplifier stroke limit is detected, confirm the specifications of the servo amplifier to be used. The following shows the case of MR-J5(W)-G use.



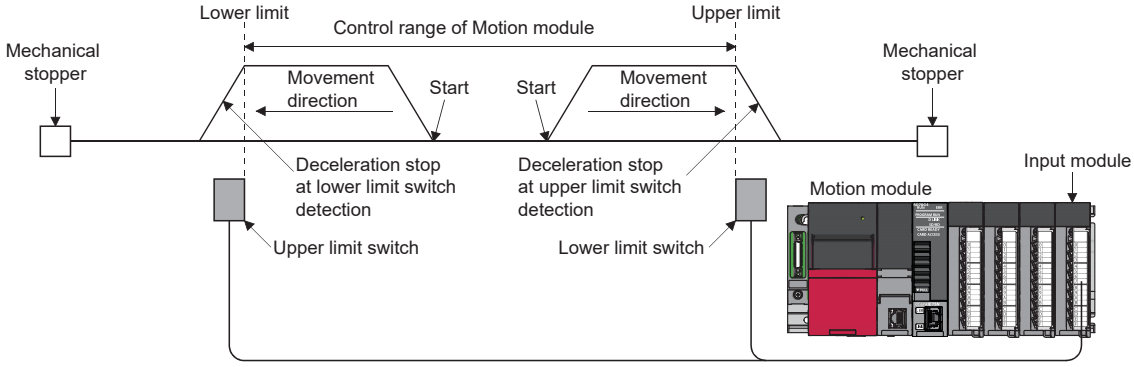
*1 Set the following servo parameters properly.
- Set "1: Input from controller" in the servo parameter "Function selection D-4 "sensor input method selection (PD41.3)". If not, "Servo parameter invalid" (error code: 1DC8H) occurs, and the controller rewrites "Function selection D-4 "sensor input method selection (PD41.3)" to "1: Input from controller". The servo parameter is enabled after resetting the servo amplifier.
- Assign the LSP/LSN signal in servo parameters "Input device selection 1 to 3 (PD03 to PD05)".

*2 The signal to be wired differs depending on the setting of servo parameter "Travel direction selection (PA14)".

Setting value of "Travel direction selection (PA14)"	Signal name of servo amplifier	
	Lower limit	Upper limit
0: Forward rotation (CCW) with the increase of the positioning address	LSN	LSP
1: Reverse rotation (CW) with the increase of the positioning address	LSP	LSN

*3 Stop processing is carried out in the Motion module.

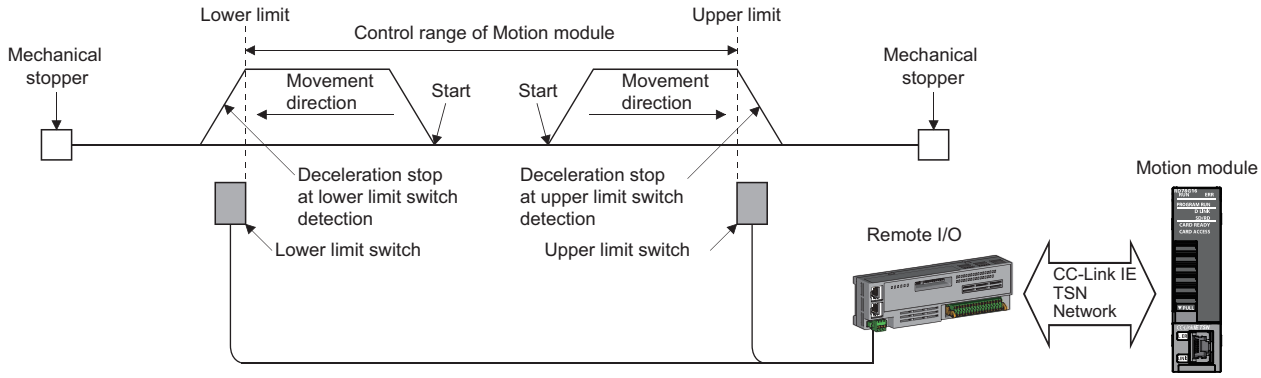
■External input signal via CPU (buffer memory of the Motion module)



Set the servo parameter properly. For details, refer to the following.

☞ Page 702 Devices Compatible with CC-Link IE TSN

■Link device



Set the servo parameters and the link device external signal assignment parameters appropriately. For details, refer to the following.

☞ Page 702 Devices Compatible with CC-Link IE TSN

☞ Page 325 Link Device External Signal Assignment Function

Wiring the hardware stroke limit

When using the hardware stroke limit function, wire the signal terminals corresponding to the upper/lower stroke limit of the device to be used as shown in the following drawing.

For the setting method of the input logic for the upper/lower stroke limit, refer to the following.

☞ Page 318 Input logic setting method for external input signals

■External input signal of the servo amplifier

Refer to the manual of the servo amplifier to be used for details on signal input availability and wiring.

Check the specifications of the servo amplifier to be connected before performing wiring and setting.

■External input signal via CPU (buffer memory of the Motion module)

For the wiring, refer to the manual of the module into which the external input signal is to be input.

■Link device

For the wiring, refer to the manual of the device station to be used.

Point

Wire the limit switch installed in the direction to which "Command position value" increases as upper limit switch and the limit switch installed in the limit switch installed in the direction to which "Command position value" decreases as lower limit switch.

If inverting the install positions of upper/lower limit switches, hardware stroke limit function cannot be operated properly. In addition, the servo motor does not stop.

The increase/decrease of "Command position value" and the motor rotation direction/movement direction can be changed by the parameters depending on the servo amplifier. Refer to the servo amplifier instruction manual for details.

When the hardware stroke limit function is not used

When not using the hardware stroke limit function, set the logic of FLS and RLS to the "negative logic" (initial value) with "[Pr.22] Input signal logic selection" and input the signal which always turns ON. Otherwise, set the logic of FLS and RLS to the "positive logic" with "[Pr.22] Input signal logic selection" and always turn OFF the input.

Precautions during control

- If the machine is stopped outside the Motion module control range (outside the upper/lower limit switches), or if stopped by hardware stroke limit detection, the starting for the "home position return control", "major positioning control", and "high-level positioning control" and the control mode switching cannot be executed. To carry out these types of control again, return the workpiece to the Motion module control range by a "JOG operation", "inching operation" or "manual pulse generator operation".
- When "[Pr.22] Input signal logic selection" is set to the initial value, the Motion module cannot carry out the positioning control if FLS (limit switch for upper limit) is separated from DICOM or RLS (limit switch for lower limit) is separated from DICOM (including when wiring is not carried out).

Forced stop function

⚠ WARNING

- When the forced stop is required to be wired, take the following measures.
  When using other than the link device for the forced stop input:
  Ensure to wire in the negative logic using b-contact.
  When using the link device for the forced stop input:
  Wire according to "[Pr.903] Forced stop signal (EMI): Link device logic setting". It is recommended to set "0: Negative logic" in "[Pr.903] Forced stop signal (EMI): Link device logic setting" and wire in the negative logic using b-contact.
- Provide safety circuit outside the Motion module so that the entire system will operate safety even when "[Pr.82] Forced stop valid/invalid selection" is set "1: Invalid". Be sure to use the forced stop signal (EMI) of the servo amplifier.

"Forced stop function" stops all axes of the servo amplifier with the forced stop signal (The initial value is set to "1: Invalid".)
The forced stop input valid/invalid is selected by "[Pr.82] Forced stop valid/invalid selection".

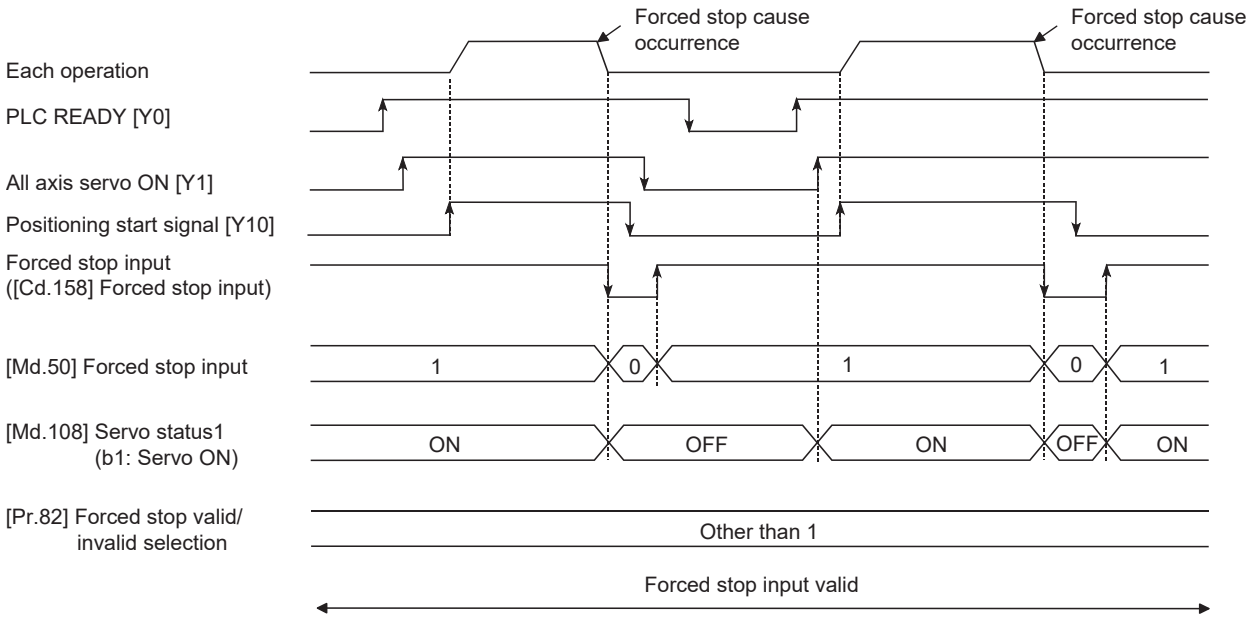
Control details

When "[Pr.82] Forced stop valid/invalid selection" is set to other than "1: Invalid", the forced stop signal is sent to all axes after the forced stop input is turned on.
Refer to the servo amplifier instruction manual for the operation of the servo amplifier after the forced stop signal is sent.
When "[Pr.82] Forced stop valid/invalid selection" is set to other than "1: Invalid", "Quick stop" defined in CiA402 is issued to all servo amplifier axes after the forced stop input is turned on. Refer to the manual of the servo amplifier for the operation of the servo amplifier when "Quick stop" is issued.
For MR-J5(W)-G: 📖MR-J5 User's Manual (Function)
The outline of the forced stop process is shown below.

Stop cause		Stop axis	M code ON signal after stop	Axis operation status after stopping ([Md.26])	Stop process					
					Home position return control		Major positioning control	High-level positioning control	Manual control	
					Machine home position return control	Fast home position return control			JOG/ Inching operation	Manual pulse generator operation
Forced stop	"[Cd.158] Forced stop input" OFF	All axes	No change	Servo OFF	Immediate stop					—

The following drawing shows the operation of the forced stop function.

■Operation example



Setting the forced stop

To use the "Forced stop function", set the following data using a program.

"[Pr.82] Forced stop valid/invalid selection" is validated at the rising edge (OFF to ON) of PLC READY [Y0] and "[Cd.158] Forced stop input" conducts checks in the operation cycle.

"[Cd.158] Forced stop input" is validated only when "[Pr.82] Forced stop valid/invalid selection" is set to "2: Valid (Buffer memory)".

When "[Pr.82] Forced stop valid/invalid setting" is set to "3: Valid (Link device)," set the link device external signal assignment function.

Setting item		Setting value	Setting details		Buffer memory address
					Axis 1 to axis 16
[Pr.82]	Forced stop valid/invalid selection	→	Set the forced stop function.		35
			1: Invalid	Forced stop is not used	
			2: Valid (Buffer memory)	Forced stop from the buffer memory is used	
			3: Valid (Link device)	Forced stop from the link device is used	
[Cd.158]	Forced stop input	→	Set the forced stop information to the buffer memory.		5945
			Other than 1: Forced stop ON (Forced stop)*1	Forced stop	
			1: Forced stop OFF (Forced stop release)	Forced stop release	

*1 A value other than "1" is regarded as "0".

Refer to the following for the setting details.

☞ Page 448 Basic Setting

How to check the forced stop

To use the states (ON/OFF) of forced stop input, set the parameters shown in the following table.

Monitor item		Monitor value	Storage details	Buffer memory address
				Axis 1 to axis 16
[Md.50]	Forced stop input	→	Stores the states (ON/OFF) of forced stop input. 0: Forced stop input ON (Forced stop) 1: Forced stop input OFF (Forced stop release)	4231

Refer to the following for information on the storage details.

☞ Page 515 Monitor Data

Precautions during control

- After the "Forced stop input" is released, the servo ON/OFF is valid for the status of all axis servo ON [Y1].
- If the setting value of "[Pr.82] Forced stop valid/invalid selection" is outside the range, "Forced stop valid/invalid setting error" (error code: 1DC1H) occurs.
- "[Md.50] Forced stop input" is stored "1" by setting "[Pr.82] Forced stop valid/invalid selection" to "1: invalid".
- When the "Forced stop input" is turned ON during operation, "Servo READY signal OFF during operation" (error code: 1A02H) does not occur.
- The status of the signal that is not selected in "[Pr.82] Forced stop valid/invalid selection" is ignored.
- Errors cannot be cleared by "[Cd.5] Axis error reset" during forced stop. Clear errors after forced stop is released.
- If "[Cd.158] Forced stop input" is set to "0000H: Forced stop ON (Forced stop)" during the operation with "[Pr.140] Driver command discard detection setting" set to "1: Detection enabled", "Driver command discard detection" (error code: 1BE6H) may occur before turning the servo OFF.

8.4 Functions to Change the Control Details

Functions to change the control details include the "speed change function", "override function", "acceleration/deceleration time change function", "torque change function" and "target position change function". Each function is executed by parameter setting or program creation and writing.

Refer to "Combination of Main Functions and Sub Functions" in the following manual for combination with main function.

MELSEC iQ-R Motion Module User's Manual (Startup)

Both the "speed change function" or "override function" change the speed, but the differences between the functions are shown below. Use the function that corresponds to the application.

"Speed change function"

- The speed is changed at any time, only in the control being executed.
- The new speed is directly set.

"Override function"

- The speed is changed for all control to be executed.
- The new speed is set as a percent (%) of the command speed.

Point

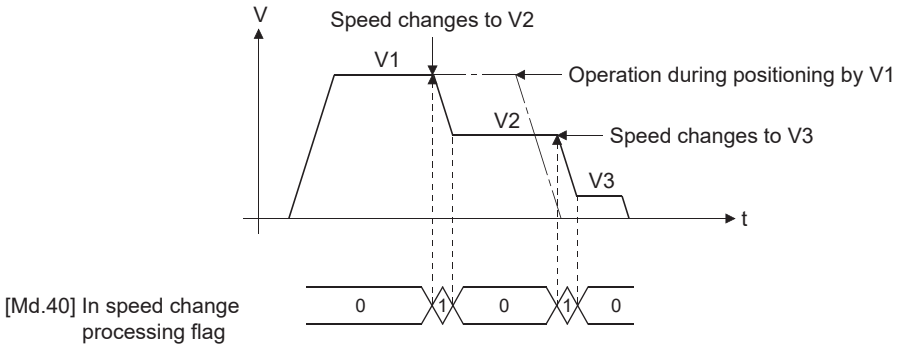
"Speed change function" and "Override function" cannot be used in the manual pulse generator operation and speed-torque control.

Speed change function

The speed control function is used to change the speed during control to a newly designated speed at any time.
The new speed is directly set in the buffer memory, and the speed is changed by a speed change command ([Cd.15] Speed change request) or external command signal.
During the machine home position return, a speed change to the creep speed cannot be carried out after deceleration start because the proximity dog ON is detected. When the speed change function is enabled and the speed is slower than the creep speed, the speed change is disabled and the speed accelerates to the creep speed after the proximity dog ON is detected.

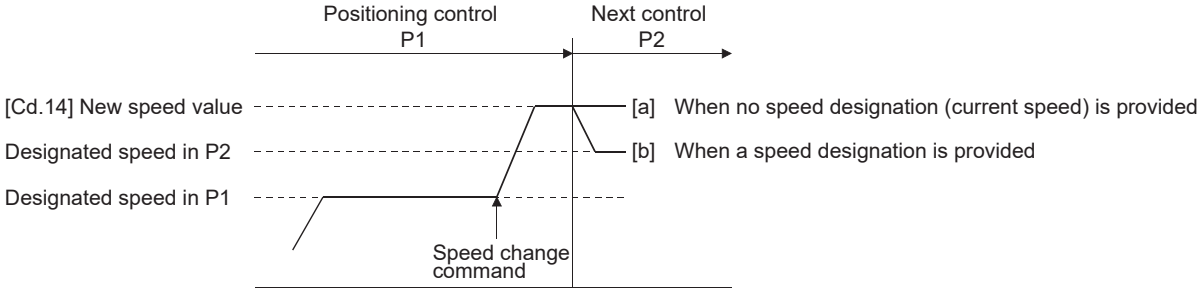
Control details

The following drawing shows the operation during a speed change.

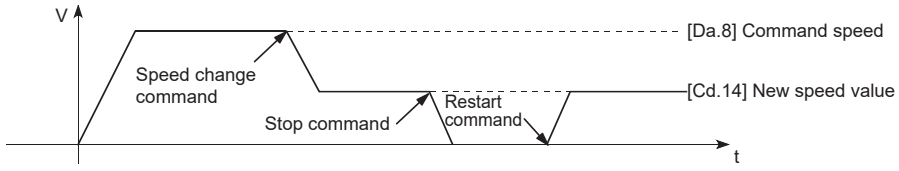


Precautions during control

- At the speed change during continuous path control, when no speed designation (current speed) is provided in the next positioning data, the next positioning data is controlled at "[Cd.14] New speed value". Also, when a speed designation is provided in the next positioning data, the next positioning data is controlled at its "[Da.8] Command speed".

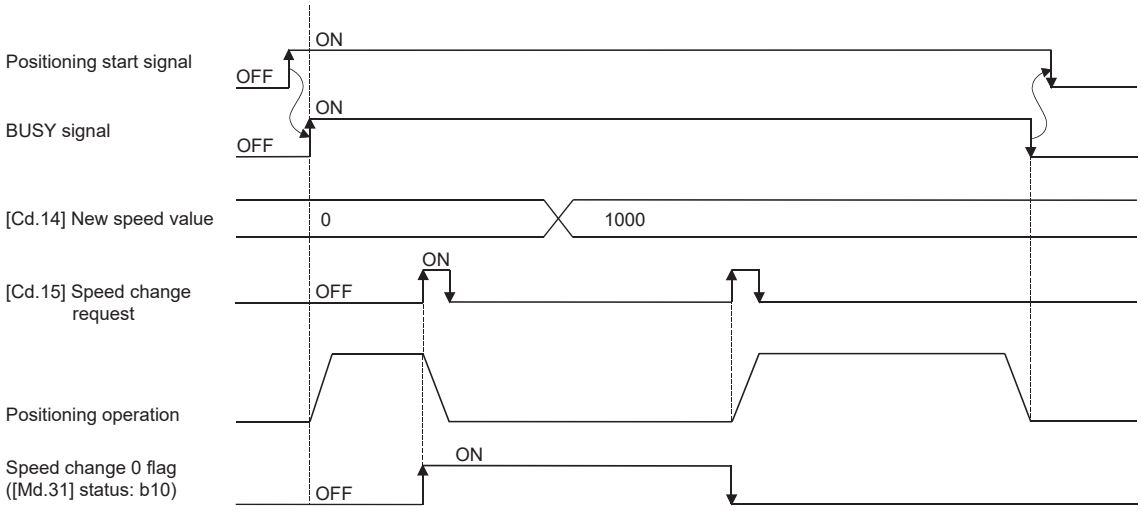


- When changing the speed during continuous path control, the speed change will be ignored if there is not enough distance remaining to carry out the change.
- When the stop command was given to make a stop after a speed change that had been made during position control, the restarting speed depends on "[Cd.14] New speed value".



• When the speed is changed by setting "[Cd.14] New speed value" to "0", the operation is carried out as follows.

• When "[Cd.15] Speed change request" is turned ON, the speed change 0 flag ([Md.31] Status: b10) turns ON. (During interpolation control, the speed change 0 flag on the reference axis side turns ON.)
• The axis stops, but "[Md.26] Axis operation status" does not change, and the BUSY signal remains ON. (If a stop signal is input, the BUSY signal will turn OFF, and "[Md.26] Axis operation status" will change to "stopped".) In this case, setting "[Cd.14] New speed value" to a value besides "0" will turn OFF the speed change 0 flag ([Md.31] Status: b10), and enable continued operation.
• Operation example



• "Deceleration/stop speed change" (warning code: 0D50H) occurs and the speed cannot be changed in the following cases.

• During deceleration by a stop command
• During automatic deceleration during positioning control

• "Speed limit value over" (warning code: 0D51H) occurs and the speed is controlled at "[Pr.8] Speed limit value" when the value set in "[Cd.14] New speed value" is larger than "[Pr.8] Speed limit value".
• When the speed is changed during interpolation control, the required speed is set in the reference axis.
• When carrying out consecutive speed changes, be sure there is an interval between the speed changes of 10ms or more. (If the interval between speed changes is short, the Motion module will not be able to track, and it may become impossible to carry out commands correctly.)
• When a speed change is requested simultaneously for multiple axes, change the speed one by one. Therefore, the start timing of speed change is different for each axis.
• Speed change cannot be carried out during the machine home position return. A request for speed change is ignored.
• When deceleration is started by the speed change function, the deceleration start flag does not turn ON.
• The speed change function cannot be used during speed control mode, torque control mode or continuous operation to torque control mode. Refer to the following for the speed change during speed control mode or continuous operation to torque control mode.

☞ Page 196 Speed-torque Control

Setting method from the CPU module

The following shows the data settings and program example for changing the control speed of axis 1 by the command from the CPU module. (In this example, the control speed is changed to "20.00mm/min".)

• Set the following data.

(Set using the program referring to the speed change time chart.)

n: Axis No. - 1

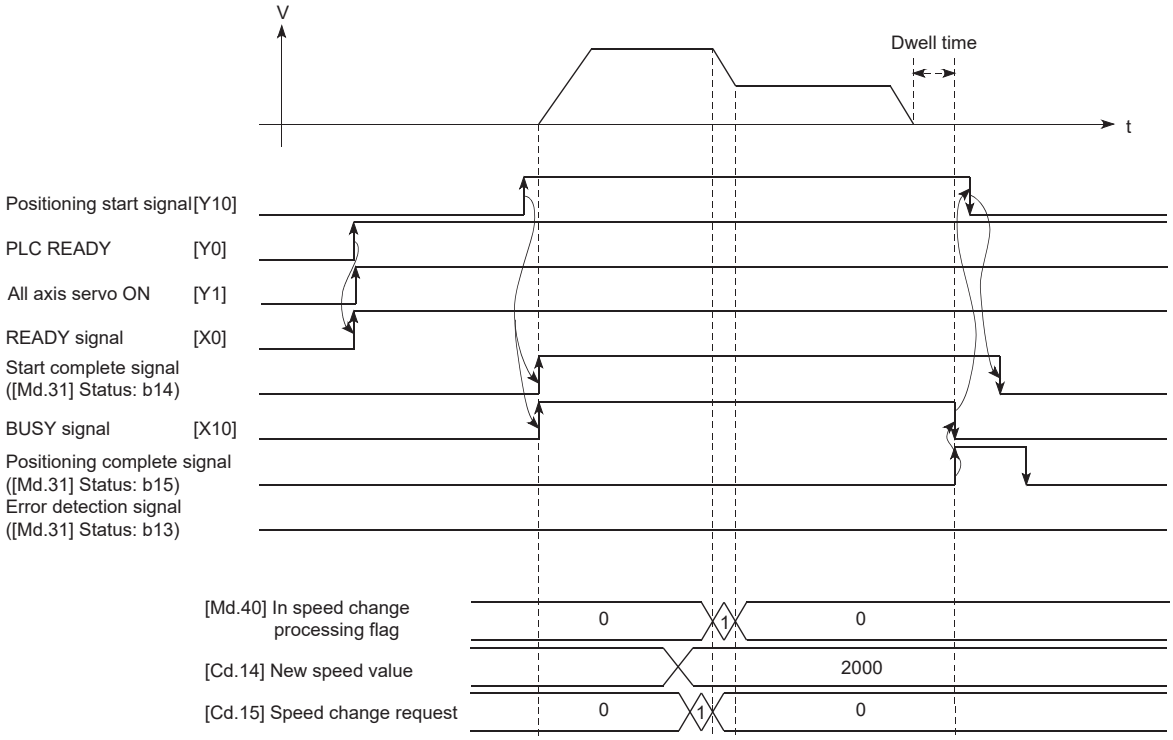
Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.14]	New speed value	2000	Set the new speed.	4314+100n 4315+100n
[Cd.15]	Speed change request	1	Set "1: Change the speed".	4316+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

• The following shows the speed change time chart.

■Operation example



Program example

Refer to the following for the program example of the speed change program.

☞ Page 630 Speed change program

Setting method using an external command signal

The speed can also be changed using an "external command signal".

The following shows the data settings and program example for changing the control speed of axis 1 using an "external command signal". (In this example, the control speed is changed to "10000.00mm/min".)

- Set the following data to change the speed using an external command signal. (Set using the program referring to the speed change time chart.)

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.42]	External command function selection	1	Set "1: External speed change request".	62+150n
[Cd.8]	External command valid	1	Set "1: Validates an external command.".	4305+100n
[Cd.14]	New speed value	1000000	Set the new speed.	4314+100n 4315+100n

Set the external command signal (DI) to be used in "[Pr.95] External command signal selection".

Refer to the following for the setting details.

☞ Page 448 Basic Setting, ☞ Page 550 Control Data

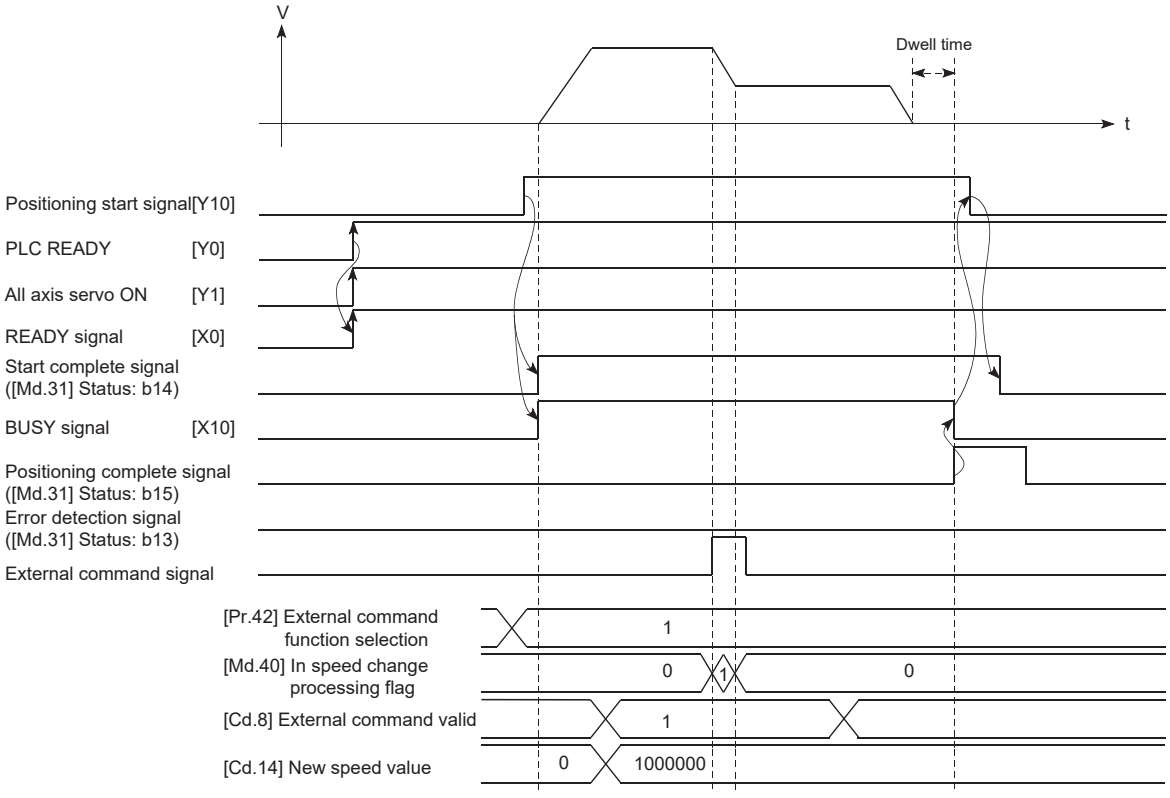
If "900: Link device" is set in "[Pr.95] External command signal selection", set the link device to be used in "[Pr.960] External speed change request: Link device type" to "[Pr.963] External speed change request: Link device logic setting".

Refer to the following for the setting details.

☞ Page 325 Link Device External Signal Assignment Function

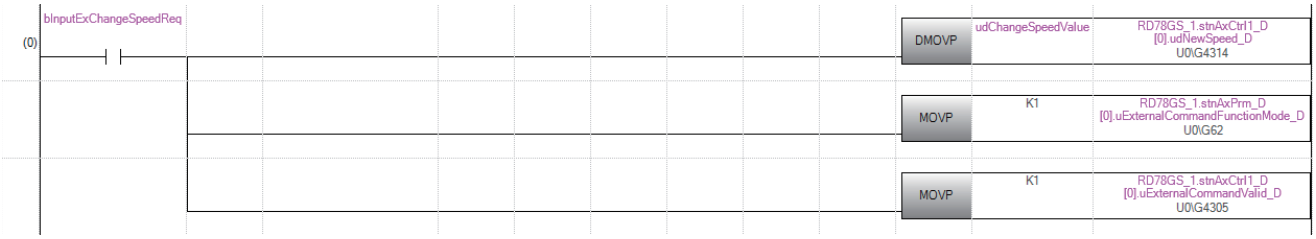
- The following shows the speed change time chart.

■Operation example



Program example

- Add the following program to the control program, and write it to the CPU module.



Classification	Label name	Description
Module label	RD78GS_1.stnAxPrm_D[0].uExternalCommandFunctionMode_D	Axis 1 External command function selection
	RD78GS_1.stnAxCtrl1_D[0].uExternalCommandValid_D	Axis 1 External command valid
	RD78GS_1.stnAxCtrl1_D[0].udNewSpeed_D	Axis 1 New speed value
Global label, local label	Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. The following table shows an example for the local label.	

	Label Name	Data Type		Class
1	udChangeSpeedValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR
2	bInputExChangeSpeedReq	Bit	...	VAR
3			...	

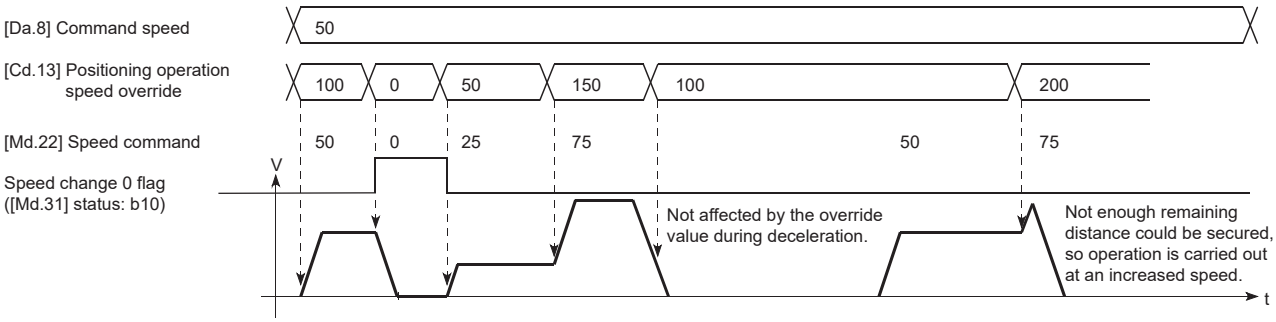
Override function

The override function changes the command speed by a designated percentage (0 to 300%) for all control to be executed. The speed can be changed by setting the percentage (%) by which the speed is changed in "[Cd.13] Positioning operation speed override".

Control details

The following shows that operation of the override function.

- A value changed by the override function is monitored by "[Md.22] Speed command".
- If "[Cd.13] Positioning operation speed override" is set to 100%, the speed will not change.
- If "[Cd.13] Positioning operation speed override" is set with a value less than "100 (%)" and "[Md.22] Speed command" is less than "1", "Less than minimum speed" (warning code: 0D04H) occurs and "[Md.22] Speed command" is set with "1" in any speed unit.
- If "[Cd.13] Positioning operation speed override" is set to "0 (%)", the speed is set to "0" and the speed change 0 flag ([Md.31] Status: b10) is set to "1". At the time, "Less than minimum speed" (warning code: 0D04H) does not occur.
- If there is not enough remaining distance to change the speed due to the "override function", when the speed is changed during the position control of speed-position switching control or position-speed switching control, the operation will be carried out at the speed that could be changed.
- If the speed changed by the override function is greater than "[Pr.8] Speed limit value", "Speed limit value over" (warning code: 0D51H) will occur and the speed will be controlled at "[Pr.8] Speed limit value". "[Md.39] In speed limit flag" will turn ON.



Precautions during control

- When changing the speed by the override function during continuous path control, the speed change will be ignored if there is not enough distance remaining to carry out the change.
- "Deceleration/stop speed change" (warning code: 0D50H) occurs and the speed cannot be changed by the override function in the following cases. (The value set in "[Cd.13] Positioning operation speed override" is validated after a deceleration stop.)

  - During deceleration by a stop command
  - During automatic deceleration during positioning control

- When the speed is changed by the override function during interpolation control, the required speed is set in the reference axis.
- When carrying out consecutive speed changes by the override function, be sure there is an interval between the speed changes of 10ms or more. (If the interval between speed changes is short, the Motion module will not be able to track, and it may become impossible to carry out commands correctly.)
- When deceleration is started by the override function, the deceleration start flag does not turn ON.
- The override function cannot be used during speed control mode, torque control mode or continuous operation to torque control mode.
- The override function cannot be used during driver home position return.

Setting method

The following shows the data settings and program example for setting the override value of axis 1 to "200%".

• Set the following data. (Set using the program referring to the speed change time chart.)

n: Axis No. - 1

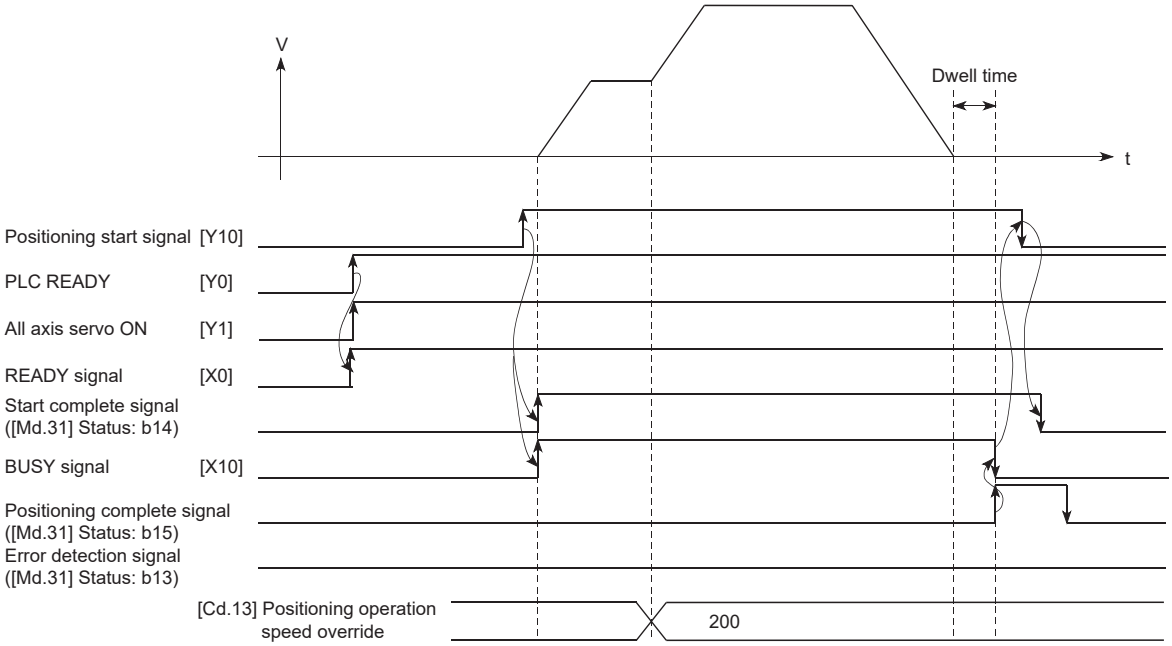
Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.13]	Positioning operation speed override	200	Set the new speed as a percentage (%).	4313+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

• The following shows a time chart for changing the speed using the override function.

■Operation example



Program example

Add the following program to the control program, and write it to the CPU module.

☞ Page 630 Override program

Acceleration/deceleration time change function

The "acceleration/deceleration time change function" is used to change the acceleration/deceleration time during a speed change to a random value when carrying out the speed change by the "speed change function" and "override function".
In a normal speed change (when the acceleration/deceleration time is not changed), the acceleration/deceleration time previously set in the parameters ([Pr.9], [Pr.10], and [Pr.25] to [Pr.30] values) is set in the positioning parameter data items [Da.3] and [Da.4], and control is carried out with that acceleration/deceleration time. However, by setting the new acceleration/deceleration time ([Cd.10], [Cd.11]) in the control data, and issuing an acceleration/deceleration time change enable command ([Cd.12] Acceleration/deceleration time change value during speed change, enable/disable) to change the speed when the acceleration/deceleration time change is enabled, the speed will be changed with the new acceleration/deceleration time ([Cd.10], [Cd.11]).

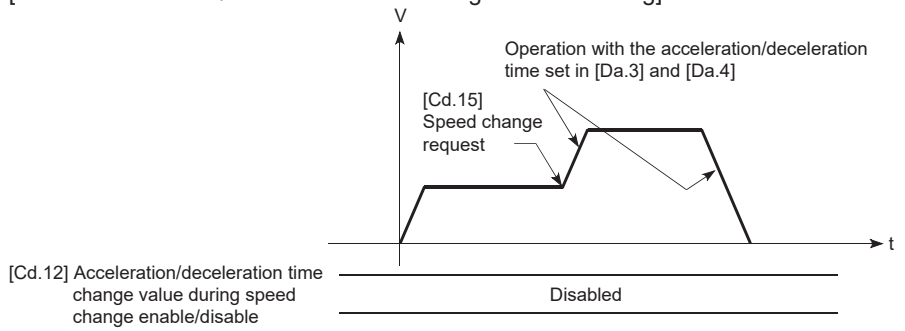
Control details

After setting the following two items, carry out the speed change to change the acceleration/deceleration time during the speed change.

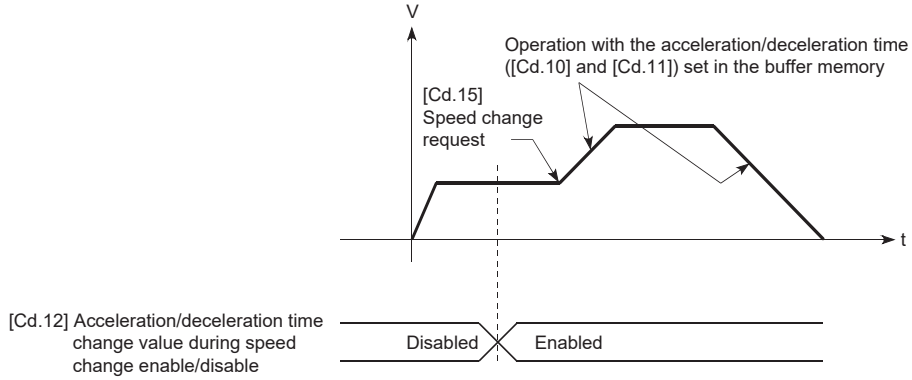
- Set change value of the acceleration/deceleration time ("[Cd.10] New acceleration time value", "[Cd.11] New deceleration time value")
- Setting acceleration/deceleration time change to enable ("[Cd.12] Acceleration/deceleration time change value during speed change, enable/disable")

The following drawing shows the operation during an acceleration/deceleration time change.

[For an acceleration/deceleration time change disable setting]



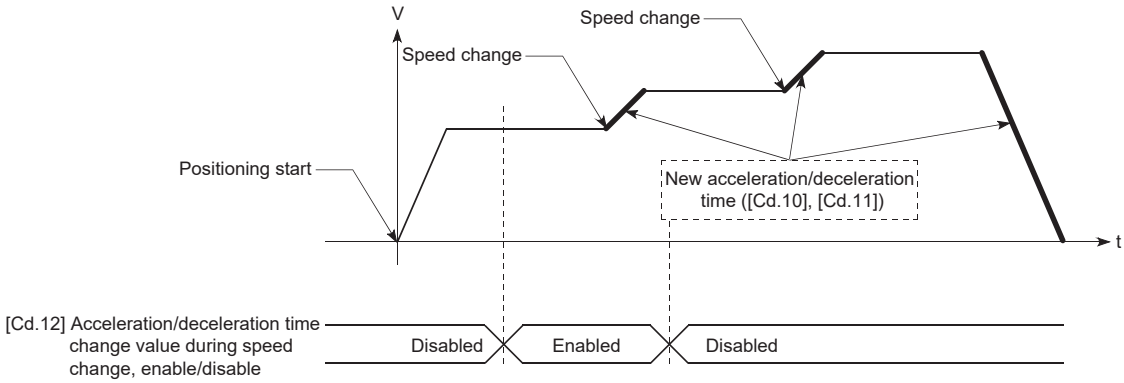
[For an acceleration/deceleration time change enable setting]



Precautions during control

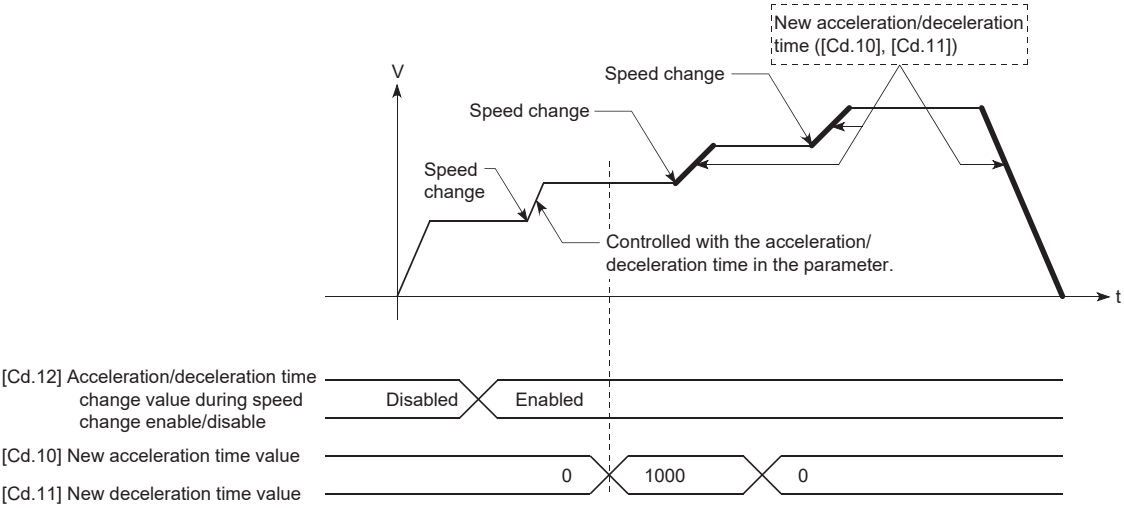
- When "0" is set in "[Cd.10] New acceleration time value" and "[Cd.11] New deceleration time value", the acceleration/deceleration time will not be changed even if the speed is changed. In this case, the operation will be controlled at the acceleration/deceleration time previously set in the parameters.
- The "new acceleration/deceleration time" is valid during execution of the positioning data for which the speed was changed. In continuous positioning control and continuous path control, the speed is changed and control is carried out with the previously set acceleration/deceleration time at the changeover to the next positioning data, even if the acceleration/deceleration time is changed to the "new acceleration/deceleration time ([Cd.10], [Cd.11])".
- Even if the acceleration/deceleration time change is set to disable after the "new acceleration/deceleration time" is validated, the positioning data for which the "new acceleration/deceleration time" was validated will continue to be controlled with that value. (The next positioning data will be controlled with the previously set acceleration/deceleration time.)

Ex.



- If the "new acceleration/deceleration time" is set to "0" and the speed is changed after the "new acceleration/deceleration time" is validated, the operation will be controlled with the previous "new acceleration/deceleration time".

Ex.



- The acceleration/deceleration change function cannot be used during speed control mode, torque control mode or continuous operation to torque control mode. Refer to the following for the acceleration/deceleration processing during speed control mode or continuous operation to torque control mode.

☞ Page 196 Speed-torque Control

Point

If the speed is changed when an acceleration/deceleration change is enabled, the "new acceleration/deceleration time" will become the acceleration/deceleration time of the positioning data being executed. The "new acceleration/deceleration time" remains valid until the changeover to the next positioning data. (The automatic deceleration processing at the completion of the positioning will also be controlled by the "new acceleration/deceleration time".)

Setting method

To use the "acceleration/deceleration time change function", write the data shown in the following table to the Motion module using the program.

The set details are validated when a speed change is executed after the details are written to the Motion module.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.10]	New acceleration time value	→	Set the new acceleration time.	4308+100n 4309+100n
[Cd.11]	New deceleration time value	→	Set the new deceleration time.	4310+100n 4311+100n
[Cd.12]	Acceleration/deceleration time change value during speed change, enable/disable	1	Set "1: Acceleration/deceleration time change enable".	4312+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

Program example

Add the following program to the control program, and write it to the CPU module.

☞ Page 631 Acceleration/deceleration time change program

Torque change function

The "torque change function" is used to change the torque limit value during torque limiting.
The torque limit value at the control start is the value set in "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value".
The following two change methods in the torque change function.

Torque change function	Details
Forward/reverse torque limit value same setting	The forward torque limit value*1 and reverse torque limit value*2 are changed to the same value by the new torque value. (Use this method when they need not be separately set.)
Forward/reverse torque limit value individual setting	The forward torque limit value*1 and reverse torque limit value*2 are individually changed respectively by the forward new torque value and new reverse torque value.

*1 Forward torque limit value: The limit value to the generated torque during CW regeneration at the CCW driving of the servo motor.
*2 Reverse torque limit value: The limit value to the generated torque during CCW regeneration at the CW driving of the servo motor.

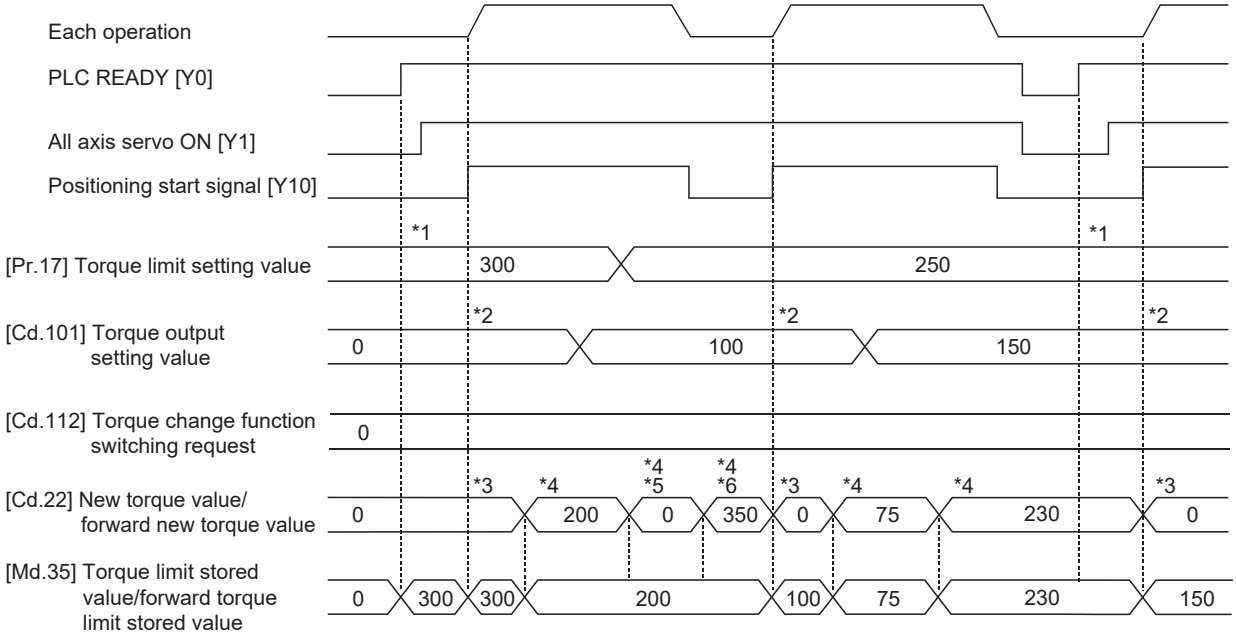
Set previously "same setting" or "individual setting" of the forward/reverse torque limit value in "[Cd.112] Torque change function switching request". Set the new torque value (forward new torque value/new reverse torque value) in the axis control data ([Cd.22] or [Cd.113]) shown below.

Torque change function	Setting item		
	Torque change function switching request ([Cd.112])	New torque value ([Cd.22], [Cd.113])	
Forward/reverse torque limit value same setting	0: Forward/reverse torque limit value same setting	[Cd.22]	New torque value/forward new torque value
		[Cd.113]	Setting invalid
Forward/reverse torque limit value individual setting	1: Forward/reverse torque limit value individual setting	[Cd.22]	New torque value/forward new torque value
		[Cd.113]	New reverse torque value

Control details

The torque value (forward new torque value/new reverse torque value) of the axis control data can be changed at all times.
The torque can be limited with a new torque value from the time the new torque value has been written to the Simple Motion module.
Note that the delay time until a torque control is executed is max. operation cycle after torque change value was written.
The toque limiting is not carried out from the time the power supply is turned ON to the time PLC READY [Y0] is turned ON.
The new torque value ([Cd.22], [Cd.113]) is cleared to zero at the leading edge (OFF to ON) of the positioning start signal [Y10], at the start of JOG operation, and at the start of synchronous control.
The torque setting range is from 0 to "[Pr.17] Torque limit setting value". (When the setting value is 0, a torque change is considered not to be carried out, and it becomes to the value set in "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value". The torque change range is 1 to "[Pr.17] Torque limit setting value".)
The following drawing shows the operation at the same setting and the operation at the individual setting for the forward new torque value and new reverse torque value.

■Operation example 1



*1 The torque limit setting value or torque output setting value becomes effective at PLC READY [Y0] rising edge (however, after the servo is turned ON.)
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*2 The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge, and the torque limit value is updated.
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

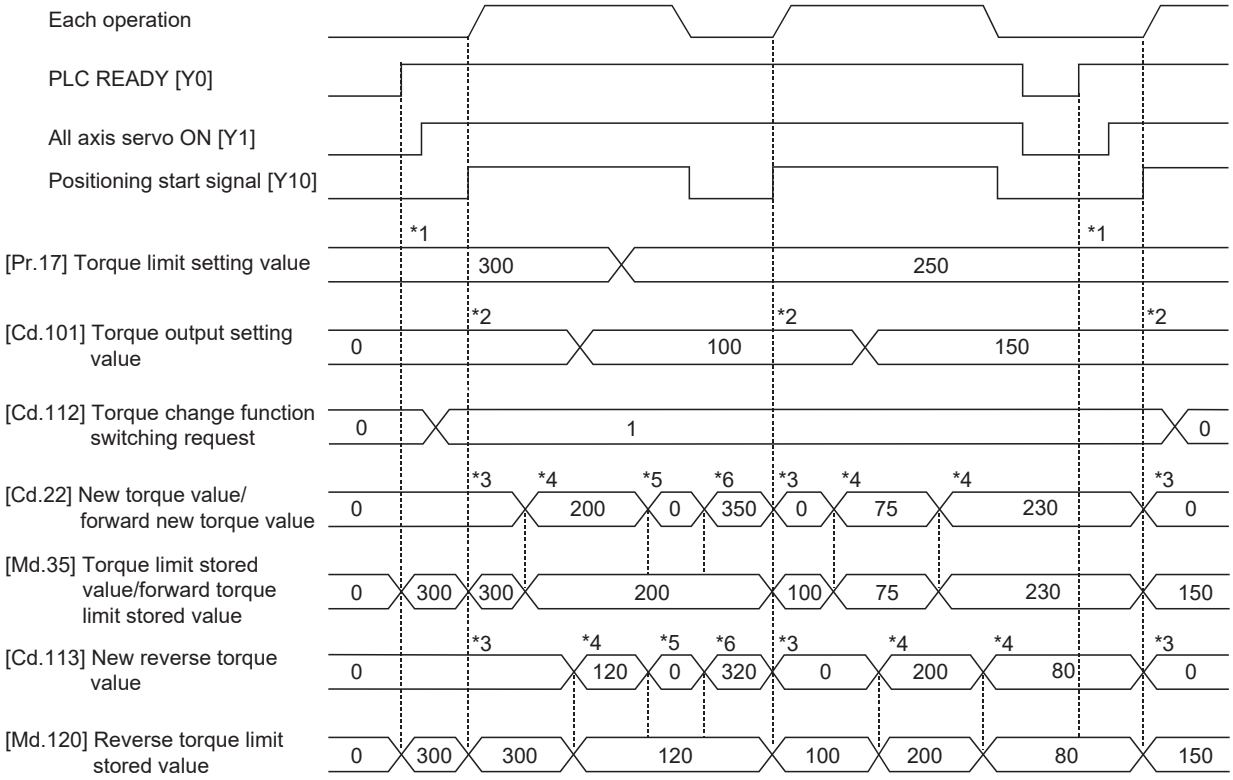
*3 The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.

*4 The torque limit value is changed by the torque changed value.

*5 When the new torque value is 0, a torque change is considered not to be carried out.

*6 When the change value exceeds the torque limit value, a torque change is considered not to be carried out.

■Operation example 2



*1 The torque limit setting value or torque output setting value becomes effective at PLC READY [Y0] rising edge (however, after the servo is turned ON.)

*2 The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge, and the torque limit value is updated.

*3 The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.

*4 The torque limit value is changed by the torque changed value.

*5 When the new torque value is 0, a torque change is considered not to be carried out.

*6 When the change value exceeds the torque limit value, a torque change is considered not to be carried out.

Precautions during control

- If a value besides "0" is set in the new torque value, the torque generated by the servo motor will be limited by the setting value. To limit the torque with the value set in "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value", set "0" to the new torque value.

Setting value of "[Cd.112] Torque change function switching request"	Setting item (New torque value)
0: Forward/reverse torque limit value same setting	[Cd.22] New torque value/forward new torque value
1: Forward/reverse torque limit value individual setting	[Cd.22] New torque value/forward new torque value
	[Cd.113] New reverse torque value

- "[Cd.22] New torque value/forward new torque value" or "[Cd.113] New reverse torque value" is validated when written to the Motion module. (However, it does not become effective from the time the power supply is turned ON to the time PLC READY [Y0] is turned ON.)
- If the setting value of "[Cd.22] New torque value/forward new torque value" is outside the setting range, "Outside new torque value range/outside forward new torque value range" (warning code: 0D07H) will occur and the torque will not be changed. If the setting value of "[Cd.113] New reverse torque value" is outside the setting range, "Outside new reverse torque value range" (warning code: 0D32H) will occur and the torque will not be changed.
- If the time to hold the new torque value is not more than 10ms, a torque change may not be executed.
- When changing from "0: Forward/reverse torque limit value same setting" to "1: Forward/reverse torque limit value individual setting" by the torque change function, set "0" or the same value set in "[Cd.22] New torque value/forward new torque value" in "[Cd.113] New reverse torque value" before change.

Setting method

To use the "torque change function", write the data shown in the following table to the Motion module using the program.

The set details are validated when written to the Motion module.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.112]	Torque change function switching request	0: Forward/reverse torque limit value same setting 1: Forward/reverse torque limit value individual setting	Sets "same setting/individual setting" of the forward torque limit value and reverse torque limit value. • Set "0" normally. (When the forward torque limit value and reverse torque limit value are not divided.) • When a value except "1" is set, it operates as "forward/reverse torque limit value same setting".	4363+100n
[Cd.22]	New torque value/ forward new torque value	0 to [Pr.17] Torque limit setting value	When "0" is set to "[Cd.112] Torque change function switching request", a new torque limit value is set. (This value is set to the forward torque limit value and reverse torque limit value.) When "1" is set to "[Cd.112] Torque change function switching request", a new forward torque limit value is set.	4325+100n
[Cd.113]	New reverse torque value	0 to [Pr.17] Torque limit setting value	"1" is set in "[Cd.112] Torque change function switching request", a new reverse torque limit value is set. • When "0" is set in "[Cd.112] Torque change function switching request", the setting value is invalid.	4364+100n

Refer to the following for the setting details.

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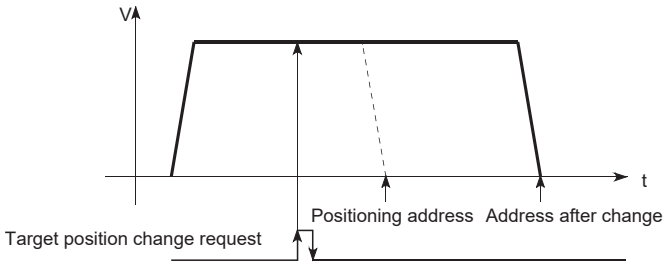
Target position change function

The "target position change function" is a function to change a target position to a newly designated target position at any timing during the position control (1-axis linear control). A command speed can also be changed simultaneously.
The target position and command speed changed are set directly in the buffer memory, and the target position change is executed by "[Cd.29] Target position change request flag".

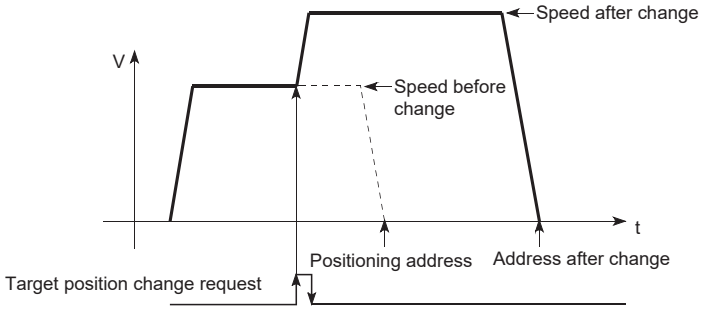
Details of control

The following charts show the details of control of the target position change function.

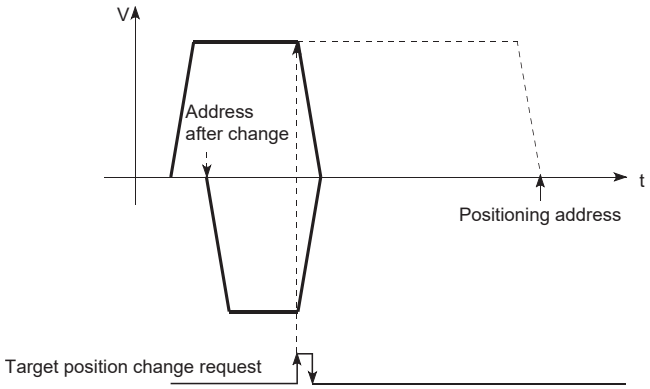
■When the address after change is positioned away from the start point more than the positioning address:



■When the speed is changed simultaneously with changing the address:



■When the direction of the operation is changed:



Precautions during operation

- If the positioning movement direction from the stop position to a new target position is reversed, stop the operation once and then position to the new target position. (☞ Page 270 When the direction of the operation is changed:)
- If a command speed exceeding the speed limit value is set to change the command speed, "Speed limit value over" (warning code: 0D51H) will occur and the new command speed will be the speed limit value. Also, if the command speed change disables the remaining distance to the target value from being assured, "Insufficient remaining distance" will occur (warning code: 0D54H, 0D55H).
- In the following cases, a target position change request given is ignored and "Target position change not possible" (warning code: 0D5BH to 0D61H) occurs.

  - During interpolation control
  - While a new target position value (address) is outside the software stroke limit range
  - While decelerating to a stop by a stop cause
  - While the positioning data whose operation pattern is continuous path control is executed
  - While the speed change 0 flag ([Md.31] Status: b10) is turned ON

- When a command speed is changed, the current speed is also changed. When the next positioning speed uses the current speed in the continuous positioning, the next positioning operation is carried out at the new speed value. When the speed is set with the next positioning data, the speed becomes the current speed and the operation is carried out at the current speed.
- When a target position change request is given during automatic deceleration in position control and the movement direction is reversed, the positioning control to a new position is performed after the positioning has stopped once. If the movement direction is not reversed, the speed accelerates to the command speed again and the positioning to the new position is performed.
- If the constant speed status is regained or the output is reversed by a target position change made while "[Md.48] Deceleration start flag" is ON, the deceleration start flag remains ON. (☞ Page 302 Deceleration start flag function)
- Carrying out the target position change to the ABS linear 1 in degrees may carry out the positioning to the new target position after the operation decelerates to stop once, even the movement direction is not reversed.

Restriction

When carrying out the target position change continuously, take an interval of 10ms or longer between the times of the target position changes. Also, take an interval of 10ms or longer when the speed change and override is carried out after changing the target position or the target position change is carried out after the speed change and override.

Setting method from the CPU module

The following shows the data settings and program example for changing the target position of axis 1 by the command from the CPU module. (In this example, the target position value is changed to "300.0μm" and the command speed is changed to "10000.00mm/min".)

• The following data is set. (Set using the program referring to the target position change time chart.)

n: Axis No. - 1

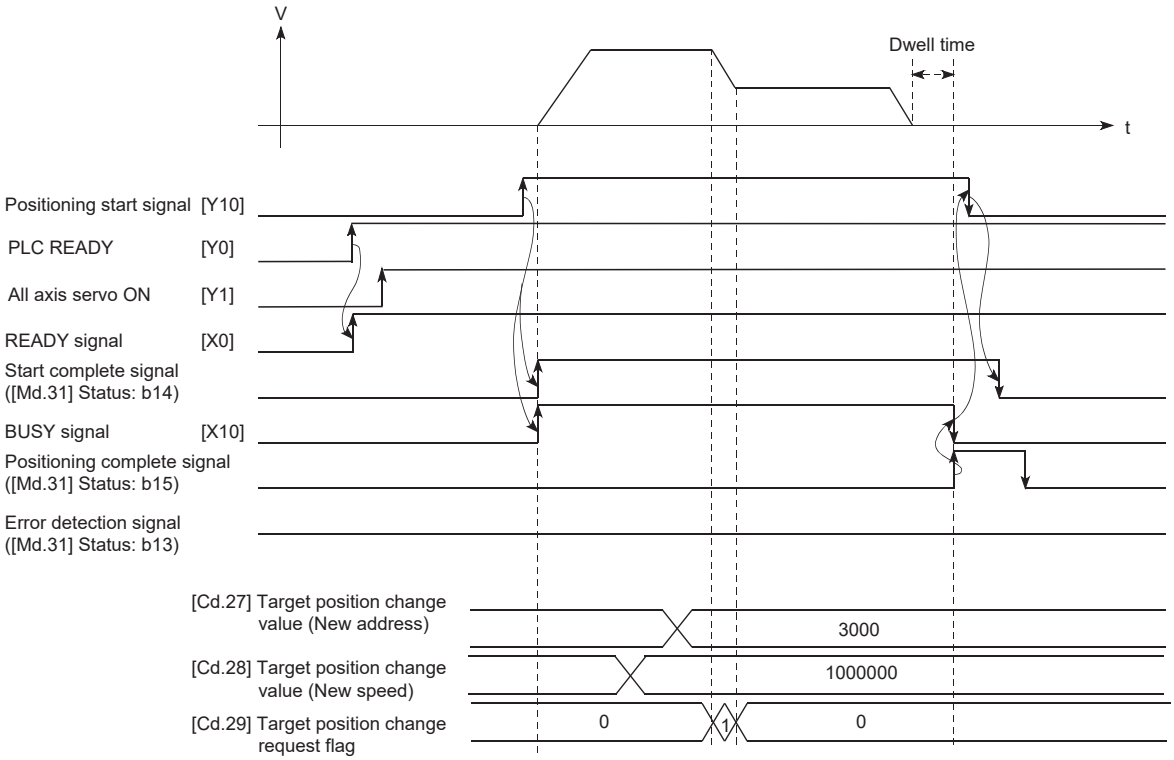
Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.27]	Target position change value (New address)	3000	Set the new address.	4334+100n 4335+100n
[Cd.28]	Target position change value (New speed)	1000000	Set the new speed.	4336+100n 4337+100n
[Cd.29]	Target position change request flag	1	Set "1: Requests a change in the target position".	4338+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

• The following shows the time chart for target position change.

■Operation example



Program example

Add the following program to the control program, and write it to the CPU module.

☞ Page 632 Target position change program

8.5 Functions Related to Start

A function related to start includes the "pre-reading start function". This function is executed by parameter setting or program creation and writing.

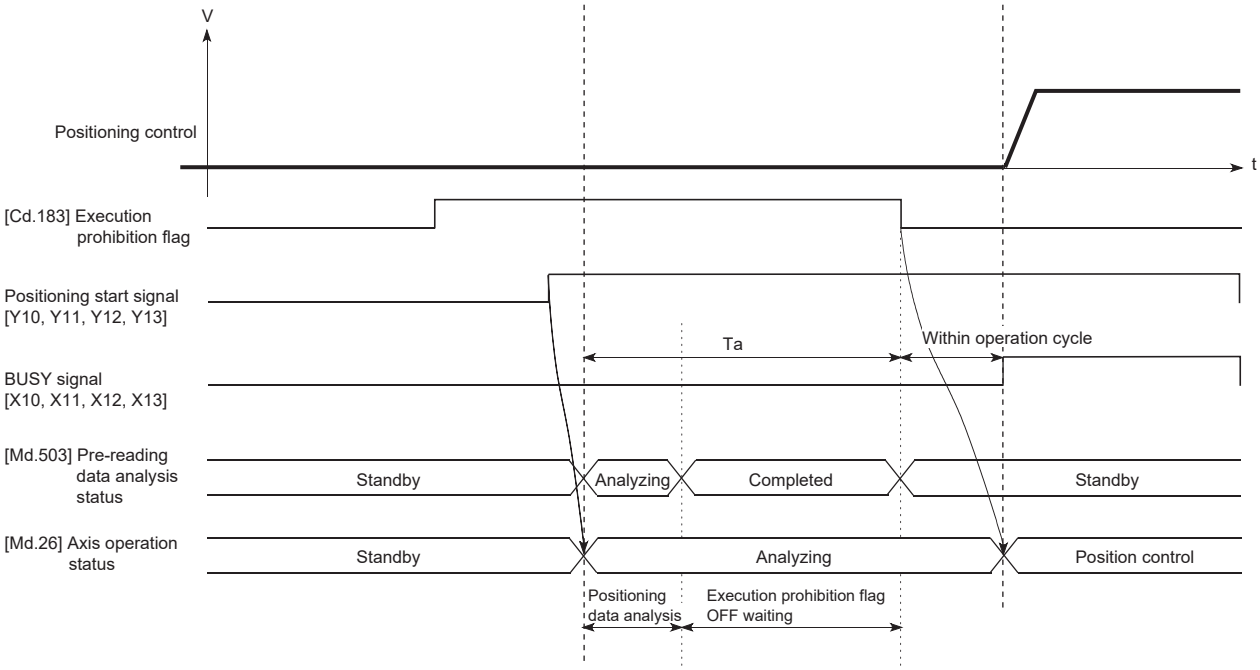
Pre-reading start function

The "pre-reading start function" does not start servo while the execution prohibition flag is ON if a positioning start request is given with the execution prohibition flag ON, and starts servo within operation cycle after OFF of the execution prohibition flag is detected. The positioning start request is given when the axis is in a standby status, and the execution prohibition flag is turned OFF at the axis operating timing.

Controls

The pre-reading start function is performed by turning ON the positioning start signal with the execution prohibition flag ([Cd.183]) ON. However, if positioning is started with the execution prohibition flag ON, the positioning data is analyzed but servo start is not provided. While the execution prohibition flag is ON, "[Md.26] Axis operation status" remains unchanged from "5: Analyzing". The servo starts within operation cycle after the execution prohibition flag has turned OFF, and "[Md.26] Axis operation status" changes to the status (e.g. position control, speed control) that matches the control method. Turn OFF the execution prohibition flag after "2: Completed" is set to "[Md.503] Pre-reading data analysis status". (Refer to the following figure.)

■Operation example

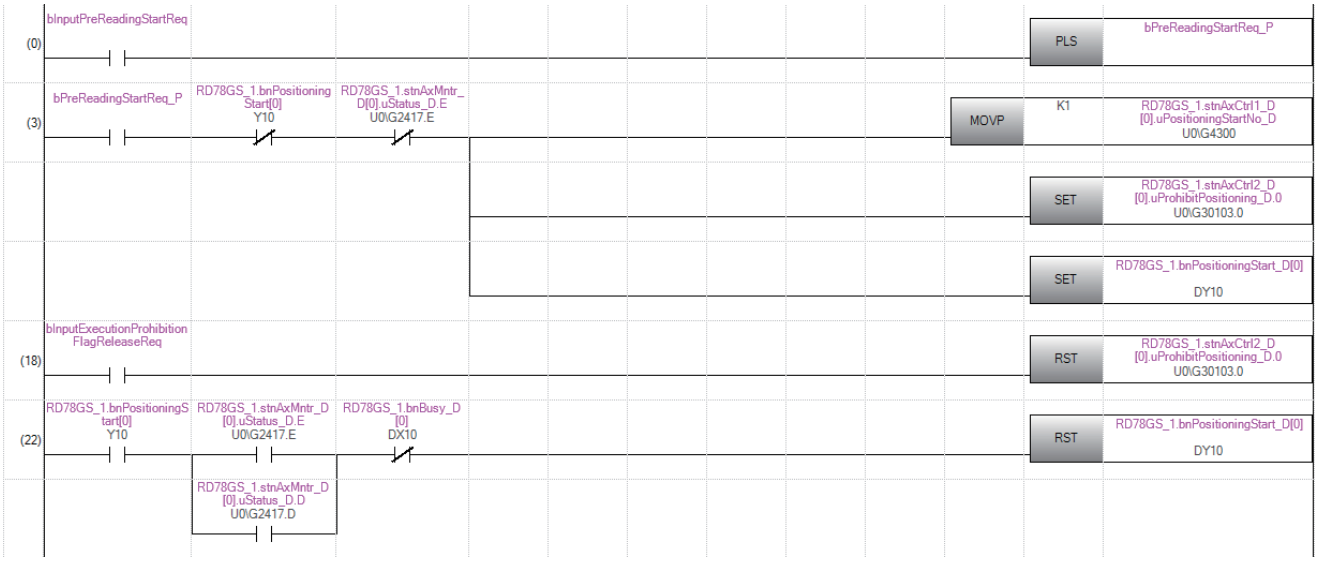


Precautions during control

- After positioning data analysis, the system is put in an execution prohibition flag OFF waiting status. Any change made to the positioning data in the execution prohibition flag OFF waiting status is not reflected on the positioning data. Change the positioning data before turning ON the positioning start signal.
- The pre-reading start function is invalid if the execution prohibition flag is turned OFF between when the positioning start signal has turned ON and when positioning data analysis is completed (Ta < start time, Ta: Reference to the above figure).
- The data No. which can execute positioning start using "[Cd.3] Positioning start No." with the pre-reading start function are No.1 to 600 only. Performing the pre-reading start function at the setting of No.7000 to 7004 or 9001 to 9004 will result in "Outside start No. range" (error code: 1AA3H).
- Always turn ON the execution prohibition flag at the same time or before turning ON the positioning start signal. Prereading may not be started if the execution prohibition flag is turned ON during Ta after the positioning start signal is turned ON. The pre-reading start function is invalid if the execution prohibition flag is turned ON after positioning start with the execution prohibition flag OFF. (It is made valid at the next positioning start.)

Program example

Refer to the following for the program example.



Classification	Label name	Description
Module label	RD78GS_1.bnBusy_D[0]	Axis 1 BUSY signal
	RD78GS_1.bnPositioningStart[0]	Axis 1 Positioning start signal
	RD78GS_1.bnPositioningStart_D[0]	
	RD78GS_1.stnAxMntr_D[0].uStatus_D.D	Axis 1 Error detection
	RD78GS_1.stnAxMntr_D[0].uStatus_D.E	Axis 1 Start complete
	RD78GS_1.stnAxCtrl1_D[0].uPositioningStartNo_D	Axis 1 Positioning start No.
	RD78GS_1.stnAxCtrl2_D[0].uProhibitPositioning_D.0	Axis 1 Execution prohibition flag
Global label, local label	Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. The following table shows an example for the local label.	

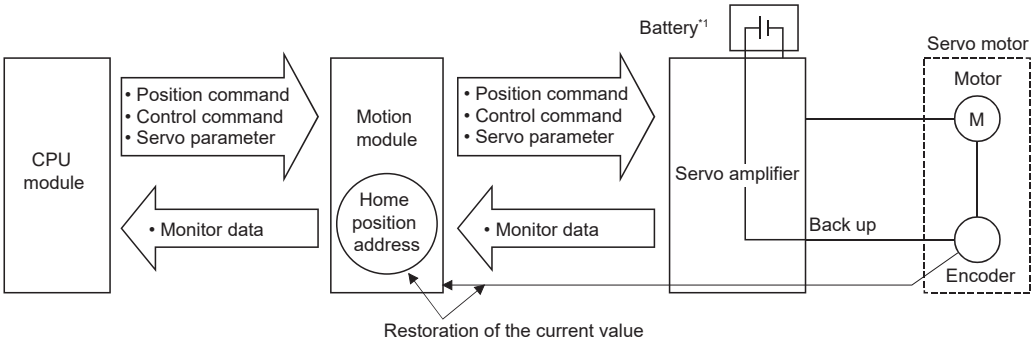
	Label Name	Data Type		Class
1	bPreReadingStartReq_P	Bit	...	VAR
2	bInputPreReadingStartReq	Bit	...	VAR
3	bInputExecutionProhibitionFlagReleaseReq	Bit	...	VAR
4			...	

8.6 Absolute Position System

The Motion module can construct an absolute position system.

The following describes precautions when constructing the absolute position system.

The configuration of the absolute position system is shown below.



*1 Depending on the servo amplifier used, it may be necessary to install a battery for retaining the location of the home position return in the servo amplifier.

Setting for absolute positions

For constructing an absolute position system, use a servo amplifier and a servo motor which enable absolute position detection.

- Setting of MR-J5(W)-G

Select "1: Enabled (absolute position detection system)" in "Absolute position detection system selection (PA03.0)". In addition, select "0: Invalid" in the servo parameter "Absolute position counter warning (AL.0E3) selection (PC29.5)".

To connect the MR-J5(W)-G, set "Electrical gear numerator (PA06)" and "Electrical gear denominator (PA07)" so that their ratio becomes 1:16.

Precautions

- When "degree" is used for the setting unit, the absolute position system can be established in infinite feed.
- When a unit other than "degree" is used for the setting unit, infinite feed is not possible when using the absolute position system.
- At the first connection with the servo amplifier in the absolute position system, "Home position return data incorrect" (warning code: 0D3CH) occurs and the home position return request turns ON if any of the following conditions is met.

  - The backup data in the unit is broken.
  - The rotation direction setting of the servo amplifier is different from that in the backup data.
  - The backup was performed while the home position return request was ON.
  - Absolute position loss occurred on the servo amplifier side.
  - HomeOffset is different from that in the backup data.
  - The encoder resolution is different from that in the backup data.
  - The servo amplifier model is different from that in the backup data.

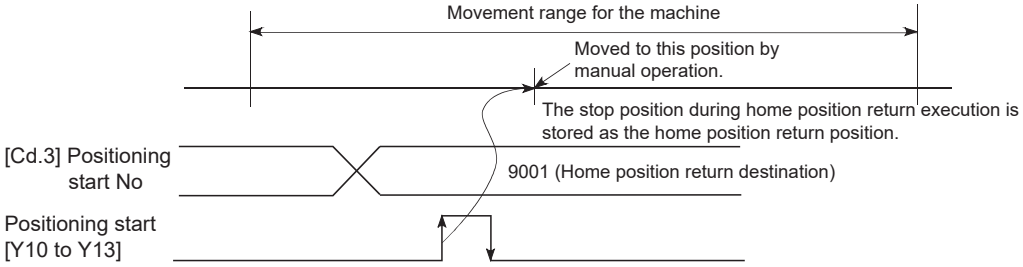
- The movement amount removed with the electronic gear of the servo amplifier cannot be restored.
- For the MR-J5-G series: If the absolute position of the servo amplifier cannot be restored, "Encoder initial communication error at servo amplifier power supply on" (error code: 1A7EH) occurs and the absolute position cannot be restored. The absolute position may be restored by checking the status of the servo amplifier and reconnecting it. If the home position return request is ON when reconnecting, execute the home position return again.

Home position return

In the absolute position system, a home position can be determined through home position return.

In the "Data set method" home position return method, the location to which the location of the home position is moved by manual operation (JOG operation/manual pulse generator operation) is treated as the home position.

■Operation example



8.7 Functions Related to Stop

Functions related to stop include the "stop command processing for deceleration stop function", "Continuous operation interrupt function" and "step function". Each function is executed by parameter setting or program creation and writing.

Stop command processing for deceleration stop function

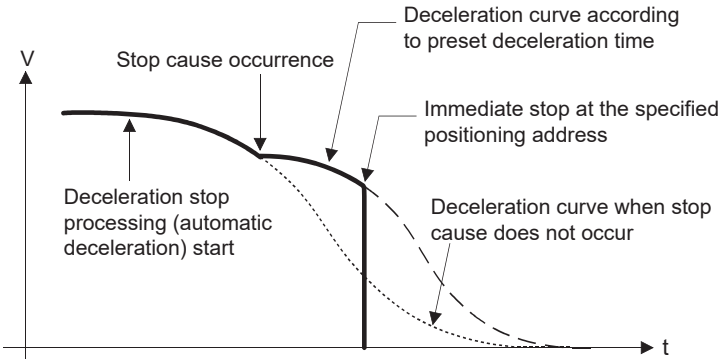
The "stop command processing for deceleration stop function" is provided to set the deceleration curve if a stop cause occurs during deceleration stop processing (including automatic deceleration).
This function is valid for both trapezoidal and S-curve acceleration/deceleration processing methods.
Refer to the following for details of the stop cause.
☞ Page 28 Stop process
The "stop command processing for deceleration stop function" performs the following two operations.

Control

The operation of "stop command processing for deceleration stop function" is explained below.

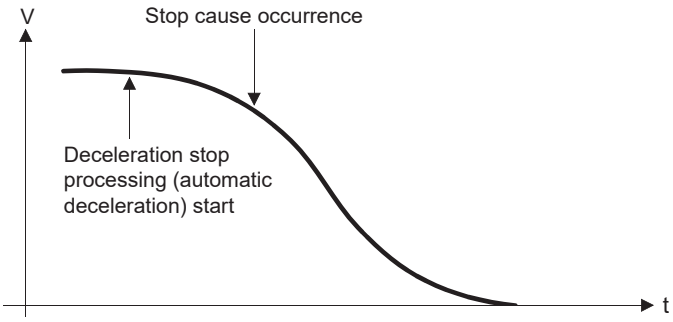
■Deceleration curve re-processing

A deceleration curve is re-processed starting from the speed at stop cause occurrence until at a stop, according to the preset deceleration time.
If a stop cause occurs during automatic deceleration of position control, the deceleration stop processing stops as soon as the target has reached the positioning address specified in the positioning data that is currently executed.



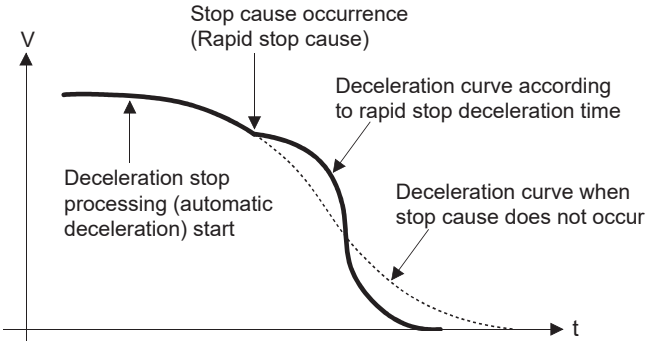
■Deceleration curve continuation

The current deceleration curve is continued after a stop cause has occurred.
If a stop cause occurs during automatic deceleration of position control, the deceleration stop processing may be complete before the target has reached the positioning address specified in the positioning data that is currently executed.

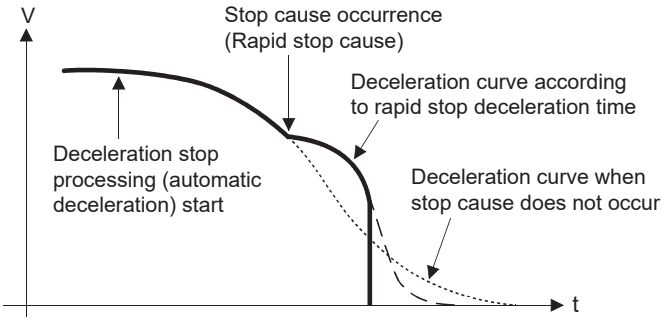


Precautions for control

- In manual control (JOG operation, inching operation, manual pulse generator operation) and speed-torque control, the stop command processing for deceleration stop function is invalid.
- The stop command processing for deceleration stop function is valid when "0: Normal deceleration stop" is set in "[Pr.37] Stop group 1 rapid stop selection" to "[Pr.39] Stop group 3 rapid stop selection" as the stopping method for stop cause occurrence.
- The stop command processing for deceleration stop function is invalid when "1: Rapid stop" is set in "[Pr.37] Stop group 1 rapid stop selection" to "[Pr.39] Stop group 3 rapid stop selection". (A deceleration curve is re-processed starting from the speed at stop cause occurrence until at a stop, according to "[Pr.36] Rapid stop deceleration time".) In the position control (including position control of speed/position changeover control or position/speed changeover control) mode, positioning may stop immediately depending on the stop cause occurrence timing and "[Pr.36] Rapid stop deceleration time" setting.



(Rapid stop in front of the specified positioning address)



(Immediate stop at the specified positioning address)

Setting method

To use the "stop command processing for deceleration stop function", set the following control data in a program.
The set data are made valid as soon as they are written to the buffer memory. PLC READY [Y0] is irrelevant.

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.42]	Stop command processing for deceleration stop selection	→	Set the stop command processing for deceleration stop function. 0: Deceleration curve re-processing 1: Deceleration curve continuation	5907

Refer to the following for the setting details.

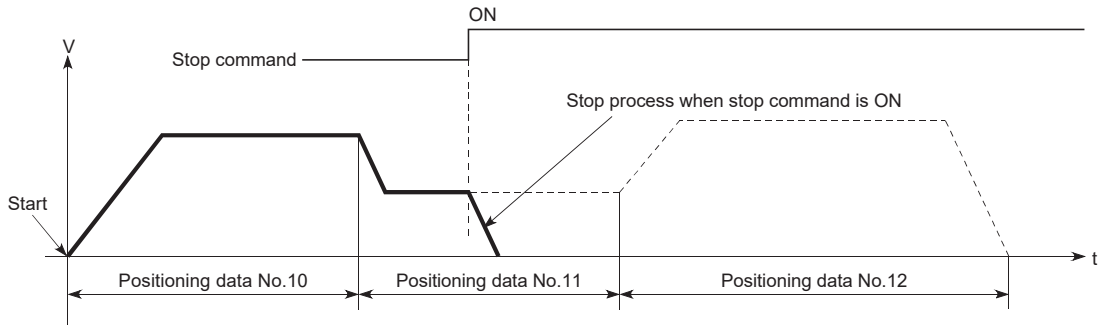
☞ Page 550 Control Data

Continuous operation interrupt function

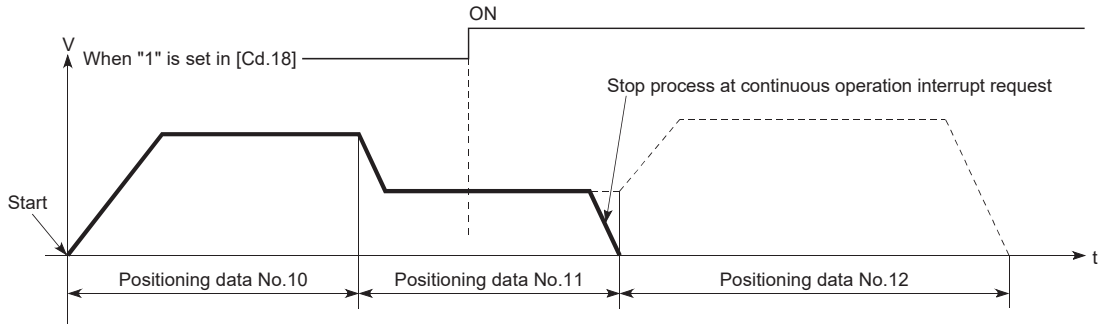
During positioning control, the control can be interrupted during continuous positioning control and continuous path control (continuous operation interrupt function). When "continuous operation interruption" is execution, the control will stop when the operation of the positioning data being executed ends. To execute continuous operation interruption, set "1: Interrupts continuous operation control or continuous path control" for "[Cd.18] Interrupt request during continuous operation".

Operation during continuous operation interruption

When the stop command is ON



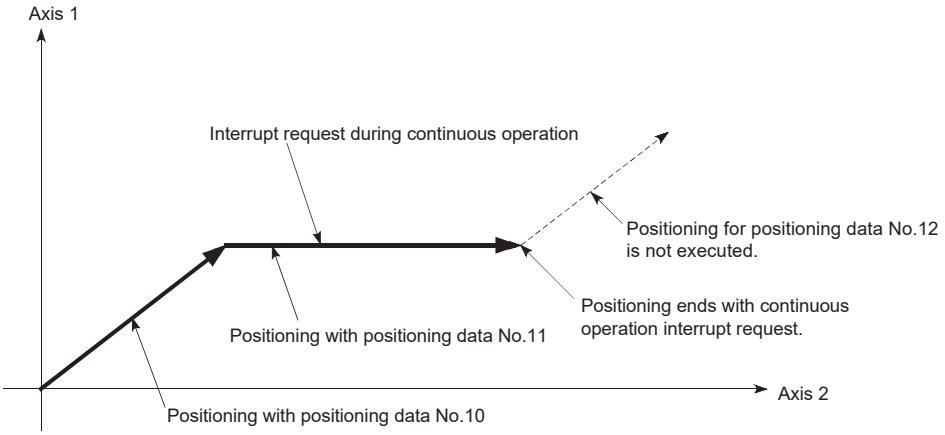
When "1" is set in [Cd.18]



8

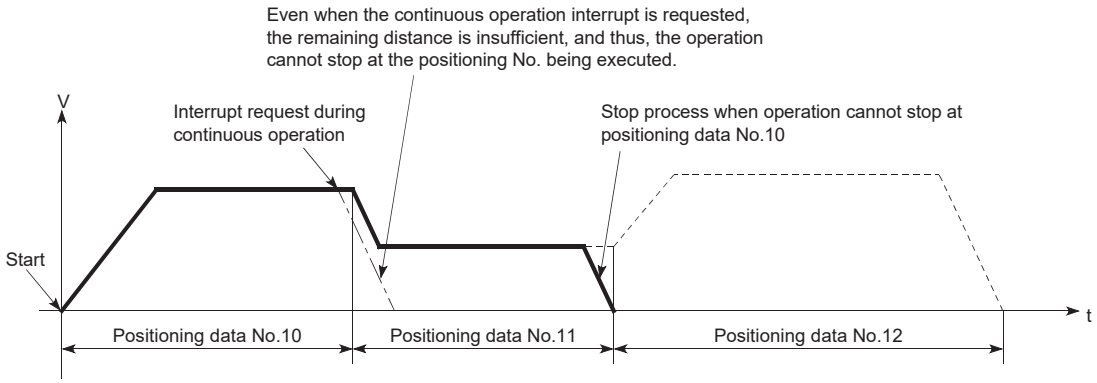
Restrictions

- When the "continuous operation interrupt request" is executed, the positioning will end. Thus, after stopping, the operation cannot be "restarted". When "[Cd.6] Restart command" is issued, "Restart not possible" (warning code: 0D02H) will occur.
- Even if the stop command is turned ON after executing the "continuous operation interrupt request", the "continuous operation interrupt request" cannot be canceled. Thus, if "restart" is executed after stopping by turning the stop command ON, the operation will stop when the positioning data No. where "continuous operation interrupt request" was executed is completed.



- If the operation cannot be decelerated to a stop because the remaining distance is insufficient when "continuous operation interrupt request" is executed with continuous path control, the interruption of the continuous operation will be postponed until the positioning data shown below.

- Positioning data No. have sufficient remaining distance
- Positioning data No. for positioning complete (pattern: 00)
- Positioning data No. for continuous positioning control (pattern: 01)



- When operation is not performed (BUSY signal is OFF), the interrupt request during continuous operation is not accepted. It is cleared to 0 at a start or restart.

Control data requiring settings

Set the following data to interrupt continuous operation.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.18]	Interrupt request during continuous operation	1	Set "1: Interrupts continuous operation control or continuous path control.".	4320+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

Step function

The "step function" is used to confirm each operation of the positioning control one by one.
It is used in debugging work for major positioning control, etc.
A positioning operation in which a "step function" is used is called a "step operation".
In step operations, the timing for stopping the control can be set. (This is called the "step mode".) Control stopped by a step operation can be continued by setting "step continues (to continue the control)" in the "step start information".

Relation between the step function and various controls

The following table shows the relation between the "step function" and various controls.
○: Set when required, ×: Setting not possible

Control type			Step function	Step applicability
Home position return control	Machine home position return control		×	Step operation not possible
	Fast home position return control		×	
Major positioning control	Position control	1-axis linear control	○	Step operation possible
		2 to 4-axis linear interpolation control	○	
		1-axis fixed-feed control	○	
		2 to 4-axis fixed-feed control (interpolation)	○	
		2-axis circular interpolation control	○	
		3-axis helical interpolation control	○	
	1 to 4-axis speed control		×	Step operation not possible
	Speed-position switching control, Position-speed switching control		○	Step operation possible
	Other control	Current value changing	○	
		JUMP instruction, NOP instruction, LOOP to LEND	×	Step operation not possible
Manual control	JOG operation, Inching operation		×	Step operation not possible
	Manual pulse generator operation		×	
Expansion control	Speed-torque control		×	

Step mode

In step operations, the timing for stopping the control can be set. This is called the "step mode". (The "step mode" is set in the control data "[Cd.34] Step mode".)
The following shows the two types of "step mode" functions.

■Deceleration unit step

The operation stops at positioning data requiring automatic deceleration. (A normal operation will be carried out until the positioning data requiring automatic deceleration is found. Once found, that positioning data will be executed, and the operation will then automatically decelerate and stop.)

■Data No. unit step

The operation automatically decelerates and stops for each positioning data. (Even in continuous path control, an automatic deceleration and stop will be forcibly carried out.)

Step start request

Control stopped by a step operation can be continued by setting "step continues" (to continue the control) in the "step start information". (The "step start information" is set in the control data "[Cd.36] Step start information".)
The following table shows the results of starts using the "step start information" during step operation.

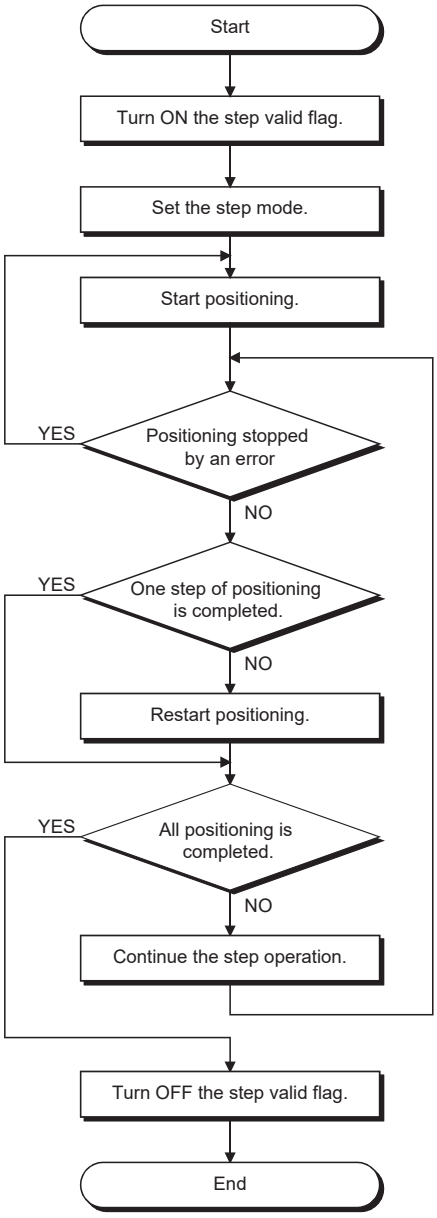
Stop status in the step operation	[Md.26] Axis operation status	[Cd.36] Step start information	Step start results
1 step of positioning stopped normally	Step standby	1: Continues step operation	The next positioning data is executed.

"Step not possible" (warning code: 0D56H) will occur if "[Md.26] Axis operation status" is as shown below or the step valid flag is OFF when step start information is set.

[Md.26] Axis operation status	Step start results
Standby	Step not continued by warning
Stopped	
Interpolation	
JOG operation	
Manual pulse generator operation	
Analyzing	
Special start standby	
Home position return	
Position control	
Speed control	
Speed control in speed-position switching control	
Position control in speed-position switching control	
Speed control in position-speed switching control	
Position control in position-speed switching control	
Synchronous control	
Control mode switch	
During speed control mode	
During torque control mode	
During continuous operation to torque control mode	

Using the step operation

The following shows the procedure for checking positioning data using the step operation.



Write "1" (carry out step operation) in "[Cd.35] Step valid flag".

Set in "[Cd.34] Step mode".

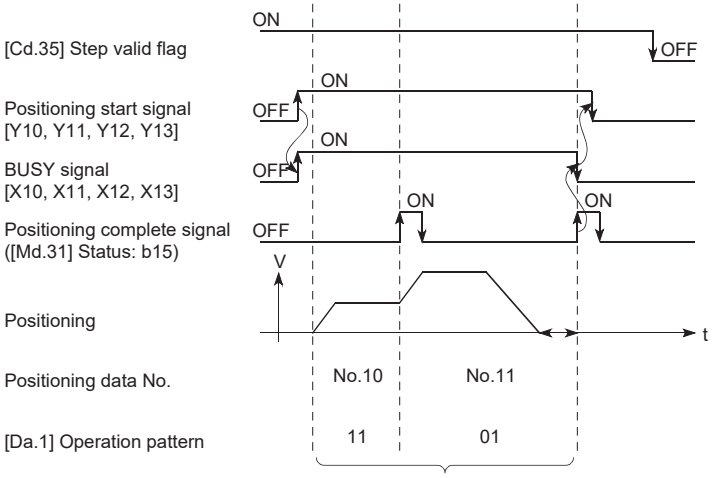
Write "1" (restart) to "[Cd.6] Restart command" and check whether the positioning data operates normally.

Write "1" (step continue) in "[Cd.36] Step start information", and check whether the next positioning data operates normally.

Write "0" (carry out no step operation) in "[Cd.35] Step valid flag".

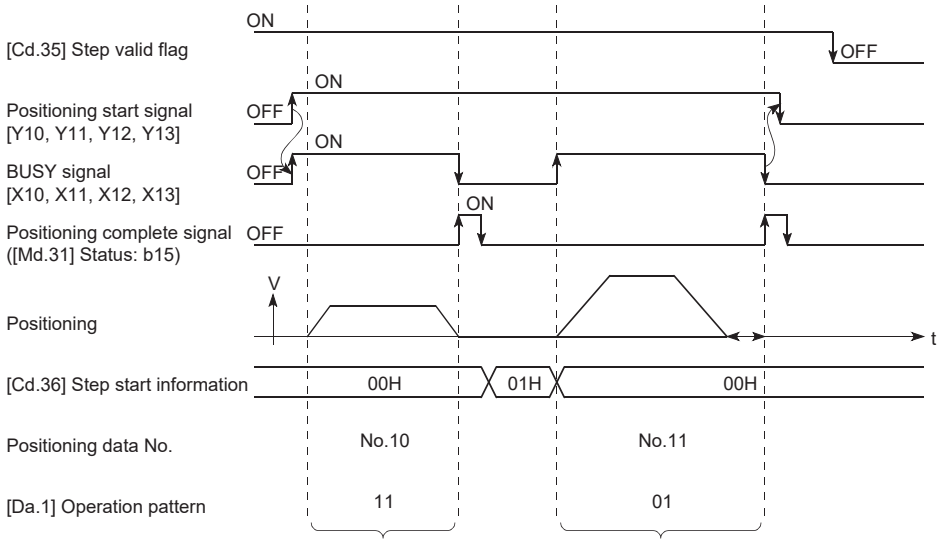
Control details

• The following drawing shows a step operation example during a "deceleration unit step".



No positioning data No. unit, so operation pattern becomes one step of unit for carrying out automatic deceleration.

• The following drawing shows a step operation example during a "data No. unit step".



Operation pattern becomes one step of positioning data No. unit regardless of continuous path control (11).

Precautions during control

• When step operation is carried out using interpolation control positioning data, the step function settings are carried out for the reference axis.

• When the step valid flag is ON, the step operation will start from the beginning if the positioning start signal is turned ON while "[Md.26] Axis operation status" is "step standby". (The step operation will be carried out from the positioning data set in "[Cd.3] Positioning start No.".)

Step function settings

To use the "step function", write the data shown in the following table to the Motion module using the program. Refer to the following for the timing of the settings.

☞ Page 283 Using the step operation

The set details are validated when written to the Motion module.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.34]	Step mode	→	Set "0: Stepping by deceleration units" or "1: Stepping by data No. units".	4344+100n
[Cd.35]	Step valid flag	1	Set "1: Validates step operations".	4345+100n
[Cd.36]	Step start information	→	Set "1: Continues step operation", depending on the stop status.	4346+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

8.8 Other Functions

Other functions include the "skip function", "M code output function", "teaching function", "command in-position function", "acceleration/deceleration processing function", "deceleration start flag function", "speed control 10 × multiplier setting for degree axis function" and "operation setting for incompletion of home position return function".
Each function is executed by parameter setting or program creation and writing.

Skip function

The "skip function" is used to stop (deceleration stop) the control of the positioning data being executed at the time of the skip signal input, and execute the next positioning data.
A skip is executed by a skip command ([Cd.37] Skip command) or external command signal.
The "skip function" can be used during control in which positioning data is used.

Relation between the skip function and various controls

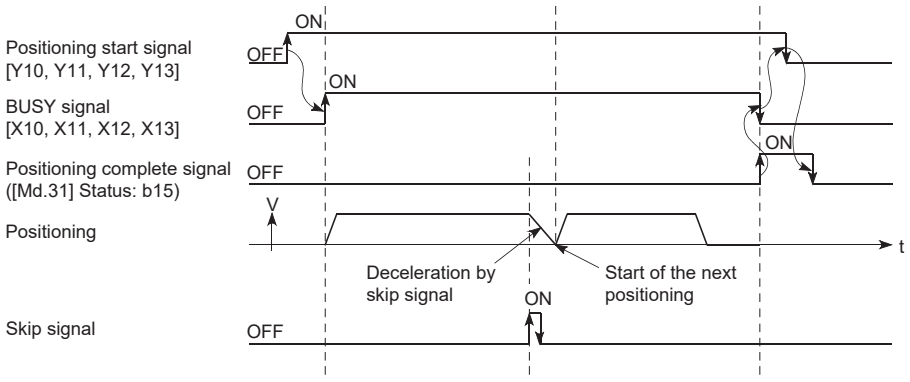
The following table shows the relation between the "skip function" and various controls.
○: Set when required, ×: Setting not possible

Control type			Skip function	Skip applicability
Home position return control	Machine home position return control		×	Skip operation not possible
	Fast home position return control		×	
Major positioning control	Position control	1-axis linear control	○	Skip operation possible
		2 to 4-axis linear interpolation control	○	
		1-axis fixed-feed control	○	
		2 to 4-axis fixed-feed control (interpolation)	○	
		2-axis circular interpolation control	○	
		3-axis helical interpolation control	○	
	1 to 4-axis speed control		×	Skip operation not possible
	Speed-position switching control		○	Skip operation possible
	Position-speed switching control		×	Skip operation not possible
	Other control	Current value changing	○	Skip operation possible
		JUMP instruction, NOP instruction, LOOP to LEND	×	Skip operation not possible
Manual control	JOG operation, Inching operation		×	Skip operation not possible
	Manual pulse generator operation		×	
Expansion control	Speed-torque control		×	

Control details

The following drawing shows the skip function operation.

■Operation example



Precautions during control

- If the skip signal is turned ON at the last of an operation, a deceleration stop will occur and the operation will be terminated.
- When a control is skipped (when the skip signal is turned ON during a control), the positioning complete signals will not turn ON.
- When the skip signal is turned ON during the dwell time, the remaining dwell time will be ignored, and the next positioning data will be executed.
- When a control is skipped during interpolation control, the reference axis skip signal is turned ON. When the reference axis skip signal is turned ON, a deceleration stop will be carried out for every axis, and the next reference axis positioning data will be executed.
- The M code ON signals will not turn ON when the M code output is set to the AFTER mode. (In this case, the M code will not be stored in "[Md.25] Valid M code".)
- The skip cannot be carried out by the speed control and position-speed switching control.
- If the skip signal is turned ON with the M code signal turned ON, the transition to the next data is not carried out until the M code signal is turned OFF.

Setting method from the CPU module

The following shows the settings and program example for skipping the control being executed in axis 1 with a command from the CPU module.

■Setting data

Set the following data.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.37]	Skip command	1	Set "1: Skip request".	4347+100n

Refer to the following for the setting details.

☞ Page 550 Control Data

- Add the following program to the control program, and write it to the CPU module.

When the "skip command" is input, the value "1" (skip request) set in "[Cd.37] Skip command" is written to the buffer memory of the Motion module.

Program example

Refer to the following for the program example.

☞ Page 634 Skip program

Setting method using an external command signal

The skip function can also be executed using an "external command signal".

The following shows the settings and program example for skipping the control being executed in axis 1 using an "external command signal".

- Set the following data to execute the skip function using an external command signal. (The setting is carried out using the program.)

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.42]	External command function selection	3	Set "3: Skip request".	62+150n
[Cd.8]	External command valid	1	Set "1: Validate external command".	4305+100n

Set the external command signal (DI) to be used in "[Pr.95] External command signal selection".

Refer to the following for the setting details.

☞ Page 448 Basic Setting, ☞ Page 550 Control Data

If "900: Link device" is set in "[Pr.95] External command signal selection", set the link device to be used in "[Pr.970] Skip request: Link device type" to "[Pr.973] Skip request: Link device logic setting".

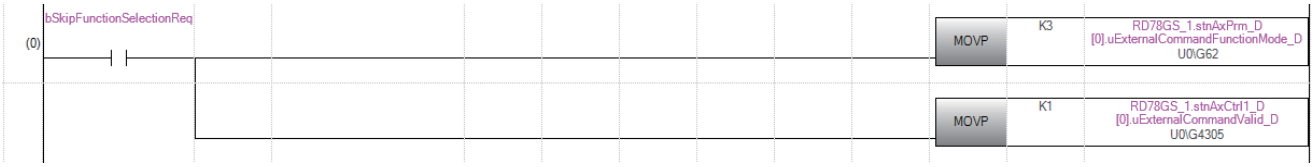
Refer to the following for the setting details.

☞ Page 325 Link Device External Signal Assignment Function

- Add the following program to the control program, and write it to the CPU module.

Program example

Refer to the following for the program example.



Classification	Label name	Description
Module label	RD78GS_1.stnAxPrm_D[0].uExternalCommandFunctionMode_D	Axis 1 External command function selection
	RD78GS_1.stnAxCtrl1_D[0].uExternalCommandValid_D	Axis 1 External command valid
Global label, local label	Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. The following table shows an example for the local label.	

	Label Name	Data Type		Class
1	bSkipFunctionSelectionReq	Bit	...	VAR
2			...	

M code output function

The "M code output function" is used to command sub work (clamping, drill rotation, tool replacement, etc.) related to the positioning data being executed.
The M code output timing can be set for each positioning data.
When the M code ON signal ([Md.31] Status: b12) is turned ON during positioning execution, a No. called the M code is stored in "[Md.25] Valid M code".
These "[Md.25] Valid M code" are read from the CPU module, and used to command auxiliary work. M codes can be set for each positioning data. (Set in setting item "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the positioning data.)
The timing for outputting (storing) the M codes can also be set in the "M code output function".

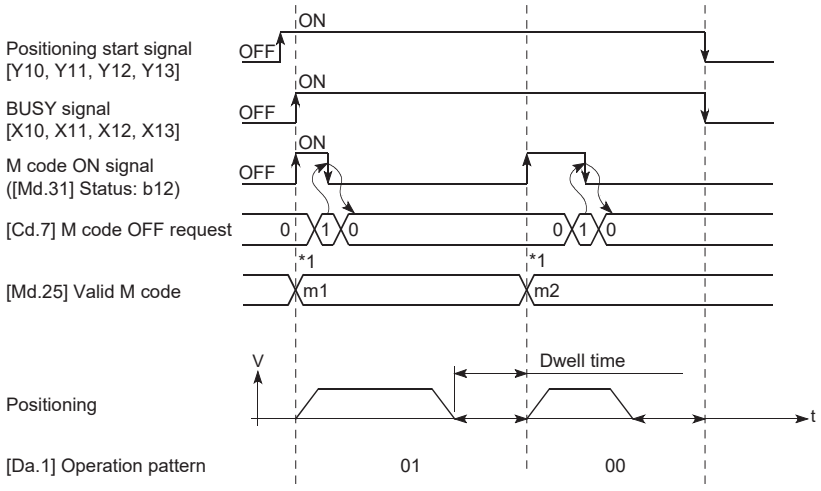
M code ON signal output timing

The timing for outputting (storing) the M codes can be set in the "M code output function". (The M code is stored in "[Md.25] Valid M code" when the M code ON signal is turned ON.)
The following shows the two types of timing for outputting M codes: the "WITH mode" and the "AFTER mode".

■WITH mode

The M code ON signal is turned ON at the positioning start, and the M code is stored in "[Md.25] Valid M code".

Ex.

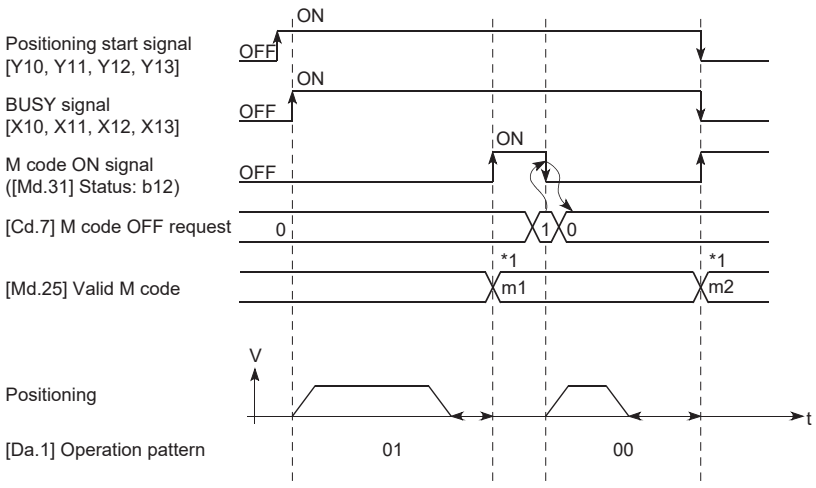


*1 m1 and m2 indicate set M codes.

■AFTER mode

The M code ON signal is turned ON at the positioning completion, and the M code is stored in "[Md.25] Valid M code".

Ex.



*1 m1 and m2 indicate set M codes.

M code ON signal OFF request

When the M code ON signal is ON, it must be turned OFF by the program.

To turn OFF the M code ON signal, set "1" (turn OFF the M code signal) in "[Cd.7] M code OFF request".

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.7]	M code OFF request	1	Set "1: Turn OFF the M code ON signal".	4304+100n

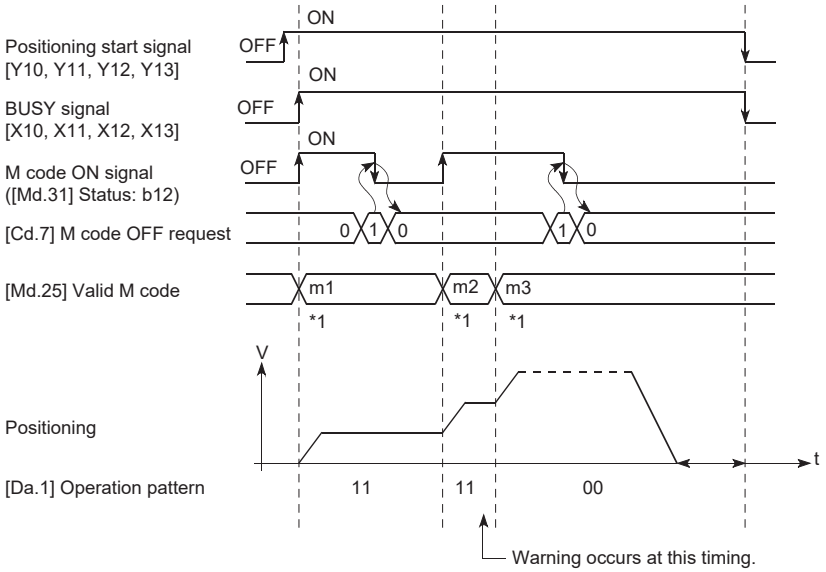
Refer to the following for the setting details.

☞ Page 550 Control Data

The next positioning data will be processed as follows if the M code ON signal is not turned OFF. (The processing differs according to "[Da.1] Operation pattern".)

[Da.1] Operation pattern		Processing
00	Independent positioning control (Positioning complete)	The next positioning data will not be executed until the M code ON signal is turned OFF.
01	Continuous positioning control	
11	Continuous path control	The next positioning data will be executed. If the M code is set to the next positioning data, "M code ON signal ON" (warning code: 0D52H) will occur.

■Operation example



*1 m1 to m3 indicate set M codes.

Point

If the M code output function is not required, set "0" in the setting item of the positioning data "[Da.10] M code/ Condition data No./Number of LOOP to LEND repetitions/Number of pitches".

Precautions during control

- During interpolation control, the reference axis M code ON signal is turned ON.
- The M code ON signal will not turn ON if "0" is set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches". (The M code will not be output, and the previously output value will be held in "[Md.25] Valid M code".)
- If the M code ON signal is ON at the positioning start, "M code ON signal start" (error code: 1AA0H) will occur, and the positioning will not start.
- If PLC READY [Y0] is turned OFF, the M code ON signal will turn OFF and "0" will be stored in "[Md.25] Valid M code".
- If the positioning operation time is short during continuous path control, there will not be enough time to turn OFF the M code ON signal and "M code ON signal ON" (warning code: 0D52H) may occur. In this case, set a "0" in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of that section's positioning data to prevent the M code from being output for avoiding the warning occurrence.
- In the AFTER mode during speed control, the M code is not output and the M code ON signal does not turn ON.
- If current value changing where "9003" has been set to "[Cd.3] Positioning start No." is performed, the M code output function is made invalid.

Setting method

"WITH mode/AFTER mode" can be set for each positioning data.

The following shows the settings to use the "M code output function".

- Set the M code No. in the positioning data "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches".
- Set the timing to output the M code ON signal.

Set the required value in the following parameter, and write it to the Motion module. The set data is made valid on the rising edge (OFF to ON) of PLC READY [Y0].

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.18]	M code ON signal output timing	→	Set the timing to output the M code ON signal. 0: WITH mode 1: AFTER mode	27+150n

Refer to the following for the setting details.

☞ Page 448 Basic Setting

Reading M codes

"M codes" are stored in the following buffer memory when the M code ON signal turns ON.

n: Axis No. - 1

Monitor item		Monitor value	Storage details	Buffer memory address
				Axis 1 to axis 16
[Md.25]	Valid M code	→	The M code No. ([Da.10] M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches) set in the positioning data is stored.	2408+100n

Refer to the following for information on the storage details.

☞ Page 515 Monitor Data

The following shows a program example for reading "[Md.25] Valid M code" to the data register (D110) of the CPU module. (The read value is used to command the sub work.)

Read M codes not as "rising edge commands", but as "ON execution commands".

Program example

Refer to the following for the program example.



Classification	Label name	Description
Module label	RD78GS_1.stnAxMntr_D[0].uStatus_D.C	Axis 1 M code ON
	RD78GS_1.stnAxMntr_D[0].uM_Code_D	Axis 1 Valid M code
Global label, local label	Defines the global label or the local label as follows. The settings of Assign (Device/Label) are not required for the label that the assignment device is not set because the unused internal relay and data device are automatically assigned. The following table shows an example for the global label.	

	Label Name	Data Type		Class
1	G_uValidMode	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL
2			...	

Teaching function

The "teaching function" is used to set addresses aligned using the manual control (JOG operation, inching operation manual pulse generator operation) in the positioning data addresses ("[Da.6] Positioning address/movement amount", "[Da.7] Arc address").

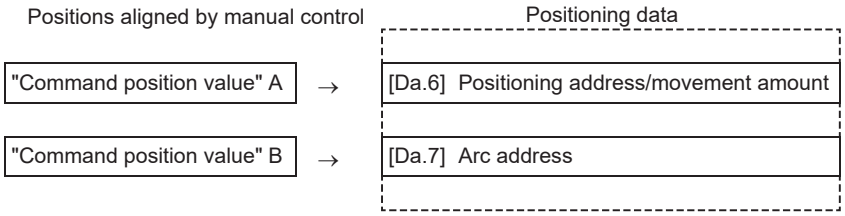
Control details

■Teaching timing

Teaching is executed using the program when the BUSY signal is OFF. (During manual control, teaching can be carried out as long as the axis is not BUSY, even when an error or warning has occurred.)

■Addresses for which teaching is possible

The addresses for which teaching is possible are "command position values" ([Md.20] Command position value) having the home position as a reference. The settings of the "movement amount" used in incremental system positioning cannot be used. In the teaching function, these "command position values" are set in "[Da.6] Positioning address/movement amount" or "[Da.7] Arc address".



Precautions during control

- Before teaching, a "machine home position return" must be carried out to establish the home position. (When a current value changing, etc., is carried out, "[Md.20] Command position value" may not show absolute addresses having the home position as a reference.)
- Teaching cannot be carried out for positions to which movement cannot be executed by manual control (positions to which the workpiece cannot physically move). (During 2-axis circular interpolation control with center point designation, etc., teaching of "[Da.7] Arc address" cannot be carried out if the center point of the arc is not within the moveable range of the workpiece.)
- Writing to the flash ROM can be executed up to 100,000 times. If writing to the flash ROM exceeds 100,000 times, the writing may become impossible (assured value is up to 100,000 times). If "Flash ROM write number error" (error code: 1080H) occurs when writing to the flash ROM has been completed, check whether or not the program is created so as to write continuously to the flash ROM.

Data used in teaching

The following control data is used in teaching.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.1]	Flash ROM write request	1	Write the set details to the flash ROM (backup the changed data).	5900
[Cd.38]	Teaching data selection	→	Sets to which "command position value" is written. 0: Written to "[Da.6] Positioning address/movement amount". 1: Written to "[Da.7] Arc address".	4348+100n
[Cd.39]	Teaching positioning data No.	→	Designates the data to be taught. (Teaching is carried out when the setting value is 1 to 600.) When teaching has been completed, this data is zero cleared.	4349+100n

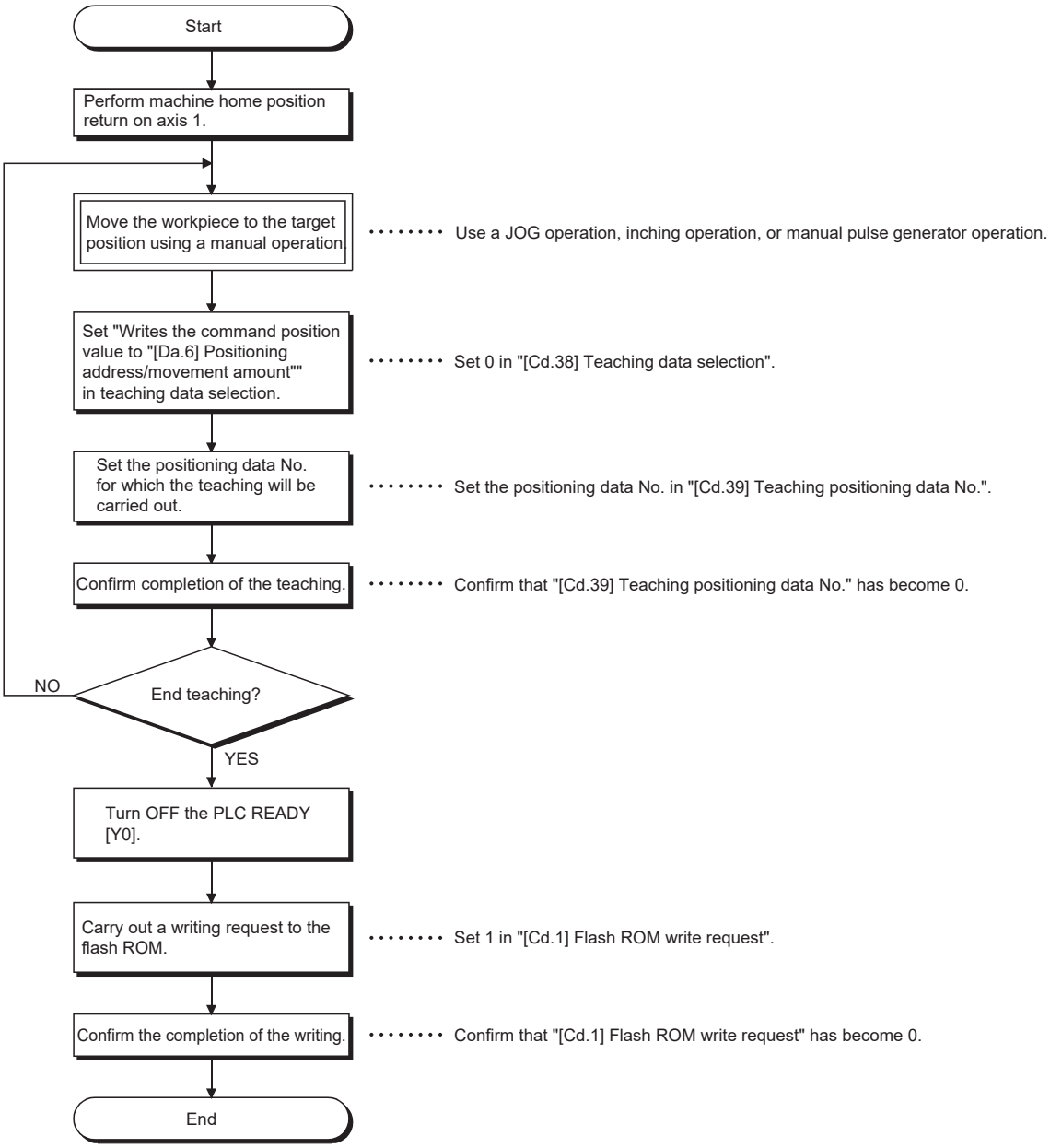
Refer to the following for the setting details.

☞ Page 550 Control Data

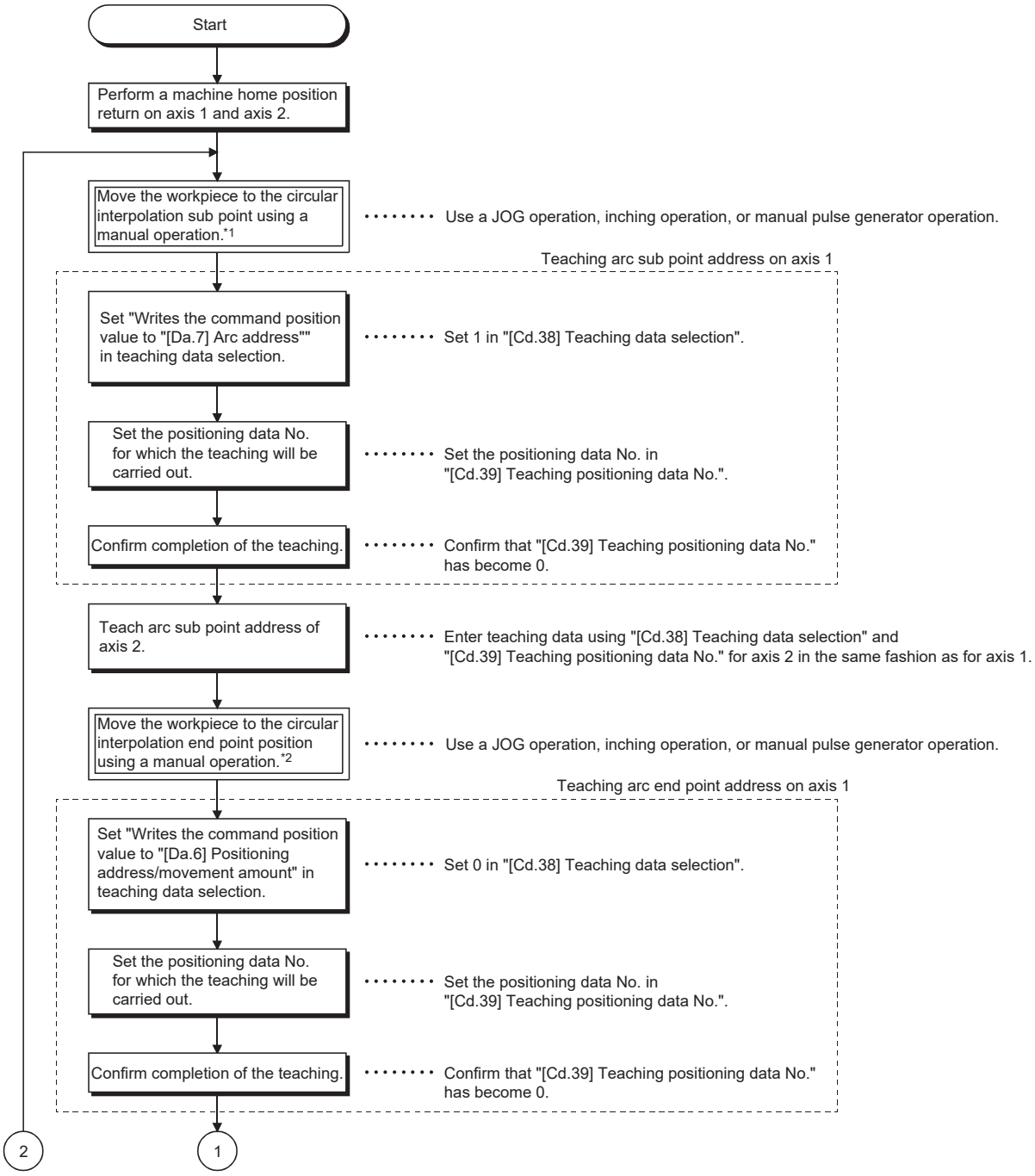
Teaching procedure

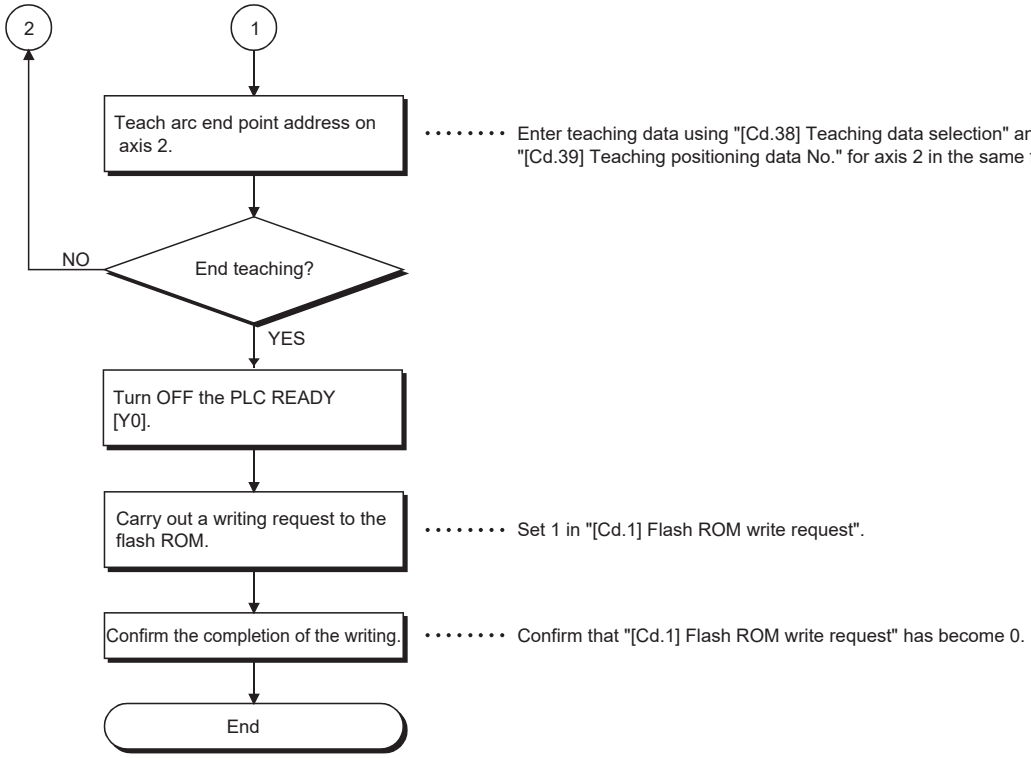
The following shows the procedure for a teaching operation.

- When teaching to "[Da.6] Positioning address/movement amount" (Teaching example on axis 1)

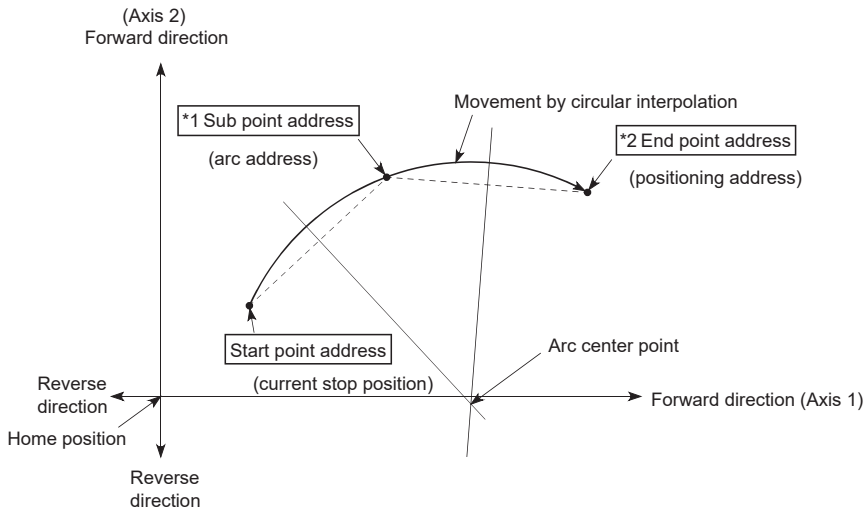


- When teaching to "[Da.7] Arc address", then teaching to "[Da.6] Positioning address/movement amount" (Teaching example for 2-axis circular interpolation control with sub point designation on axis 1 and axis 2)





■Motion path



*1 The sub point address is stored in the arc address.

*2 The end point address is stored in the positioning address.

Teaching program example

The following shows a program example for setting (writing) the positioning data obtained with the teaching function to the Motion module.

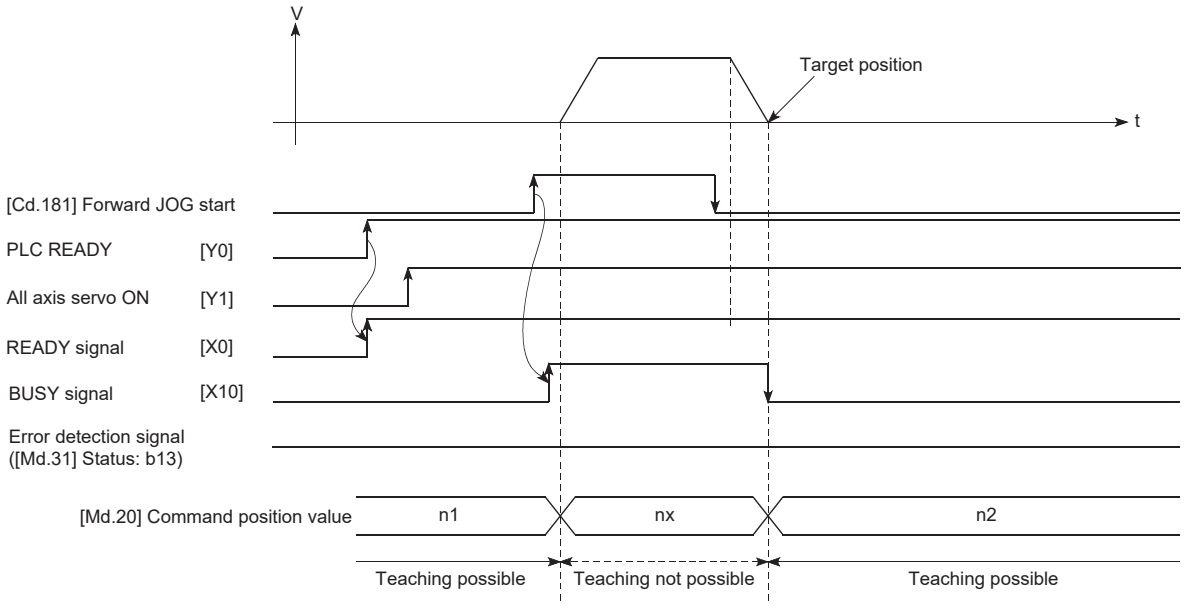
■Setting conditions

When setting the command position value as the positioning address, write it when the BUSY signal is OFF.

■Operation example

The following example shows a program carrying out the teaching of axis 1.

- Move the workpiece to the target position using a JOG operation (or an inching operation, a manual pulse generator operation).



Point

- Confirm the teaching function and teaching procedure before setting the positioning data.
- The positioning addresses that are written are absolute address (ABS) values.
- The positioning data written by the teaching function overwrites the data of buffer memory only. Therefore, read from the buffer memory and write to the flash ROM before turning the power OFF as necessary.

Program example

Refer to the following for the program example.

☞ Page 635 Teaching program

Command in-position function

The "command in-position function" checks the remaining distance to the stop position during the automatic deceleration of positioning control, and sets "1". This flag is called the "command in-position flag". The command in-position flag is used as a front-loading signal indicating beforehand the completion of the position control.

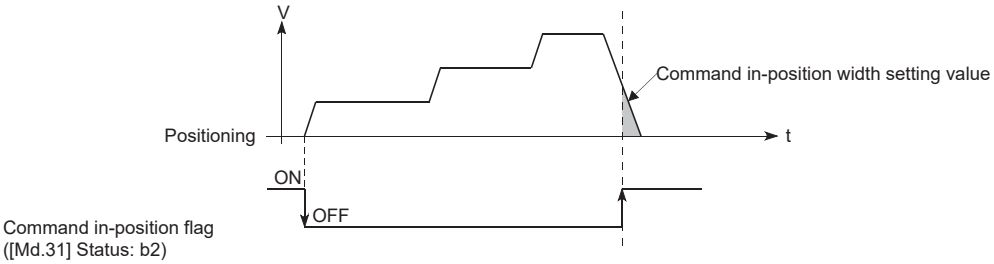
Control details

The following shows control details of the command in-position function.

- When the remaining distance to the stop position during the automatic deceleration of positioning control becomes equal to or less than the value set in "[Pr.16] Command in-position width", "1" is stored in the command in-position flag ([Md.31] Status: b2).

■Command in-position width check

Remaining distance ≤ "[Pr.16] Command in-position width" setting value

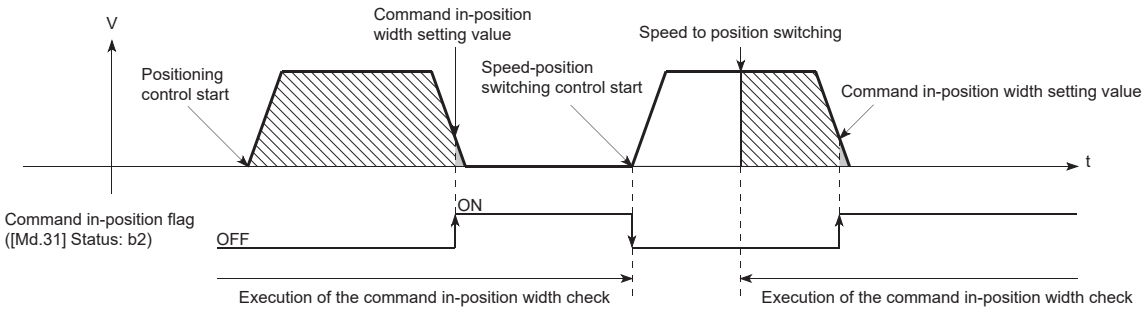


- A command in-position width check is carried out every operation cycle.

Precautions during control

- A command in-position width check will not be carried out in the following cases.

- During speed control
- During speed control in speed-position switching control
- During speed control in position-speed switching control
- During speed control mode
- During torque control mode
- During continuous operation to torque control mode



- The command in-position flag will be turned OFF in the following cases. ("0" will be stored in "[Md.31] Status: b2".)

- At the positioning control start
- At the speed control start
- At the speed-position switching control, position-speed switching control start
- At the home position return control start
- At the JOG operation start
- At the inching operation start
- When the manual pulse generator operation is enabled

- "[Pr.16] Command in-position width" and command in-position flag ([Md.31] Status: b2) of the reference axis are used during interpolation control. When "[Pr.20] Interpolation speed designation method" is "Composite speed", the command in-position width check is carried out in the remaining distance on the composite axis (line/arc connecting the start point address and end point address).

Setting method

To use the "command in-position function", set the required value in the parameter shown in the following table, and write it to the Motion module.

The set data is made valid on the rising edge (OFF to ON) of PLC READY [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.16]	Command in-position width	→	Turn ON the command in-position flag, and set the remaining distance to the stop position of the position control.	100

Refer to the following for the setting details.

☞ Page 448 Basic Setting

Confirming the command in-position flag

The "command in-position flag" is stored in the following buffer memory.

n: Axis No. - 1

Monitor item		Monitor value	Storage details	Buffer memory address
				Axis 1 to axis 16
[Md.31]	Status	→	The command in-position flag is stored in the "b2" position.	2417+100n

Refer to the following for information on the storage details.

☞ Page 515 Monitor Data

Point

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

Acceleration/deceleration processing function

The "acceleration/deceleration processing function" adjusts the acceleration/deceleration of each control to the acceleration/deceleration curve suitable for device.

Setting the acceleration/deceleration time changes the slope of the acceleration/deceleration curve.

The following two methods can be selected for the acceleration/deceleration curve:

- Trapezoidal acceleration/deceleration
- S-curve acceleration/deceleration

Refer to the following for acceleration/deceleration processing of speed-torque control.

☞ Page 196 Speed-torque Control

"Acceleration/deceleration time 0 to 3" control details and setting

In the Motion module, four types each of acceleration time and deceleration time can be set. By using separate acceleration/deceleration times, control can be carried out with different acceleration/deceleration times for positioning control, JOG operation, and home position return.

Set the required values for the acceleration/deceleration time in the parameters shown in the following table, and write them to the Motion module.

The set details are validated when written to the Motion module.

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.9]	Acceleration time 0	→	Set the acceleration time at a value within the range of 1 to 8388608ms.	1000
[Pr.25]	Acceleration time 1	→		1000
[Pr.26]	Acceleration time 2	→		1000
[Pr.27]	Acceleration time 3	→		1000
[Pr.10]	Deceleration time 0	→	Set the deceleration time at a value within the range of 1 to 8388608ms.	1000
[Pr.28]	Deceleration time 1	→		1000
[Pr.29]	Deceleration time 2	→		1000
[Pr.30]	Deceleration time 3	→		1000

Refer to the following for the setting details.

☞ Page 448 Basic Setting

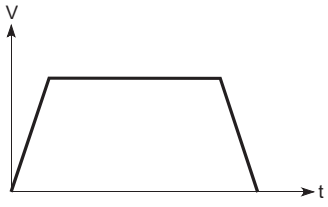
"Acceleration/deceleration method setting" control details and setting

In the "acceleration/deceleration method setting", the acceleration/deceleration processing method is selected and set. The set acceleration/deceleration processing is applied to all acceleration/deceleration. (except for inching operation, manual pulse generator operation and speed-torque control.)

The two types of "acceleration/deceleration processing method" are shown below.

■Trapezoidal acceleration/deceleration processing method

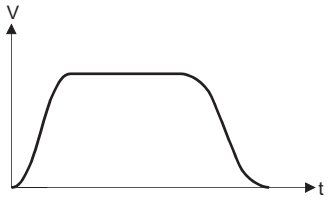
This is a method in which linear acceleration/deceleration is carried out based on the acceleration time, deceleration time, and speed limit value set by the user.



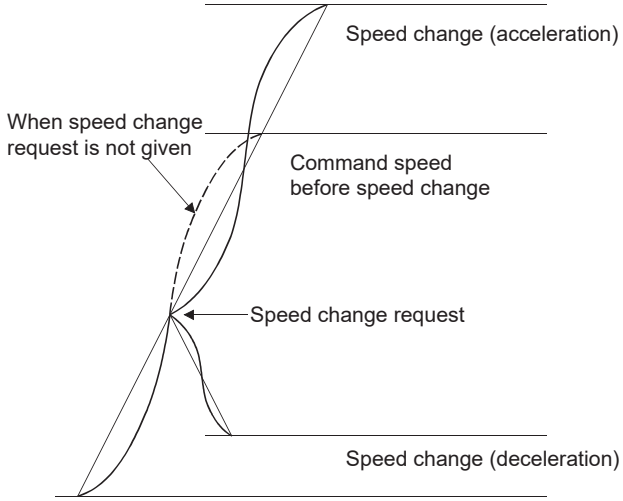
■S-curve acceleration/deceleration processing method

In this method, the motor burden is reduced during starting and stopping.

This is a method in which acceleration/deceleration is carried out gradually, based on the acceleration time, deceleration time, speed limit value, and "[Pr.35] S-curve ratio" (1 to 100%) set by the user.



When a speed change request or override request is given during S-curve acceleration/deceleration processing, S-curve acceleration/deceleration processing begins at a speed change request or override request start.



Set the required values for the "acceleration/deceleration method setting" in the parameters shown in the following table, and write them to the Motion module.

The set details are validated when written to the Motion module.

Setting item		Setting value	Setting details	Factory-set initial value
[Pr.34]	Acceleration/deceleration process selection	→	Set the acceleration/deceleration method. 0: Trapezoidal acceleration/deceleration processing 1: S-curve acceleration/deceleration processing	0
[Pr.35]	S-curve ratio	→	Set the acceleration/deceleration curve when "1" is set in "[Pr.34] Acceleration/deceleration process selection".	100

Refer to the following for the setting details.

☞ Page 448 Basic Setting

Point

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with the engineering tool. Execution by a program uses many programs and devices. The execution becomes complicated, and the scan times will increase.

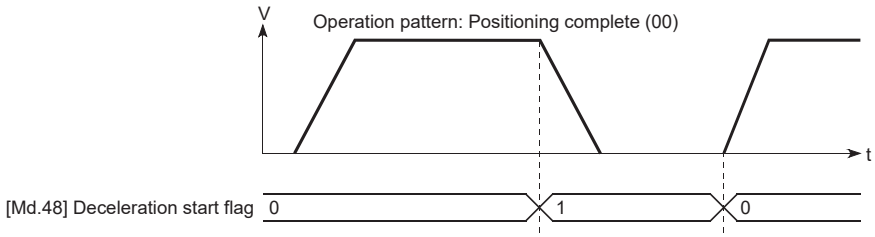
Deceleration start flag function

The "deceleration start flag function" turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control whose operation pattern is "Positioning complete". This function can be used as a signal to start the operation to be performed by other equipment at each end of position control or to perform preparatory operation, etc. for the next position control.

Control details

When deceleration for a stop is started in the position control whose operation pattern is "Positioning complete", "1" is stored into "[Md.48] Deceleration start flag". When the next operation start is made or the manual pulse generator operation enable status is gained, "0" is stored. (Reference to the figure below)

■Start made with positioning data No. specified



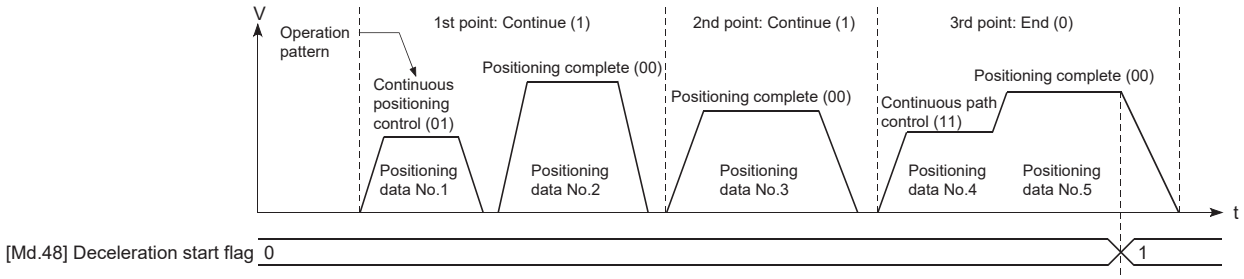
■Block start

At a block start, this function is valid for only the position control whose operation pattern is "Positioning complete" at the point whose shape has been set to "End". (Reference to the figure below)

The following table indicates the operation of the deceleration start flag in the case of the following block start data and positioning data.

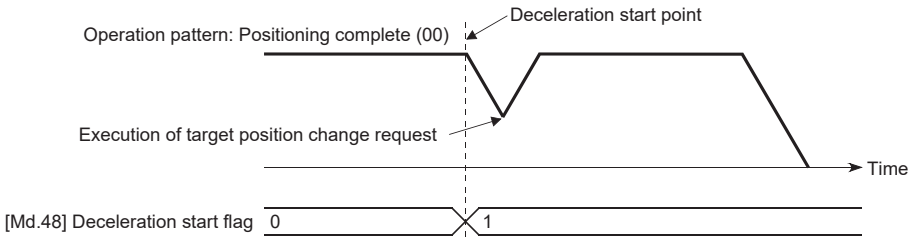
Block start data	[Da.11] Shape	[Da.12] Start data No.	[Da.13] Special start instruction
1st point	1: Continue	1	0: Block start
2nd point	1: Continue	3	0: Block start
3rd point	0: End	4	0: Block start
⋮			

Positioning Data No.	[Da.1] Operation pattern
1	01: Continuous positioning control
2	00: Positioning complete
3	00: Positioning complete
4	11: Continuous path control
5	00: Positioning complete
⋮	

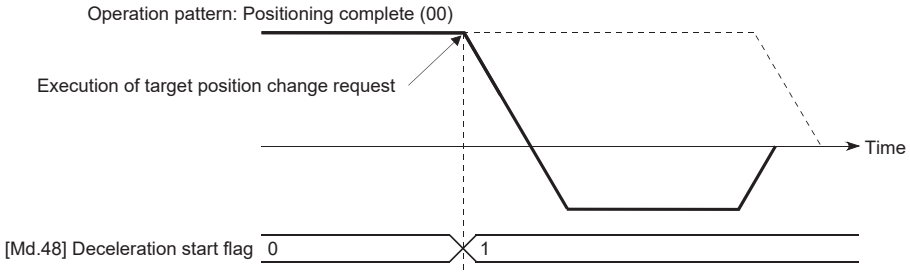


Precautions during control

- The deceleration start flag function is valid for the control method of "1-axis linear control", "2-axis linear interpolation control", "3-axis linear interpolation control", "4-axis linear interpolation control", "speed-position switching control" or "position-speed switching control". In the case of linear interpolation control, the function is valid for only the reference axis. Refer to "Combination of Main Functions and Sub Functions" in the following manual for details.
  MELSEC iQ-R Motion Module User's Manual (Startup)
- The deceleration start flag does not turn ON when the operation pattern is "continuous positioning control" or "continuous path control".
- The deceleration start flag function is invalid for a home position return, JOG operation, inching operation, manual pulse generator operation, speed-torque control and deceleration made with a stop signal.
- The deceleration start flag does not turn ON when a speed change or override is used to make deceleration.
- If a target position change is made while the deceleration start flag is ON, the deceleration start flag remains ON.



- When the movement direction is reversed by a target position change, the deceleration start flag turns ON.



- During position control of position-speed switching control, the deceleration start flag is turned ON by automatic deceleration. The deceleration start flag remains ON if position control is switched to speed control by the position-speed switching signal after the deceleration start flag has turned ON.
- If the condition start of a block start is not made since the condition is not satisfied, the deceleration start flag turns ON when the shape is "End".
- When an interrupt request during continuous operation is issued, the deceleration start flag turns ON at a start of deceleration in the positioning data being executed.

Setting method

To use the "deceleration start flag function", set "1" to the following control data using a program.

The set data is made valid on the rising edge (OFF to ON) of PLC READY [Y0].

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.41]	Deceleration start flag valid	→	Set whether the deceleration start flag function is made valid or invalid. 0: Deceleration start flag invalid 1: Deceleration start flag valid	5905

Refer to the following for the setting details.

☞ Page 550 Control Data

Checking of deceleration start flag

The "deceleration start flag" is stored into the following buffer memory addresses.

n: Axis No. - 1

Monitor item		Monitor value	Storage details	Buffer memory address
				Axis 1 to axis 16
[Md.48]	Deceleration start flag	→	0: Status other than below 1: Status from deceleration start to next operation start or manual pulse generator operation enable	2499+100n

Refer to the following for information on the storage details.

☞ Page 515 Monitor Data

Speed control 10 x multiplier setting for degree axis function

The "Speed control 10 × multiplier setting for degree axis function" is provided to execute the positioning control by 10 × speed of the setting value in the command speed and the speed limit value when the setting unit is "degree".

Control details

When "Speed control 10 multiplier specifying function for degree axis" is valid, this function related to the command speed, monitor data, speed limit value, is shown below.

■Command speed

- Parameters

- "[Pr.7] Bias speed at start"
- "[Pr.46] Home position return speed"
- "[Cd.14] New speed value"
- "[Cd.17] JOG speed"
- "[Cd.25] Position-speed switching control speed change register"
- "[Cd.28] Target position change value (New speed)"
- "[Cd.140] Command speed at speed control mode"
- "[Da.8] Command speed"

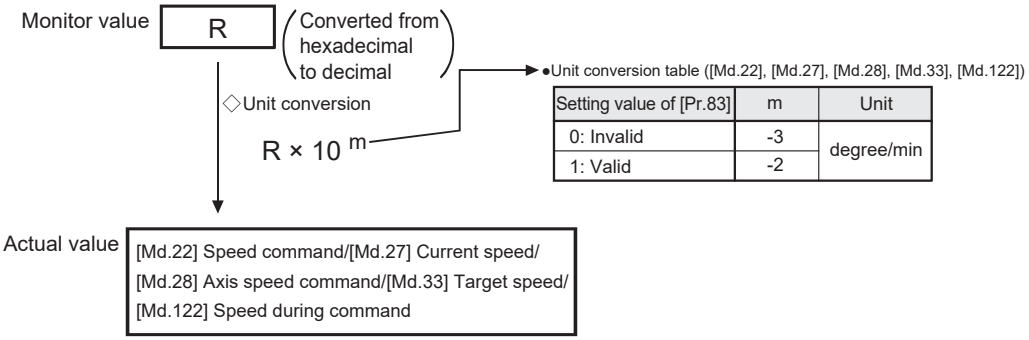
- Major positioning control

- For "2 to 4 axis linear interpolation control" and "2 to 4 axis fixed-feed control", the positioning control is performed at decuple speed of command speed, when "[Pr.83] Speed control 10 × multiplier setting for degree axis" of reference axis is valid.
- For "2 to 4 axis speed control", "[Pr.83] Speed control 10 × multiplier setting for degree axis" is evaluated whether it is valid for each axis. If valid, the positioning control will be performed at decuple speed of command speed.

■Monitor data

- "[Md.22] Speed command"
- "[Md.27] Current speed"
- "[Md.28] Axis speed command"
- "[Md.33] Target speed"
- "[Md.122] Speed during command"

For the above monitoring data, "[Pr.83] Speed control 10 × multiplier setting for degree axis" is evaluated whether it is valid for each axis. If valid, unit conversion value is changed ($\times 10^{-3} \rightarrow \times 10^{-2}$). The unit conversion table of monitor value is shown below.



●Unit conversion table ([Md.22], [Md.27], [Md.28], [Md.33], [Md.122])

Setting value of [Pr.83]	m	Unit
0: Invalid	-3	degree/min
1: Valid	-2	

■Speed limit value

- "[Pr.8] Speed limit value"
- "[Pr.31] JOG speed limit value"
- "[Cd.146] Speed limit value at torque control mode"
- "[Cd.147] Speed limit value at continuous operation to torque control mode"

For the speed limit value, "[Pr.83] Speed control 10 × multiplier setting for degree axis" is evaluated whether it is valid for each axis. If valid, the positioning control will be performed at decuple speed of setting value (max. speed).

Setting method

Set "Valid/Invalid" by "[Pr.83] Speed control 10 × multiplier setting for degree axis".

Normally, the speed specification range is 0.001 to 2000000.000 [degree/min], but it will be decupled and become 0.01 to 20000000.00 [degree/min] by setting "[Pr.83] Speed control 10 × multiplier setting for degree axis" to valid.

To use the "Speed control 10 × multiplier setting for degree axis function", set the parameters shown in the following table.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.83]	Speed control 10 × multiplier setting for degree axis	→	Set the speed control 10 × multiplier setting for degree axis. 0: Invalid 1: Valid	63+150n

Refer to the following for the setting details.

☞ Page 448 Basic Setting

Operation setting for incompletion of home position return function

The "Operation setting for incompletion of home position return function" is provided to select whether positioning control is operated or not when the home position return request flag is ON.

Control details

Possibility of positioning start when "[Pr.55] Operation setting for incompletion of home position return" is valid is shown below.

○: Positioning start possible (Execution possible), ×: Positioning start impossible (Execution not possible)

Positioning control	[Pr.55] Operation setting for incompletion of home position return	
	"0: Positioning control is not executed." and "home position return request flag ON"	"1: Positioning control is executed." and "home position return request flag ON"
• Machine home position return • JOG operation • Inching operation • Manual pulse generator operation • Current value changing using current value changing start No. (No.9003).	○*1	○*1
When the following cases at block start, condition start, wait start, repeated start, multiple axes simultaneous start and pre-reading start • 1-axis linear control • 2/3/4-axis linear interpolation control • 1/2/3/4-axis fixed-feed control • 2-axis circular interpolation control (with sub point designation/center point designation) • 3-axis helical interpolation control (with sub point designation/center point designation) • 1/2/3/4-axis speed control • Speed-position switching control (INC mode/ABS mode) • Position-speed switching control • Current value changing using positioning data No. (No.1 to 600).	×	○*1
Control mode switching	×	○*1

*1 There may be restrictions in the operation for incompletion of home position return depending on the setting or specifications of the servo amplifier. Refer to the servo amplifier instruction manual for details.

Precautions during control

- "Start at home position return incomplete" (error code: 1AA6H) occurs if the home position return request flag ([Md.31] Status: b3) is executed the positioning control by turning on, when "0: Positioning control is not executed" is selected the operation setting for incompletion of home position return setting, and positioning control will not be performed. At this time, operation with the manual control (JOG operation, inching operation, manual pulse generator operation) is available.
- When the home position return request flag ([Md.31] Status: b3) is ON, starting Fast home position return will result in "Home position return request ON" (error code: 1A45H) despite the setting value of "[Pr.55] Operation setting for incompletion of home position return", and Fast home position return will not be performed.

Setting method

To use the "Operation setting for incompletion of home position return", set the following parameters using a program.

n: Axis No. - 1

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Pr.55]	Operation setting for incompletion of home position return	→	Set the operation setting for incompletion of home position return. 0: Positioning control is not executed. 1: Positioning control is executed.	87+150n

Refer to the following for the setting details.

☞ Page 448 Basic Setting

8.9 Servo ON/OFF

Servo ON/OFF

This function executes servo ON/OFF of the servo amplifiers connected to the Motion module.
By establishing the servo ON status with the servo ON command, servo motor operation is enabled.
The following two signals can be used to execute servo ON/OFF.

- All axis servo ON [Y1]
- [Cd.100] Servo OFF command

n: Axis No. - 1

Setting item	Buffer memory address
	Axis 1 to axis 16
[Cd.100] Servo OFF command	4351+100n

A list of the "All axis servo ON [Y1]" and "[Cd.100] Servo OFF command" is given below.
○: Servo ON (Servo operation enabled)
×: Servo OFF (Servo operation disabled)

Setting item		[Cd.100] Servo OFF command			
		Setting value "0"	Command to servo amplifier	Setting value "1"	Command to servo amplifier
All axis servo ON [Y1]	OFF	×	Servo ON command: OFF Ready ON command: OFF	×	Servo ON command: OFF Ready ON command: OFF
	ON	○	Servo ON command: ON Ready ON command: ON	×	Servo ON command: OFF Ready ON command: ON

Point

When the delay time of "Electromagnetic brake sequence output (PC02)" is used, execute the servo ON to OFF by "[Cd.100] Servo OFF command". (When all axis servo ON [Y1] is turned ON to OFF, set "1" in "[Cd.100] Servo OFF command" and execute the servo OFF. Then, turn off [Y1] after delay time passes.)
Refer to each servo amplifier instruction manual for details of servo ON command OFF and ready ON command OFF from Motion module.

After the initial communication with the servo amplifier completes, the status will not change to servo ON in the following cases.

- "Servo parameter invalid" (error code: 1DC8H) is occurring.*1
- The current value restoration is not completed.*2

*1 Refer to the following for details.
☞ Page 702 Devices Compatible with CC-Link IE TSN

*2 After the initial communication with the servo amplifier completes, restoration of current value is performed by the Motion module. Status of the current value restoration can be checked by the following monitor data.

n: Axis No. - 1

Monitor item		Monitor value	Storage details	Buffer memory address
				Axis 1 to axis 16
[Md.190]	Controller position value restoration complete status	→	Store the controller current value restoration completion status of a connected device. If the current value has been restored using the INC restoration method, "1" is set. If the current value has been restored using the ABS restoration method, "2" is set. If the device is disconnected, "0" is set.	59327+100n

Servo ON (Servo operation enabled)

The following shows the procedure for servo ON.

1. Make sure that the servo amplifier LED indicates "r_" (MR-J5(W)-G).
(The initial value for "All axis servo ON [Y1]" is "OFF".)

2. Set "0" for "[Cd.100] Servo OFF command".

3. Turn ON "All axis servo ON [Y1]".
Now the servo amplifier turns ON the servo (servo operation enabled state). (The servo amplifier LED indicates "r_" (MR-J5(W)-G).)

Servo OFF (Servo operation disabled)

The following shows the procedure for servo OFF.

1. Set "1" for "[Cd.100] Servo OFF command". (The servo amplifier LED indicates "r_" (MR-J5(W)-G).)
(If "[Cd.100] Servo OFF command" set "0" again, after the servo operation enabled.)

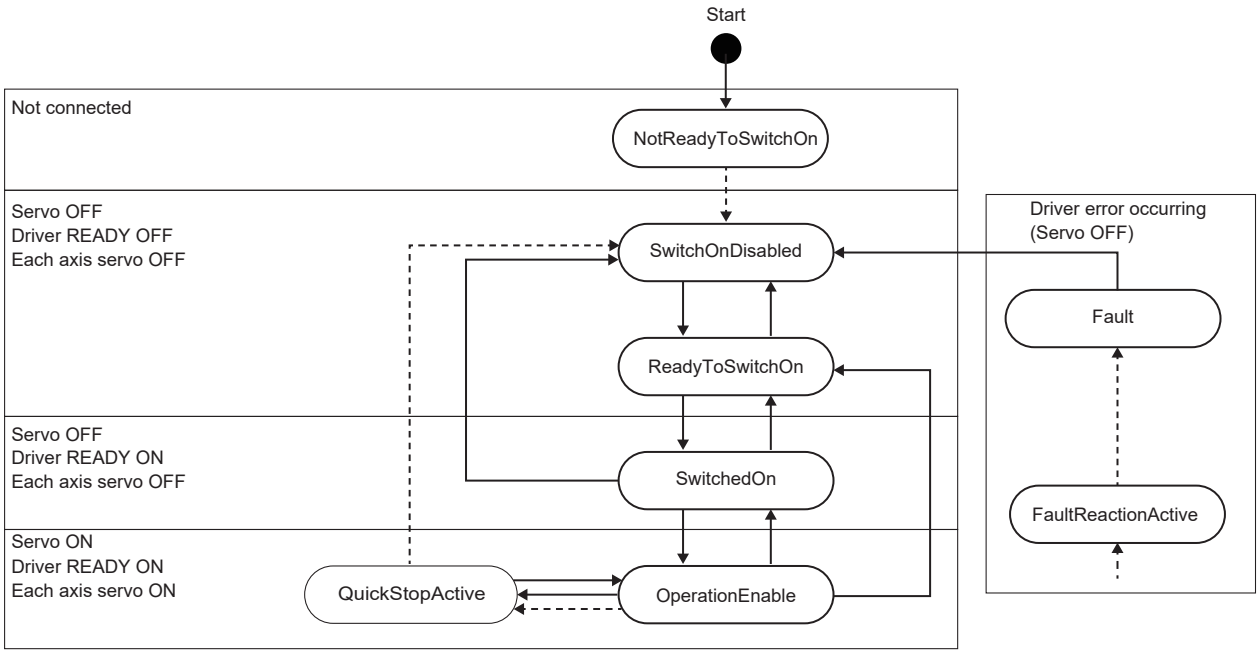
2. Turn OFF "All axis servo ON [Y1]".
(The servo amplifier LED indicates "r_" (MR-J5(W)-G).)

Point

- If the servo motor is rotated by external force during the servo OFF status, follow up processing is performed.
- Change between servo ON or OFF status while operation is stopped (position control mode). The servo OFF command of during positioning in position control mode, manual pulse control, home position return, speed control mode, torque control mode and continuous operation to torque control mode will be ignored.
- When the servo OFF is given to all axes, "All axis servo ON [Y1]" is applied even if all axis servo ON command is turned ON to OFF with "[Cd.100] Servo OFF command" set "0".

PDS status transition

A drive unit connected as an axis operates according to the status transition defined in the following CiA402 drive profile. The Motion module judges whether the servo is ON or OFF according to the current status of drive unit.
For detailed operation in each state, refer to the manual of connected drive unit.



Follow-up function

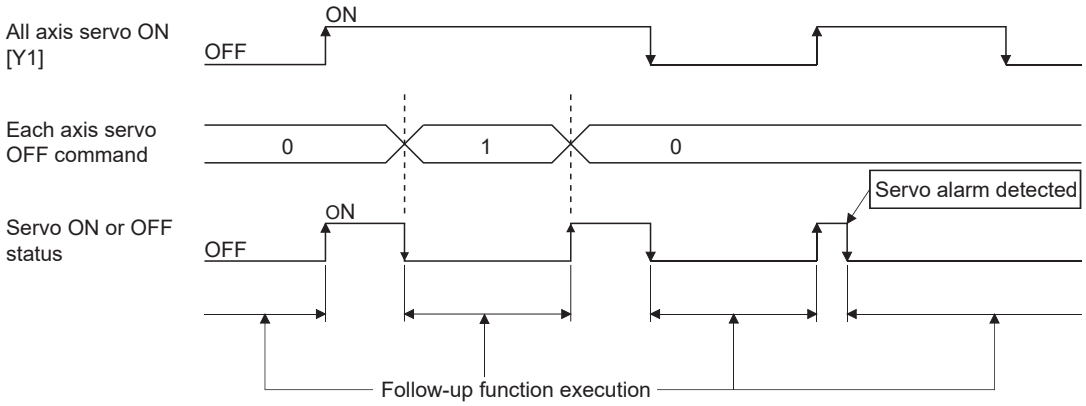
Follow-up function

The follow up function monitors the number of motor rotations (actual position value) with the servo OFF and reflects the value in the command position value.

If the servo motor rotates during the servo OFF, the servo motor will not just rotate for the amount of droop pulses at switching the servo ON next time, so that the positioning can be performed from the stop position.

Execution of follow up

Follow up function is executed continually during the servo OFF status.



Point

The follow up function performs the process if the "Motion module and the servo amplifier is turned ON" and "servo OFF" regardless of the presence of the absolute position system.

In the following case, however, the follow up processing is performed even if the servo is ON.

• When the control mode of the servo amplifier is not supported by the Motion module[*1].

*1 Control modes supported by the Motion module
- Position control mode
- Speed control mode
- Torque control mode
- Continuous operation to torque control mode
- Home position return mode

9 COMMON FUNCTIONS

The details and usage of the "common functions" executed according to the user's requirements are explained in this chapter.
Common functions include functions required when using the Motion module, such as parameter initialization and execution data backup.
Read the setting and execution procedures for each common function indicated in this chapter thoroughly, and execute the appropriate function where required.

9.1 Outline of Common Functions

"Common functions" are executed according to the user's requirements, regardless of the control method, etc.
These common functions are executed by an engineering tool or programs.
The following table shows the functions included in the "common functions".

Common function	Details	Means	
		Program	Engineering tool
Parameter initialization function	This function returns the setting data stored in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of Motion module to the default values.	○	○
Execution data backup function	This function writes the "execution data", currently in use for control, to the flash ROM/internal memory (nonvolatile).	○	○
External input signal select function	This function is used to select from the following signals when using each external input signal of each axis (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP)). • External input signal of servo amplifier • External input signal via CPU (buffer memory) • Link device input signal	○	○
Link device external signal assignment function	This function assigns a link device to an external signal of the Motion module.	○	○
History monitor function	This function monitors start history and current value history of all axes.	—	○
Virtual servo amplifier function	This function executes the operation as the axis (virtual servo amplifier axis) that operates only command (instruction) virtually without servo amplifiers.	○	○
Driver communication function	The function uses "Master-slave operation function" of the servo amplifier. The master axes are controlled by the Motion module and the slave axes are controlled by data communication between servo amplifiers (driver communication) without the Motion module.	○	○
Mark detection function	This function is used to latch any data at the input timing of the mark detection signal (DI).	○	○
Optional data monitor function	This function is used to store the data selected by user up to 4 data per axis to buffer memory and monitor them.	○	○
Event history function	This function takes errors that occur on the Motion module and event information and collects them in the CPU module or saves them to the SD memory card. This function enables to check the error history even after the power OFF or reset by holding the error contents in the CPU module.	—	○
Servo transient transmission function	This function reads and writes objects of devices with transient transmission.	○	—
Test mode	This mode executes the test operation and adjustment of axes using an engineering tool.	—	○

9.2 Parameter Initialization Function

The "parameter initialization function" is used to return the setting data set in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of Motion module to the default values.

Parameter initialization means

- Initialization is executed with a program.
- Initialization is executed by an engineering tool.

Refer to "Help" in the "Simple Motion Module Setting Function" for the execution method by an engineering tool.

Control details

The following table shows the setting data initialized by the "parameter initialization function".
(The data initialized are "buffer memory/internal memory" and "flash ROM/internal memory (nonvolatile)" setting data.)

Target area	
Parameters	Servo network composition parameters
	Common parameters
	Basic parameters
	Detailed parameters
	Home position return basic parameters
	Home position return detailed parameters
	Extended parameters
	Link device external signal assignment parameters
Mark detection	Mark detection setting parameters
Synchronous control parameters	Servo input axis parameters
	Synchronous encoder axis parameters
	Synchronous encoder axis parameters via link device
	Command generation axis parameters
	Command generation axis positioning data
	Synchronous parameters
Positioning data	Positioning data (No.1 to 100)
	Positioning data (No.101 to 600)
Block start data	Block start data (block No.7000 to 7001)
	Condition data (block No.7000 to 7001)
	Block start data (block No.7002 to 7004)
	Condition data (block No.7002 to 7004)
Cam data	

Precautions during control

- Execute parameter initialization only when the positioning control is not carried out (when PLC READY [Y0] is OFF). "In PLC READY" (warning code: 0D05H) will occur if executed when PLC READY [Y0] is ON.
- Writing to the flash ROM is up to 100,000 times. If writing to the flash ROM exceeds 100,000 times, the writing may become impossible, and "Flash ROM write error" (error code: 1A31H) will occur.
- A "CPU module reset" or "CPU module power restart" must be carried out after the parameters are initialized.
- If an error occurs on the parameter set in the Motion module when PLC READY [Y0] is turned ON, the READY signal [X0] will not be turned ON and the control cannot be carried out.

Restriction

Parameter initialization takes approximately 7 seconds. When a short time is assigned to the main cycle*1, initialization may take more than 7 seconds.
Do not turn the power ON/OFF or reset the CPU module during parameter initialization.
If the power is turned OFF or the CPU module is reset to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.

*1 Cycle of processing executed at free time except for the positioning control. It changes by status of axis start.

Parameter initialization method

- Parameter initialization can be carried out by writing the data shown in the table below to the buffer memory of Motion module. The initialization of the parameter is executed at the time point the data is written to the buffer memory of Motion module.

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.2]	Parameter initialization request	1	Set "1: Requests parameter initialization.".	5901

Refer to the following for the setting details.
☞ Page 550 Control Data
When the initialization is complete, "0" will be set in "[Cd.2] Parameter initialization request" by the Motion module automatically

9.3 Execution Data Backup Function

When the buffer memory data of Motion module is rewritten from the CPU module, "the data backed up in the flash ROM/internal memory (nonvolatile)" of Motion module may differ from "the execution data in use for control (buffer memory data)". In this case, the execution data will be lost when the power supply of CPU module is turned OFF.
The "execution data backup function" is used to back up the execution data by writing to the flash ROM/internal memory (nonvolatile). The data backed up will be written to the buffer memory when the power is turned ON next time.

Point

When the Motion module is replaced, all the data in the Motion module including absolute position data can be backed up (read to) in the personal computer and restored to (written to) the Motion module again by using the backup/restore function of an engineering tool. Refer to "Help" in the "Simple Motion Module Setting Function" of the engineering tool for details.

Execution data backup means

- The backup is executed with a program.
- The data is written to the flash ROM by an engineering tool.

Refer to "Help" in the "Simple Motion Module Setting Function" for the flash ROM write method by an engineering tool.

Control details

- The following shows the data that can be written to the flash ROM/internal memory (nonvolatile) using the "execution data backup function".

Target area	
Parameters	Servo network composition parameters
	Common parameters
	Basic parameters
	Detailed parameters
	Home position return basic parameters
	Home position return detailed parameters
	Extended parameters
	Link device external signal assignment parameters
Mark detection	Mark detection setting parameters
Synchronous control parameters	Servo input axis parameters
	Synchronous encoder axis parameters
	Synchronous encoder axis parameters via link device
	Command generation axis parameters
	Command generation axis positioning data
	Synchronous parameters
Positioning data	Positioning data (No.1 to 100)
	Positioning data (No.101 to 600)
Block start data	Block start data (block No.7000 to 7001)
	Condition data (block No.7000 to 7001)
	Block start data (block No.7002 to 7004)
	Condition data (block No.7002 to 7004)

- The module parameters are stored in the CPU module. Therefore, these parameters cannot be backed up in the flash ROM in the Motion module.
- The cam data (cam storage area) is separately saved in the flash ROM/internal memory (nonvolatile). Therefore, it is not a target of the backup function.

Precautions during control

- Data can only be written to the flash ROM when the positioning control is not carried out (when the PLC READY [Y0] is OFF). "In PLC READY" (warning code: 0D05H) will occur if executed when PLC READY [Y0] is ON.
- Writing to the flash ROM can be executed up to 100,000 times. If writing to the flash ROM exceeds 100,000 times, the writing may become impossible, and "Flash ROM write error" (error code: 1A31H) will occur.
- After the power supply is turned ON or the CPU module is reset once, writing to the flash ROM using a program is limited to up to 25 times. If the 26th writing is executed, "Flash ROM write number error" (error code: 1080H) will occur. If this error occurs, carry out the error reset or power OFF → ON/CPU module reset operation again.

Restriction

The writing time to the flash ROM is approximately 5 seconds. When a short time is assigned to the main cycle[*1], writing may take more than 5 seconds.
Do not turn the power ON/OFF or reset the CPU module during executing the flash ROM writing.
If the power is turned OFF or the CPU module is reset to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.

*1 Cycle of processing executed at free time except for the positioning control. It changes by status of axis start.

Execution data backup method

- Refer to the following for the data transmission processing at the backup of the execution data.

☞ Page 591 Data transmission process

- Execution data backup can be carried out by writing the data shown in the table below to the buffer memory of Motion module. The writing to the flash ROM/internal memory (nonvolatile) is executed at the time point the data is written to the buffer memory of Motion module.

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.1]	Flash ROM write request	1	Set "1: Requests write access to flash ROM.".	5900

Refer to the following for the setting details.

☞ Page 550 Control Data

When the writing to the flash ROM/internal memory (nonvolatile) is complete, "0" will be set in "[Cd.1] Flash ROM write request" by the Motion module automatically.

9.4 External Input Signal Select Function

The "external input signal select function" is used to select from the following signals when using each external input signal of each axis (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP)).

- External input signal of servo amplifier
- External input signal via CPU (buffer memory)
- Link device input signal

Setting details

The method for setting the external input signals used in each axis (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP)) is shown below.

Setting item		Initial value	Setting details
[Pr.116]	FLS signal selection	0001H	■Set with a hexadecimal. H _ _ _ _ Input type Set the input type used as the external input signal. 1 (0001H): Servo amplifier*1 2 (0002H): Buffer memory 3 (0003H): Link device*2 15 (000FH): Invalid
[Pr.117]	RLS signal selection	0001H	
[Pr.118]	DOG signal selection	0001H	
[Pr.119]	STOP signal selection	0002H	

*1 The setting is not available in "[Pr.119] STOP signal selection". If it is set, "STOP signal selection error" (error code: 1BD3H) occurs and PLC READY [Y0] is not turned ON.

*2 For details, refer to the following.
☞ Page 325 Link Device External Signal Assignment Function

Point

- When using the MR-J5(W)-G, set the servo parameters as follows.

- Set "Function selection C-G DI status read selection (PC79.0)" to "Eh".
- Set "Function selection D-4 Sensor input method selection (PD41.3)" to "1: Input from controller".
- Set "Function selection D-4 Limit switch enabled status selection (PD41.2)" to "1: Enabled only for homing mode".
- Set "DI pin polarity selection (PD60)" to "00000000h".
- Set "Function selection T-3 Device input polarity 1 (PT29.0)" to "1: Dog detection with ON".

If the above servo parameters are set to different values, "Servo parameter invalid" (error code: 1DC8H) occurs, and the Motion module rewrites the value of said servo parameters to the above values. The servo parameters are enabled after the Motion module or servo amplifier is reset.

- When parameter automatic setting is enabled, the saved parameters are automatically updated. Check the execution result of automatically updating the saved parameters in the event history.
- When "[Pr.95] External command signal selection" is set to use the DOG signal of the axis, the DOG signal of the servo amplifier is used regardless of the setting value of "[Pr.118] DOG signal selection". For details of the logic selection for the signal, refer to the following. ☞ Page 702 Devices Compatible with CC-Link IE TSN
- A virtual servo amplifier cannot be used in an external command. When the axis selected in "[Pr.95] External command signal selection" is a virtual servo amplifier, the setting is invalid.

■When "1: Servo amplifier" is set to the input type

The following table shows the pin No. of the external input signal of the servo amplifier to be used.

Pin No. of servo amplifier*1	Signal name
CN3-2	LSP
CN3-12	LSN
CN3-19	DOG
CN3-20	EM2

*1 This servo amplifier means about MR-J5(W)-_G_(-RJ). For details, refer to the servo amplifier instruction manual to be used.
For MR-J5(W)-G: 📖MR-J5 User's Manual (Hardware)

■When "2: Buffer memory" is set to the input type

Use the control data shown below to operate the external input signals (upper/lower stroke limit signal, proximity dog signal, and stop signal).

Setting item		Setting value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Cd.44]	External input signal operation device	→	Set the status of the upper/lower limit signal, the proximity dog signal and the stop signal.	5928 to 5931

Refer to the following for the setting details.

☞ Page 553 [Cd.44] External input signal operation device

■When "3: Link device" is set to the input type

Refer to the following for the setting details.

☞ Page 325 Link Device External Signal Assignment Function

Input logic setting method for external input signals

The signal logic can be switched according to the external input signals (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), stop signal (STOP), and external command signal/switching signal (DI)) of the servo amplifier or external device connected with the Motion module.

For the system that does not use the upper/lower limit signal with b-contact, this function enables the control without wiring by setting "Positive logic" to the parameter logic setting.

When using the upper/lower limit signal, be sure to use in the negative logic (b-contact).

The logic setting method for external input signals (upper/lower limit signal, proximity dog signal and stop signal) is shown below.

For the interface of the logic selection, the setting area varies depending on the input type and signal type of the external signal.

Input type of "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection"	Signal type	Setting area
1: Servo amplifier	FLS/RLS/DOG	[Pr.22] Input signal logic selection
2: Buffer memory	FLS/RLS/DOG/STOP	
3: Link device	FLS	[Pr.913] Upper limit signal (FLS): Link device logic setting
	RLS	[Pr.923] Lower limit signal (RLS): Link device logic setting
	DOG	[Pr.933] Proximity dog signal (DOG): Link device logic setting
	STOP	[Pr.943] Stop signal (STOP): Link device logic setting

■Parameter setting

Use the following parameter to switch the logic of the external input signals from the servo amplifier and buffer memory (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), stop signal (STOP), and external command/switching signal (DI)).

Setting item		Initial value	Setting details
[Pr.22]	Input signal logic selection	0	Select the logic of the signal which is input to the Motion module from the external device. 0: Negative logic 1: Positive logic (Always "0" is set to the part not used.)

Refer to the following for the setting details.

☞ Page 459 Detailed parameters 1

When the external input signal of the servo amplifier is used, set the same value as the value set in the input logic setting of the servo amplifier. If the value is not same as the value of the input logic setting, the limit signal may be detected during the home position return. For the input logic specification of the servo amplifier, refer to the instruction manual of the servo amplifier to be used.

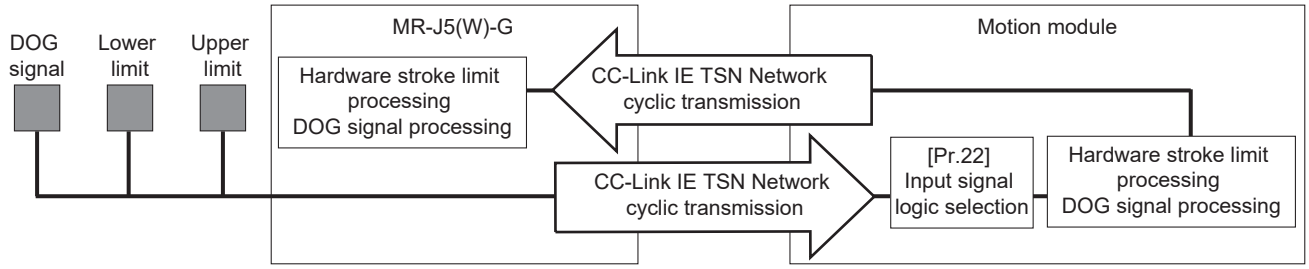
■External input signals when the MR-J5(W)-G is connected

The data sent and received with the external input signal when connecting the Motion module to the MR-J5(W)-G is shown below.

[Flow of upper/lower stroke limit signal (FLS/RLS) and proximity dog signal (DOG)]

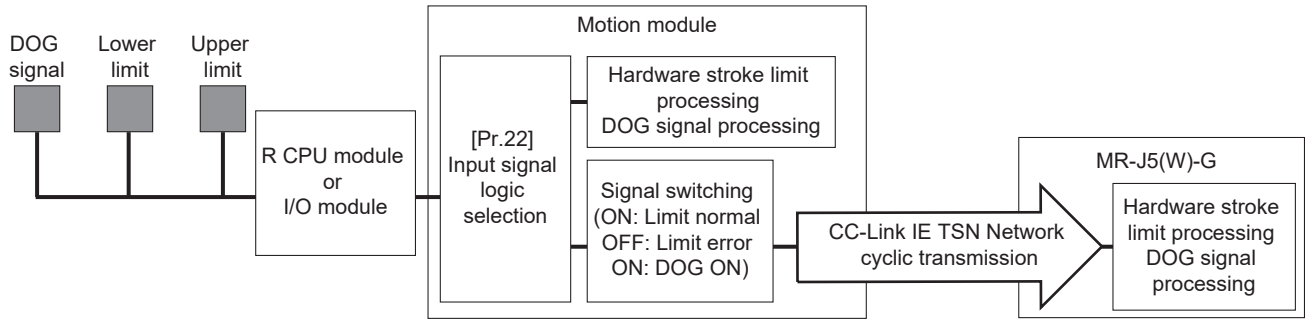
- When the external input signal of the servo amplifier is used

  The inputted command signal is sent from the servo amplifier to the Motion module, following which the stop command or DOG signal is sent to the servo amplifier after the input signal logic selection processing completes in the Motion module.



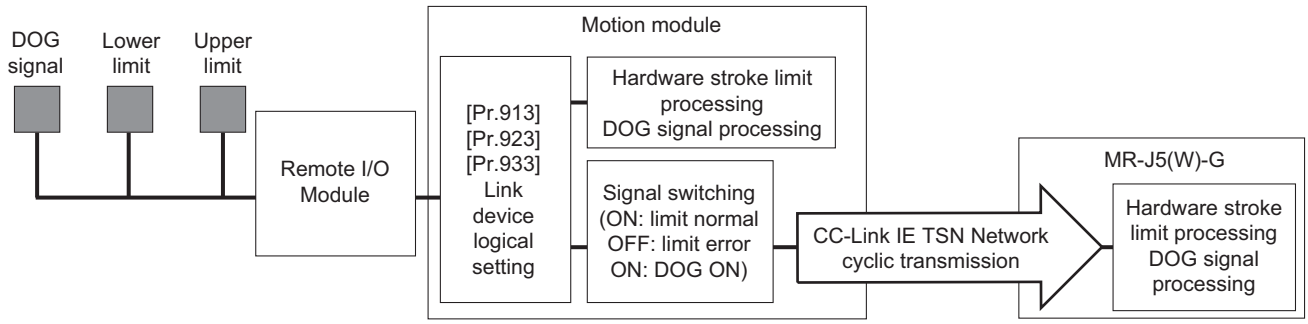
- When other than the external input signal of the servo amplifier is used

  The stop command or DOG signal is sent to the servo amplifier after the input signal logic selection processing completes in the Motion module.



• When using the link device

The upper/lower limit switch signal or the DOG signal is sent to the servo amplifier after the input signal logic selection processing completes in the Motion module.



Remote I/O	→	Motion module		→		→	MR-J5(W)-G
Upper/lower limit signal bit		**[Pr.913]Upper limit signal (FLS): Link device logic setting [Pr.923]Lower limit signal (RLS): Link device logic setting**	**Hardware stroke limit error detection**		**Lower limit signal (RLS)(b0)" and "Upper limit signal(FLS)(b1)" of "[Md.30] External input signal"**		**Hardware stroke limit error detection**
0	→	0: Negative logic	Detect	→	OFF	→	Detect
		1: Positive logic	Not detect		ON		Not detect
1		0: Negative logic	Not detect		ON		Not detect
		1: Positive logic	Detect		OFF		Detect

Remote I/O	→	Motion module		→		→	MR-J5(W)-G	
DOG signal bit		**[Pr.933] Proximity dog signal (DOG): Link device logic setting**	**Processing with proximity dog signal detection**		**"Proximity dog signal (DOG)(b6)" of "[Md.30] External input signal"**		**External input signal logic (Function selection T-3 Device input polarity 1 (PT29.0))**	**Processing with proximity dog signal detection**
0	→	0: Detection at ON	Not proceed	→	OFF	→	1: Dog detection with on	Not proceed
		1: Detection at OFF	Proceed		ON		1: Dog detection with on	Proceed
1		0: Detection at ON	Proceed		ON		1: Dog detection with on	Proceed
		1: Detection at OFF	Not proceed		OFF		1: Dog detection with on	Not proceed

Point

Hardware stroke limit processing and DOG signal processing are executed by reading the signal status of the servo amplifier with the object Digital inputs [Obj. 60FDh] and sending Control DI 5 [Obj. 2D05h] from the controller.

■External input signal via link device, external command signal

The following parameters are used for logic switching when various external input signals and external command signals are input from the link device of the CC-Link IE TSN network.

Signal type		Setting item		Initial value	Setting details*1
External input signals*2	Forced stop signal (EMI)	[Pr.903]	Forced stop signal (EMI): Link device logic setting	0	0: Negative logic 1: Positive logic
	Upper limit signal (FLS)	[Pr.913]	Upper limit signal (FLS): Link device logic setting	0	
	Lower limit signal (RLS)	[Pr.923]	Lower limit signal (RLS): Link device logic setting	0	
	Proximity dog signal (DOG)	[Pr.933]	Proximity dog signal (DOG): Link device logic setting	0	0: Detection at ON 1: Detection at OFF
	Stop signal (STOP)	[Pr.943]	Stop signal (STOP): Link device logic setting	0	
External command signals	External positioning start request	[Pr.953]	External positioning start request: Link device logic setting	0	
	External speed change request	[Pr.963]	External speed change request: Link device logic setting	0	
	Skip request	[Pr.973]	Skip request: Link device logic setting	0	
	Block No.7000 start request	[Pr.1023]	Block No.7000 start request: Link device logic setting	0	
	Block No.7001 start request	[Pr.1033]	Block No.7001 start request: Link device logic setting	0	
	Block No.7002 start request	[Pr.1043]	Block No.7002 start request: Link device logic setting	0	
	Block No.7003 start request	[Pr.1053]	Block No.7003 start request: Link device logic setting	0	
	Block No.7004 start request	[Pr.1063]	Block No.7004 start request: Link device logic setting	0	
	Speed-position control switching request	[Pr.983]	Speed-position control switching request: Link device logic setting	0	0: Detection at ON 1: Detection at OFF 2: Detection at leading edge 3: Detection at trailing edge
	Main shaft clutch control request (ON control mode)	[Pr.993]	Main shaft clutch control request (ON control mode): Link device logic setting	0	
	Main shaft clutch control request (OFF control mode)	[Pr.998]	Main shaft clutch control request (OFF control mode): Link device logic setting	0	
	Auxiliary shaft clutch control request (ON control mode)	[Pr.1003]	Auxiliary shaft clutch control request (ON control mode): Link device logic setting	0	
	Auxiliary shaft clutch control request (OFF control mode)	[Pr.1008]	Auxiliary shaft clutch control request (OFF control mode): Link device logic setting	0	
	Synchronous encoder axis start request	[Pr.1013]	Synchronous encoder axis start request: Link device logic setting	0	0: Negative logic 1: Positive logic 2: Detection at trailing edge 3: Detection at leading edge
	Mark detection input signal	[Pr.811]	Mark detection signal detection direction setting	0	0: Detection at leading edge 1: Detection at trailing edge

Setting item		Initial value	Setting details*3
[Pr.22]	Input signal logic selection	0	Select the logic of the signal to be input to the Motion module from the outside. 0: Negative logic 1: Positive logic • b0: Lower limit • b1: Upper limit • b3: Stop signal • b6: Proximity dog signal

*1 For the setting details, refer to the following.
☞ Page 325 Link Device External Signal Assignment Function

*2 For the logic setting of the external input signals, refer to the following.
☞ Page 702 Devices Compatible with CC-Link IE TSN

*3 For the setting details, refer to the following.
☞ Page 459 Detailed parameters 1

■Precautions on parameter setting

- The logic switching parameters are validated when PLC READY [Y0] is turned OFF to ON. (The logic is negative right after power-on.)
- If the logic of each signal is set erroneously, the operation may not be carried out correctly. Before setting, check the specifications of the equipment to be used.

Input filter setting method for external input signals

The input filter is used to suppress chattering when the external input signal is chattering by noise, etc.
The setting area of the input filter varies by the input type of "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection".

Input type of "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection"	Setting area
1: Servo amplifier	Input filter of the servo amplifier*1
2: Buffer memory	No setting (No input filter when the buffer memory is set.)
3: Link device	Set at the device station.

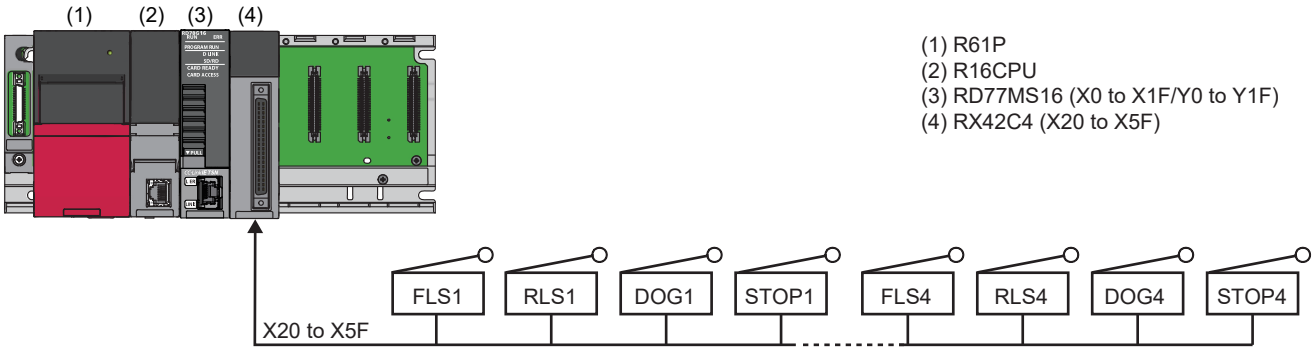
*1 In the case of MR-J5(W)-G, set by the servo parameter "Input filter setting (PD11)".
For details, refer to the manual of the servo amplifier.
MR-J5-G/MR-J5W-G User's Manual (Parameters)

Program

The following shows the program example to operate "[Cd.44] External input signal operation device" of axis 1, axis 4, axis 8, and axis 16 using the limit switch connected to the input module when "2: Buffer memory" is set in "[Pr.116] FLS signal selection" to "[Pr.119] STOP signal selection".

■System configuration

The following figure shows the system configuration used for the program examples.



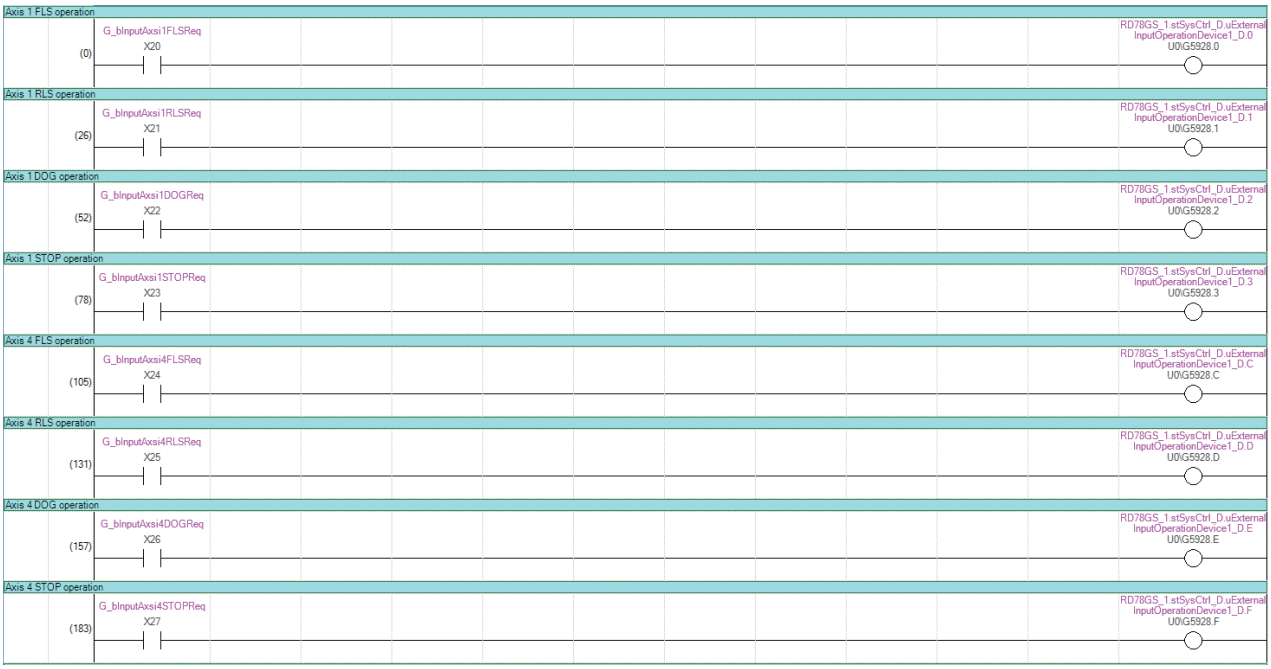
■List of labels to be used

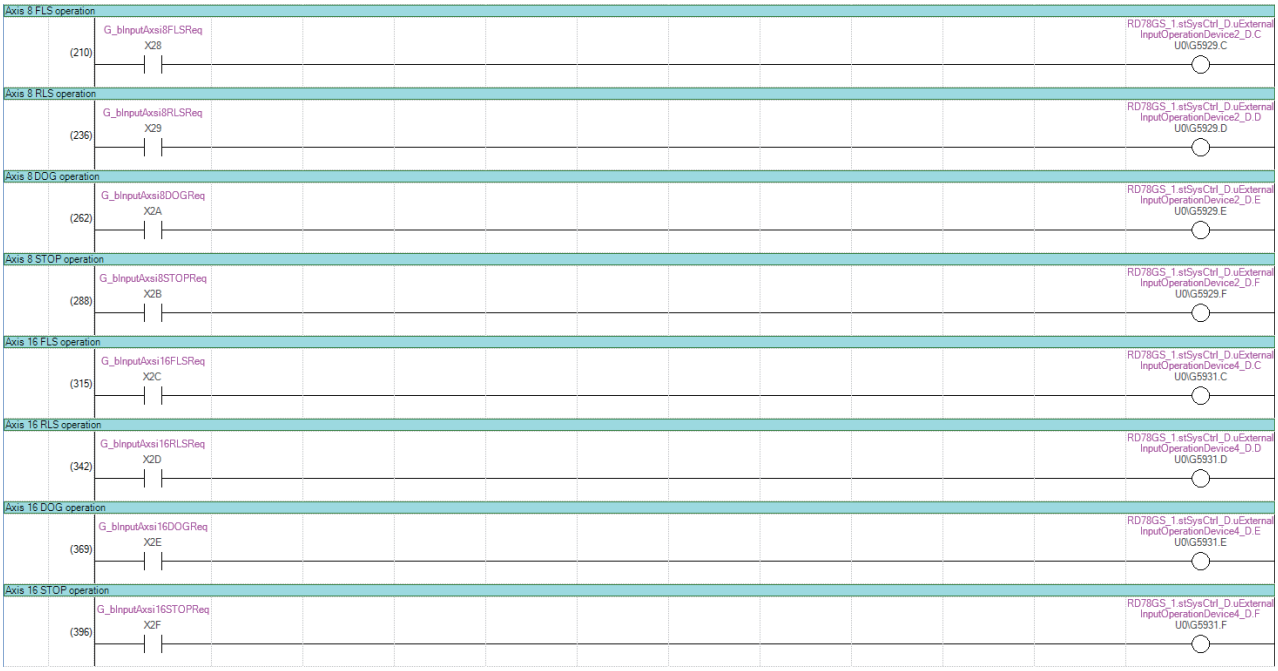
In the program examples, the labels to be used are assigned as follows.

Classification	Label name	Description
Module label	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice1_D.0	Axis 1 FLS
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice1_D.1	Axis 1 RLS
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice1_D.2	Axis 1 DOG
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice1_D.3	Axis 1 STOP
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice1_D.C	Axis 4 FLS
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice1_D.D	Axis 4 RLS
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice1_D.E	Axis 4 DOG
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice1_D.F	Axis 4 STOP
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice2_D.C	Axis 8 FLS
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice2_D.D	Axis 8 RLS
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice2_D.E	Axis 8 DOG
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice2_D.F	Axis 8 STOP
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice4_D.C	Axis 16 FLS
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice4_D.D	Axis 16 RLS
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice4_D.E	Axis 16 DOG
	RD78GS_1.stSysCtrl_D.uExternalInputOperationDevice4_D.F	Axis 16 STOP
Global label	Defines the global labels to set the assignment device as follows.	

	Label Name	Data Type		Class	Assign (Device/Label)
1	G_bInputAxsi1FLSReq	Bit	...	VAR_GLOBAL	X20
2	G_bInputAxsi1RLSReq	Bit	...	VAR_GLOBAL	X21
3	G_bInputAxsi1DOGReq	Bit	...	VAR_GLOBAL	X22
4	G_bInputAxsi1STOPReq	Bit	...	VAR_GLOBAL	X23
5	G_bInputAxsi4FLSReq	Bit	...	VAR_GLOBAL	X24
6	G_bInputAxsi4RLSReq	Bit	...	VAR_GLOBAL	X25
7	G_bInputAxsi4DOGReq	Bit	...	VAR_GLOBAL	X26
8	G_bInputAxsi4STOPReq	Bit	...	VAR_GLOBAL	X27
9	G_bInputAxsi8FLSReq	Bit	...	VAR_GLOBAL	X28
10	G_bInputAxsi8RLSReq	Bit	...	VAR_GLOBAL	X29
11	G_bInputAxsi8DOGReq	Bit	...	VAR_GLOBAL	X2A
12	G_bInputAxsi8STOPReq	Bit	...	VAR_GLOBAL	X2B
13	G_bInputAxsi16FLSReq	Bit	...	VAR_GLOBAL	X2C
14	G_bInputAxsi16RLSReq	Bit	...	VAR_GLOBAL	X2D
15	G_bInputAxsi16DOGReq	Bit	...	VAR_GLOBAL	X2E
16	G_bInputAxsi16STOPReq	Bit	...	VAR_GLOBAL	X2F
17			...		

Program example





9.5 Link Device External Signal Assignment Function

This function assigns link devices to the external signals of the Motion module.
Signals such as the upper/lower limit signal and proximity dog signal can be assigned to link devices.

Point

- The following are available in Add-on SimpleMotion version "Ver.1.33" or later.
  - Synchronous encoder via link device
  - Mark detection (link device input)
- The following are available in Add-on SimpleMotion version "Ver.1.35" or later.
  - Forced stop signal (EMI)
  - Upper limit signal (FLS)
  - Lower limit signal (RLS)
  - Proximity dog signal (DOG)
  - Stop signal (STOP)
  - External positioning start request
  - External speed change request
  - Skip request
  - Speed-position control switching request
  - Main shaft clutch control request (ON control mode/OFF control mode)
  - Auxiliary shaft clutch control request (ON control mode/OFF control mode)
  - Block No.7001 start request to Block No.7004 start request

Signals that can be assigned

The following signals used in the Motion module can be assigned to the link devices of the CC-Link IE TSN Network. The same link device can be assigned to multiple external signals.

■Bit device

- External input signal

○: Setting possible, ×: Setting not possible

External signal	RX			RY			RWr			RWw			Settable points
	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	
Forced stop signal (EMI)	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 module*1
Upper limit signal (FLS)	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Lower limit signal (RLS)	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Proximity dog signal (DOG)	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Stop signal (STOP)	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis

*1 Only the setting value for the axis 1 is valid.

• External command signal

○: Setting possible, ×: Setting not possible

External signal	RX			RY			RWr			RWw			Settable points
	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	
External positioning start request	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
External speed change request	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Skip request	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Speed-position control switching request*1	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Main shaft clutch control request (ON control mode/ OFF control mode)*1	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Auxiliary shaft clutch control request (ON control mode/ OFF control mode)*1	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Synchronous encoder axis start request*1*2	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Block No.7000 start request*3	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Block No.7001 start request*3	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Block No.7002 start request*3	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Block No.7003 start request*3	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Block No.7004 start request*3	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 axis
Input signal for mark detection*1*4	○	×	×	○	×	×	○	×	×	○	×	×	1 point/1 mark detection setting

*1 High accuracy operation using synchronous input timing information is performed only when the following conditions are satisfied. If the following conditions are not satisfied, the accuracy is that of the operation cycle.
In the high accuracy operation, the signal detection is judged based on the synchronous input timing information. Therefore, if the external command signal X is turned OFF→ON→OFF/ON→OFF→ON within 1 synchronous cycle, the rise and fall of the signal are detected. At this time, the following monitors are turned ON for 1 operation cycle only.
- Synchronous encoder axis start request: [Md.325] Synchronous encoder axis status "b6: Start request flag"
- Input signal for mark detection: No monitor
- Other external command signals: [Md.900] Link device external command signal monitor

Refer to the following for a setting example.
☞ Page 337 Setting example of high accuracy input using synchronous input timing information of remote I/O
📖CC-Link IE Field Network Remote I/O Module User's Manual
[Conditions for possible high accuracy]
- The RX of a Mitsubishi Electric remote input module that supports the synchronous timing control mode is assigned.
- The synchronous timing control mode is enabled.
- The synchronous input timing information of the input signal to be used is link-refreshed. (The link device used in the synchronous timing information is assigned.)

*2 Set by synchronous encoder axis parameters via link device. For details, refer to "Synchronous Encoder Axis" in the following manual.
📖MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

*3 Block No. 7000 to 7004 start requests can be used to initiate a block start directly from any link device. For details, refer to the following.
☞ Page 20 Start

*4 Set by mark detection setting parameters. Refer to the following for details.
☞ Page 359 Mark Detection Function

■Word device

• External input signal

○: Setting possible, ×: Setting not possible

External signal	RX			RY			RWr			RWw			Settable points
	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	1 bit	1 word	2 words	
Synchronous encoder input*1*2	×	○	○	×	○	○	×	○	○	×	○	○	1 point/1 axis

*1 When assigning RX/RY, the setting is made in units of 16 points.

*2 Set by synchronous encoder axis parameters via link device. For details, refer to "Synchronous Encoder Axis" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

Operation in case of data link error during communication

■Bit device

Signals are as follows regardless of the logical setting.

External signal	Operation details
Forced stop signal	Forced stop of all axes of the servo amplifier.
Upper/lower limit signal	Outside the upper/lower limit range.
Proximity dog signal	The proximity dog signal becomes invalid.
Stop signal	The control of the axis is stopped.
Main shaft/auxiliary shaft clutch control request	ON control mode: Main shaft/auxiliary shaft clutch control request (ON control mode) is always treated as undetected. OFF control mode: Main shaft/auxiliary shaft clutch control request (OFF control mode) is always treated as detected.
Other signals	No request is made.

■Word device

Synchronous encoder axis: When the connection is in progress, the connection is disabled.

Setting method

Set this function with link device external signal assignment parameters. Refer to the following for details on each setting.

☞Page 333 Related buffer memory

☞Page 431 List of Buffer Memory Addresses

For the setting method of the mark detection input signal, refer to the following.

☞Page 359 Mark Detection Function

For the setting method of the synchronous encoder axis start request and the synchronous encoder input, refer to "Synchronous Encoder Axis" in the following manual.

MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

■Forced stop signal

Set the following for the forced stop signal.

• Set to use the link device for the forced stop signal.

Item		Details	Buffer memory address
			Axis 1 to axis 16
[Pr.82]	Forced stop valid/invalid selection	Set "3: Valid (Link device)".*1	35

*1 If "3: Valid (Link device)" is set in "[Pr.82] Forced stop valid/invalid selection", and the link device external signal assignment parameter is not set, "Forced stop signal link device incorrect configuration" (error code: 1F13H) occurs, and the READY signal [X0] does not turn ON.

• Set the link device external signal assignment parameter to be used as the forced stop signal.

n: Axis No. - 1

Item		Details	Buffer memory address
			Axis 1 to axis 16
[Pr.900]	Forced stop signal (EMI): Link device type	Set the link device type for use.	440000+320n
[Pr.901]	Forced stop signal (EMI): Link device start No.	Set the link device No. for use.	440001+320n
[Pr.902]	Forced stop signal (EMI): Link device bit specification	Set the bit No. that is used when "13H: RWr" and "14H: RWw" are set to the link device type.	440002+320n
[Pr.903]	Forced stop signal (EMI): Link device logic setting	Set the logic for assignment signal. • 0: Negative logic • 1: Positive logic	440003+320n

■FLS signal, RLS signal

Set the FLS signal and the RLS signal of the corresponding axis as follows.

• Set the corresponding signal to use the link device and set the corresponding signal logic.

n: Axis No. - 1

Item		Details	Buffer memory address
			Axis 1 to axis 16
[Pr.116]	FLS signal selection	Set "3: Link device".*1	116+150n
[Pr.117]	RLS signal selection		117+150n

*1 If "3: Link device" is set in "[Pr. 116] FLS signal selection" and "[Pr. 117] RLS signal selection", and the link device external signal assignment parameter is not set, "FLS signal link device incorrect configuration" (error code: 1F14H) or "RLS signal link device incorrect configuration" (error code: 1F15H) occurs, and the READY signal [X0] does not turn ON.

• Set the link device external signal assignment parameter to be used as the corresponding signal.

n: Axis No. - 1

Item		Details	Buffer memory address
			Axis 1 to axis 16
[Pr.910]	Upper limit signal (FLS): Link device type	Set the link device type for use.	440010+320n
[Pr.920]	Lower limit signal (RLS): Link device type		440020+320n

Item		Details	Buffer memory address
			Axis 1 to axis 16
[Pr.911]	Upper limit signal (FLS): Link device start No.	Set the link device No. for use.	440011+320n
[Pr.921]	Lower limit signal (RLS): Link device start No.		440021+320n
[Pr.912]	Upper limit signal (FLS): Link device bit specification	Set the bit No. that is used when "13H: RWr" and "14H: RWw" are set to the link device type.	440012+320n
[Pr.922]	Lower limit signal (RLS): Link device bit specification		440022+320n
[Pr.913]	Upper limit signal (FLS): Link device logic setting	Set the logic for assignment signal. • 0: Negative logic • 1: Positive logic	440013+320n
[Pr.923]	Lower limit signal (RLS): Link device logic setting		440023+320n

■DOG signal, STOP signal

Set the DOG signal and the STOP signal of the corresponding axis as follows.

• Set the corresponding signal to use the link device and set the corresponding signal logic.

n: Axis No. - 1

Item		Details	Buffer memory address
			Axis 1 to axis 16
[Pr.118]	DOG signal selection	Set "3: Link device".*1	118+150n
[Pr.119]	STOP signal selection		119+150n

*1 If "3: Link device" is set in "[Pr. 118] DOG signal selection" and "[Pr. 119] STOP signal selection", and the link device external signal assignment parameter is not set, "DOG signal link device incorrect configuration" (error code: 1F16H) or "STOP signal link device incorrect configuration" (error code: 1F17H) occurs, and the READY signal [X0] does not turn ON.

• Set the link device external signal assignment parameter to be used as the corresponding signal.

n: Axis No. - 1

Item		Details	Buffer memory address
			Axis 1 to axis 16
[Pr.930]	Proximity dog signal (DOG): Link device type	Set the link device type for use.	440030+320n
[Pr.940]	Stop signal (STOP): Link device type		440040+320n
[Pr.931]	Proximity dog signal (DOG): Link device start No.	Set the link device No. for use.	440031+320n
[Pr.941]	Stop signal (STOP): Link device start No.		440041+320n
[Pr.932]	Proximity dog signal (DOG): Link device bit specification	Set the bit No. that is used when "13H: RWr" and "14H: RWw" are set to the link device type.	440032+320n
[Pr.942]	Stop signal (STOP): Link device bit specification		440042+320n
[Pr.933]	Proximity dog signal (DOG): Link device logic setting	Set the logic for assignment signal. • 0: Detection at ON • 1: Detection at OFF	440033+320n
[Pr.943]	Stop signal (STOP): Link device logic setting		440043+320n

■External command signal

Set as follows for the external command signals other than the speed-position switching request and the main shaft/auxiliary shaft clutch control request.

For the speed-position switching request and the main shaft/auxiliary shaft clutch control request, refer to the following.

☞ Page 43 MAJOR POSITIONING CONTROL

Also refer to the following manual.

📖MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

• Set to use the link device for the external command signal.

n: Axis No. - 1

Item		Details	Buffer memory address
			Axis 1 to axis 16
[Pr.95]	External command signal selection	Set "900: Link device".*1	69+150n

*1 The signal is invalid when "900: Link device" is set in "[Pr.95] External command signal selection", and the link device external signal assignment parameter is not correctly set.

• Set the link device external signal assignment parameter to be used as the corresponding signal.

n: Axis No. - 1

Item		Details	Buffer memory address
			Axis 1 to axis 16
[Pr.950]	External positioning start request: Link device type	Set the link device type for use.	440050+320n
[Pr.960]	External speed change request: Link device type		440060+320n
[Pr.970]	Skip request: Link device type		440070+320n
[Pr.980]	Speed-position control switching request: Link device type		440080+320n
[Pr.990]	Main shaft clutch control request (ON control mode): Link device type		440090+320n
[Pr.995]	Main shaft clutch control request (OFF control mode): Link device type		440095+320n
[Pr.1000]	Auxiliary shaft clutch control request (ON control mode): Link device type		440100+320n
[Pr.1005]	Auxiliary shaft clutch control request (OFF control mode): Link device type		440105+320n
[Pr.1020]	Block No.7000 start request: Link device type		440120+320n
[Pr.1030]	Block No.7001 start request: Link device type		440130+320n
[Pr.1040]	Block No.7002 start request: Link device type		440140+320n
[Pr.1050]	Block No.7003 start request: Link device type		440150+320n
[Pr.1060]	Block No.7004 start request: Link device type		440160+320n
[Pr.951]	External positioning start request: Link device start No.	Set the link device No. for use.	440051+320n
[Pr.961]	External speed change request: Link device start No.		440061+320n
[Pr.971]	Skip request: Link device start No.		440071+320n
[Pr.981]	Speed-position control switching request: Link device start No.		440081+320n
[Pr.991]	Main shaft clutch control request (ON control mode): Link device start No.		440091+320n
[Pr.996]	Main shaft clutch control request (OFF control mode): Link device start No.		440096+320n
[Pr.1001]	Auxiliary shaft clutch control request (ON control mode): Link device start No.		440101+320n
[Pr.1006]	Auxiliary shaft clutch control request (OFF control mode): Link device start No.		440106+320n
[Pr.1021]	Block No.7000 start request: Link device start No.		440121+320n
[Pr.1031]	Block No.7001 start request: Link device start No.		440131+320n
[Pr.1041]	Block No.7002 start request: Link device start No.		440141+320n
[Pr.1051]	Block No.7003 start request: Link device start No.		440151+320n
[Pr.1061]	Block No.7004 start request: Link device start No.		440161+320n

Item		Details	Buffer memory address
			Axis 1 to axis 16
[Pr.952]	External positioning start request: Link device bit specification	Set the bit No. that is used when "13H: RWr" and "14H: RWw" are set to the link device type.	440052+320n
[Pr.962]	External speed change request: Link device bit specification		440062+320n
[Pr.972]	Skip request: Link device bit specification		440072+320n
[Pr.982]	Speed-position control switching request: Link device bit specification		440082+320n
[Pr.992]	Main shaft clutch control request (ON control mode): Link device bit specification		440092+320n
[Pr.997]	Main shaft clutch control request (OFF control mode): Link device bit specification		440097+320n
[Pr.1002]	Auxiliary shaft clutch control request (ON control mode): Link device bit specification		440102+320n
[Pr.1007]	Auxiliary shaft clutch control request (OFF control mode): Link device bit specification		440107+320n
[Pr.1022]	Block No.7000 start request: Link device bit specification		440122+320n
[Pr.1032]	Block No.7001 start request: Link device bit specification		440132+320n
[Pr.1042]	Block No.7002 start request: Link device bit specification		440142+320n
[Pr.1052]	Block No.7003 start request: Link device bit specification		440152+320n
[Pr.1062]	Block No.7004 start request: Link device bit specification		440162+320n
[Pr.953]	External positioning start request: Link device logic setting	Set the logic for assignment signal. • 0: Detection at ON • 1: Detection at OFF • 2: Detection at leading edge*1 • 3: Detection at trailing edge*1	440053+320n
[Pr.963]	External speed change request: Link device logic setting		440063+320n
[Pr.973]	Skip request: Link device logic setting		440073+320n
[Pr.983]	Speed-position control switching request: Link device logic setting		440083+320n
[Pr.993]	Main shaft clutch control request (ON control mode): Link device logic setting		440093+320n
[Pr.998]	Main shaft clutch control request (OFF control mode): Link device logic setting		440098+320n
[Pr.1003]	Auxiliary shaft clutch control request (ON control mode): Link device logic setting		440103+320n
[Pr.1008]	Auxiliary shaft clutch control request (OFF control mode): Link device logic setting		440108+320n
[Pr.1023]	Block No.7000 start request: Link device logic setting		440123+320n
[Pr.1033]	Block No.7001 start request: Link device logic setting		440133+320n
[Pr.1043]	Block No.7002 start request: Link device logic setting		440143+320n
[Pr.1053]	Block No.7003 start request: Link device logic setting		440153+320n
[Pr.1063]	Block No.7004 start request: Link device logic setting		440163+320n
[Pr.984]	Speed-position control switching request: Acquisition delay compensation time*1	Set the compensation time such as delay of sensor. Set a positive value to compensate for a delay. -32768 to 32767μs	440084+320n
[Pr.994]	Main shaft clutch control request (ON control mode): Acquisition delay compensation time*1		440094+320n
[Pr.999]	Main shaft clutch control request (OFF control mode): Acquisition delay compensation time*1		440099+320n
[Pr.1004]	Auxiliary shaft clutch control request (ON control mode): Acquisition delay compensation time*1		440104+320n
[Pr.1009]	Auxiliary shaft clutch control request (OFF control mode): Acquisition delay compensation time*1		440109+320n

*1 The signals for which "2: Detection at leading edge" and "3: Detection at trailing edge" can be selected in "Link device logic setting" and the signals for which "Acquisition delay compensation time" can be set are as follows.
· Speed-position control switching request
· Main shaft clutch control request (ON control mode)
· Main shaft clutch control request (OFF control mode)
· Auxiliary shaft clutch control request (ON control mode)
· Auxiliary shaft clutch control request (OFF control mode)

Point

- For the external command signals other than main shaft/auxiliary shaft clutch control requests, the DOG signal of axis and the link device cannot be used together as an external command signal for the same axis. For main shaft/auxiliary shaft clutch control requests, use "[Pr.405] Main shaft clutch control setting" or "[Pr.422] Auxiliary shaft clutch control setting" to switch he DOG signal of axis and the link device.
  When selecting "101: DOG signal of axis 1" to "116: DOG signal of Axis 16" in "[Pr.95] External command signal selection", the external command signals can be used only with the function selected in "[Pr.42] External command function selection".
  When selecting "900: Link device" in "[Pr.95] External command signal selection", all external command signals for which the link device external signal assignment parameters are set can be used. ("[Pr.42] External command function selection" is ignored.)
- Using a link device No. that is not assigned in the network configuration settings does not result in an error/warning. The signal is detected when the link device or the corresponding buffer memory is operated.
  If the link device No. exceeds the setting range of the start No., an error/warning occurs.

Monitoring method

The input status of each bit device signal can be monitored by the following signal.

• External input signal

n: Axis No. - 1

Monitor item		Storage details	Buffer memory address
			Axis 1 to axis 16
[Md.50]	Forced stop input	Forced stop signal (EMI)	4231
[Md.30]	External input signal	• b0: Lower limit signal (RLS) • b1: Upper limit signal (FLS) • b3: Stop signal (STOP) • b6: Proximity dog signal (DOG)	2416+100n

• External command signal

n: Axis No. - 1

j: Synchronous encoder axis No. - 1

Monitor item		Storage details	Buffer memory address
			Axis 1 to axis 16
[Md.900]	Link device external command signal monitor	• b0: External positioning start request flag • b1: External speed change request flag • b2: Skip request flag • b3: Speed-position control switching request flag • b4: Main shaft clutch control request (ON control mode) flag • b5: Main shaft clutch control request (OFF control mode) flag • b6: Auxiliary shaft clutch control request (ON control mode) flag • b7: Auxiliary shaft clutch control request (OFF control mode) flag • b9: Block No.7000 start request flag • bA: Block No.7001 start request flag • bB: Block No.7002 start request flag • bC: Block No.7003 start request flag • bD: Block No.7004 start request flag	59328+100n
[Md.325]	Synchronous encoder axis status	b6: Start command flag	35210+20j

Related buffer memory

Each external signal can be assigned by setting the following buffer memories.
When assigning the forced stop signal (EMI), only the setting value for the axis 1 is valid.
For an axis within the setting of maximum number of control axes, when the setting value of "[Pr.95] External command signal selection" is set to "900: Link device", if the link device external signal assignment parameters are not set to any external command signals other than the main shaft/auxiliary shaft clutch control request, the synchronous encoder axis start request, or the input signal for mark detection, or the setting value of link device external signal assignment parameters is incorrect, "External command signal selection error" (error code: 1BCFH) occurs.

Point

- Refer to the following for mark detection setting parameters.
  ☞ Page 359 Mark Detection Function
- For the synchronous encoder axis parameters via link device, refer to "Synchronous Encoder Axis" in the following manual.
  📖MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

■For bit device setting

n: Axis No. - 1

Setting item		Setting details, setting value	Buffer memory address
			Axis 1 to axis 16
[Pr.900]	Forced stop signal (EMI): Link device type	Set the link device type for use. • Others: Invalid • 11H: RX • 12H: RY • 13H: RWr • 14H: RWw Fetch cycle: At power supply ON/the CPU module reset	440000+320n
[Pr.910]	Upper limit signal (FLS): Link device type		440010+320n
[Pr.920]	Lower limit signal (RLS): Link device type		440020+320n
[Pr.930]	Proximity dog signal (DOG): Link device type		440030+320n
[Pr.940]	Stop signal (STOP): Link device type		440040+320n
[Pr.950]	External positioning start request: Link device type		440050+320n
[Pr.960]	External speed change request: Link device type		440060+320n
[Pr.970]	Skip request: Link device type		440070+320n
[Pr.980]	Speed-position control switching request: Link device type		440080+320n
[Pr.990]	Main shaft clutch control request (ON control mode): Link device type		440090+320n
[Pr.995]	Main shaft clutch control request (OFF control mode): Link device type		440095+320n
[Pr.1000]	Auxiliary shaft clutch control request (ON control mode): Link device type		440100+320n
[Pr.1005]	Auxiliary shaft clutch control request (OFF control mode): Link device type		440105+320n
[Pr.1020]	Block No.7000 start request: Link device type		440120+320n
[Pr.1030]	Block No.7001 start request: Link device type		440130+320n
[Pr.1040]	Block No.7002 start request: Link device type		440140+320n
[Pr.1050]	Block No.7003 start request: Link device type		440150+320n
[Pr.1060]	Block No.7004 start request: Link device type		440160+320n

Setting item		Setting details, setting value	Buffer memory address
			Axis 1 to axis 16
[Pr.901]	Forced stop signal (EMI): Link device start No.	Set the link device type for use.[*1] • RX/RY: 0 to 1FFFH • RWr/RWw: 0 to 3FFH Fetch cycle: At power supply ON/the CPU module reset	440001+320n
[Pr.911]	Upper limit signal (FLS): Link device start No.		440011+320n
[Pr.921]	Lower limit signal (RLS): Link device start No.		440021+320n
[Pr.931]	Proximity dog signal (DOG): Link device start No.		440031+320n
[Pr.941]	Stop signal (STOP): Link device start No.		440041+320n
[Pr.951]	External positioning start request: Link device start No.		440051+320n
[Pr.961]	External speed change request: Link device start No.		440061+320n
[Pr.971]	Skip request: Link device start No.		440071+320n
[Pr.981]	Speed-position control switching request: Link device start No.		440081+320n
[Pr.991]	Main shaft clutch control request (ON control mode): Link device start No.		440091+320n
[Pr.996]	Main shaft clutch control request (OFF control mode): Link device start No.		440096+320n
[Pr.1001]	Auxiliary shaft clutch control request (ON control mode): Link device start No.		440101+320n
[Pr.1006]	Auxiliary shaft clutch control request (OFF control mode): Link device start No.		440106+320n
[Pr.1021]	Block No.7000 start request: Link device start No.		440121+320n
[Pr.1031]	Block No.7001 start request: Link device start No.		440131+320n
[Pr.1041]	Block No.7002 start request: Link device start No.		440141+320n
[Pr.1051]	Block No.7003 start request: Link device start No.		440151+320n
[Pr.1061]	Block No.7004 start request: Link device start No.		440161+320n
[Pr.902]	Forced stop signal (EMI): Link device bit specification	Set the bit No. that is used when "13H: RWr" and "14H: RWw" are set to the link device type.[*2] • 00H to 0FH Fetch cycle: At power supply ON/the CPU module reset	440002+320n
[Pr.912]	Upper limit signal (FLS): Link device bit specification		440012+320n
[Pr.922]	Lower limit signal (RLS): Link device bit specification		440022+320n
[Pr.932]	Proximity dog signal (DOG): Link device bit specification		440032+320n
[Pr.942]	Stop signal (STOP): Link device bit specification		440042+320n
[Pr.952]	External positioning start request: Link device bit specification		440052+320n
[Pr.962]	External speed change request: Link device bit specification		440062+320n
[Pr.972]	Skip request: Link device bit specification		440072+320n
[Pr.982]	Speed-position control switching request: Link device bit specification		440082+320n
[Pr.992]	Main shaft clutch control request (ON control mode): Link device bit specification		440092+320n
[Pr.997]	Main shaft clutch control request (OFF control mode): Link device bit specification		440097+320n
[Pr.1002]	Auxiliary shaft clutch control request (ON control mode): Link device bit specification		440102+320n
[Pr.1007]	Auxiliary shaft clutch control request (OFF control mode): Link device bit specification		440107+320n
[Pr.1022]	Block No.7000 start request: Link device bit specification		440122+320n
[Pr.1032]	Block No.7001 start request: Link device bit specification		440132+320n
[Pr.1042]	Block No.7002 start request: Link device bit specification		440142+320n
[Pr.1052]	Block No.7003 start request: Link device bit specification		440152+320n
[Pr.1062]	Block No.7004 start request: Link device bit specification		440162+320n

Setting item		Setting details, setting value	Buffer memory address
			Axis 1 to axis 16
[Pr.903]	Forced stop signal (EMI): Link device logic setting	Set the logic for assignment signal. (Only the 0th bit is valid.) • 0: Negative logic When link device relevant bit = 0 EMI: Forced stop input ON (Forced stop) FLS, RLS: Limit signal OFF (Limit over) • 1: Positive logic Opposite of the negative logic Fetch cycle: At power supply ON/the CPU module reset	440003+320n
[Pr.913]	Upper limit signal (FLS): Link device logic setting		440013+320n
[Pr.923]	Lower limit signal (RLS): Link device logic setting		440023+320n
[Pr.933]	Proximity dog signal (DOG): Link device logic setting	Set the logic for assignment signal. (Only the 0th and 1st bits are valid for signals for which "2: Detection at leading edge" and "3: Detection at trailing edge" are selectable. Otherwise, only the 0th bit is valid. For high accuracy, select "2: Detection at leading edgeDetection at leading edge" or "3: Detection at trailing edge.) • 0: Detection at ON The link device status and the signal status are not inverted. When the link device is set to 0, the corresponding signal is set to OFF. When the link device is set to 1, the corresponding signal is set to ON. • 1: Detection at OFF The link device status and the signal status are inverted. When the link device is set to 0, the corresponding signal is set to ON. When the link device is set to 1, the corresponding signal is set to OFF. • 2: Detection at leading edge*3 Detect the rising edge detection link device. When the corresponding bit of the link device is changed from 0 to 1, the corresponding signal is turned ON. Other than above: the corresponding signal is turned OFF. • 3: Detection at trailing edge*3 Detect the trailing edge detection link device. When the corresponding bit of the link device is changed from 1 to 0, the corresponding signal is turned ON. Other than above: the corresponding signal is turned OFF. Fetch cycle: At power supply ON/the CPU module reset	440033+320n
[Pr.943]	Stop signal (STOP): Link device logic setting		440043+320n
[Pr.953]	External positioning start request: Link device logic setting		440053+320n
[Pr.963]	External speed change request: Link device logic setting		440063+320n
[Pr.973]	Skip request: Link device logic setting		440073+320n
[Pr.983]	Speed-position control switching request: Link device logic setting		440083+320n
[Pr.993]	Main shaft clutch control request (ON control mode): Link device logic setting		440093+320n
[Pr.998]	Main shaft clutch control request (OFF control mode): Link device logic setting		440098+320n
[Pr.1003]	Auxiliary shaft clutch control request (ON control mode): Link device logic setting		440103+320n
[Pr.1008]	Auxiliary shaft clutch control request (OFF control mode): Link device logic setting		440108+320n
[Pr.1023]	Block No.7000 start request: Link device logic setting		440123+320n
[Pr.1033]	Block No.7001 start request: Link device logic setting		440133+320n
[Pr.1043]	Block No.7002 start request: Link device logic setting		440143+320n
[Pr.1053]	Block No.7003 start request: Link device logic setting		440153+320n
[Pr.1063]	Block No.7004 start request: Link device logic setting		440163+320n
[Pr.984]	Speed-position control switching request: Acquisition delay compensation time*3	Set the compensation time such as delay of sensor. Set a positive value to compensate for a delay. -32768 to 32767μs Fetch cycle: At power supply ON/the CPU module reset	440084+320n
[Pr.994]	Main shaft clutch control request (ON control mode): Acquisition delay compensation time*3		440094+320n
[Pr.999]	Main shaft clutch control request (OFF control mode): Acquisition delay compensation time*3		440099+320n
[Pr.1004]	Auxiliary shaft clutch control request (ON control mode): Acquisition delay compensation time*3		440104+320n
[Pr.1009]	Auxiliary shaft clutch control request (OFF control mode): Acquisition delay compensation time*3		440109+320n

*1 If the setting value is outside the setting range, "Outside the link device start No. range" (error code: 1F10H) occurs and the corresponding external signal becomes invalid.

*2 If the setting value is outside the setting range, "Outside the link device bit specification range" (error code: 1F11H) occurs and the corresponding external signal becomes invalid.

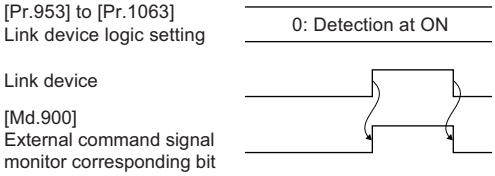
*3 The signals for which "2: Detection at leading edge" and "3: Detection at trailing edge" can be selected and "Acquisition delay compensation time" can be set are as follows.
· Speed-position control switching request
· Main shaft clutch control request (ON control mode)
· Main shaft clutch control request (OFF control mode)
· Auxiliary shaft clutch control request (ON control mode)
· Auxiliary shaft clutch control request (OFF control mode)

■For bit device monitor

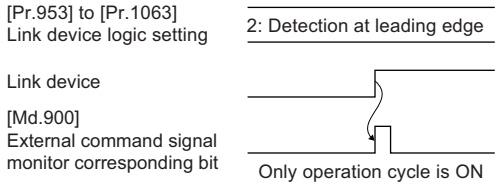
n: Axis No. - 1

Monitor item		Setting details/setting value	Buffer memory address
			Axis 1 to axis 16
[Md.900]	Link device external command signal monitor	Monitor the status of the external command signals assigned to link devices. (The status in which "[Pr.953] to [Pr.1063] Link device logic setting" is reflected is stored.*1) • 0: Signal status OFF/No link device assigned • 1: Signal status ON b0: External positioning start request flag b1: External speed change request flag b2: Skip request flag b3: Speed-position control switching request flag b4: Main shaft clutch control request (ON control mode) flag b5: Main shaft clutch control request (OFF control mode) flag b6: Auxiliary shaft clutch control request (ON control mode) flag b7: Auxiliary shaft clutch control request (OFF control mode) flag b9: Block No.7000 start request flag bA: Block No.7001 start request flag bB: Block No.7002 start request flag bC: Block No.7003 start request flag bD: Block No.7004 start request flag Refresh cycle: Operation cycle	59328+100n

*1 When "0: Detection at ON" or "1: Detection at OFF" is selected, the monitor is always ON when the corresponding signal is ON.



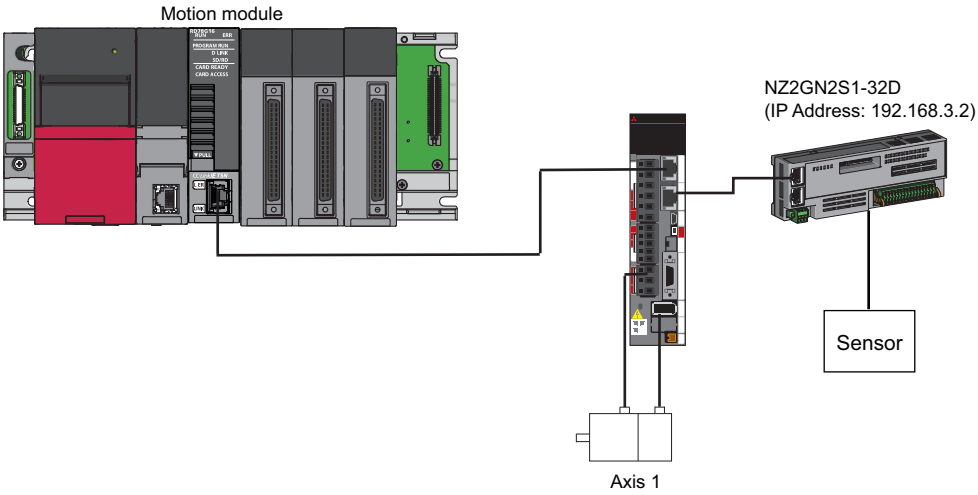
When "2: Detection at leading edge" or "3: Detection at trailing edge" is selected, the monitor is turned ON only in a cycle when the corresponding signal is ON.



Setting example of high accuracy input using synchronous input timing information of remote I/O

Ex.

For the remote I/O NZ2GN2S1-32D input signal with high accuracy

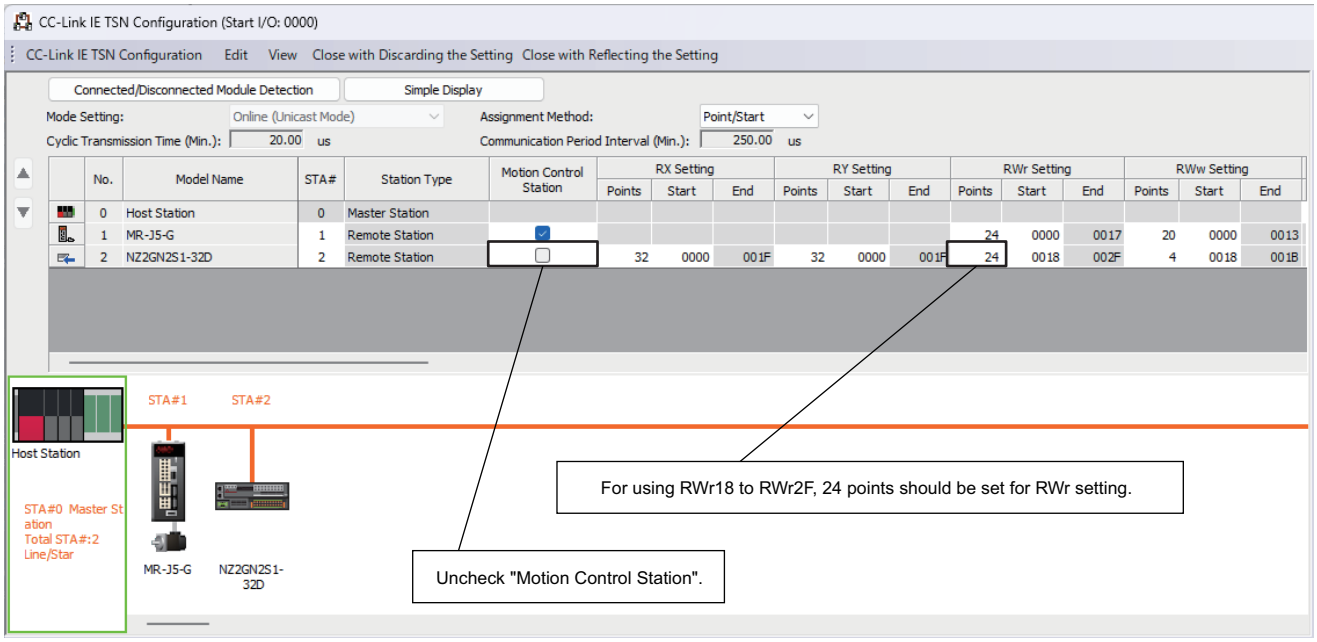


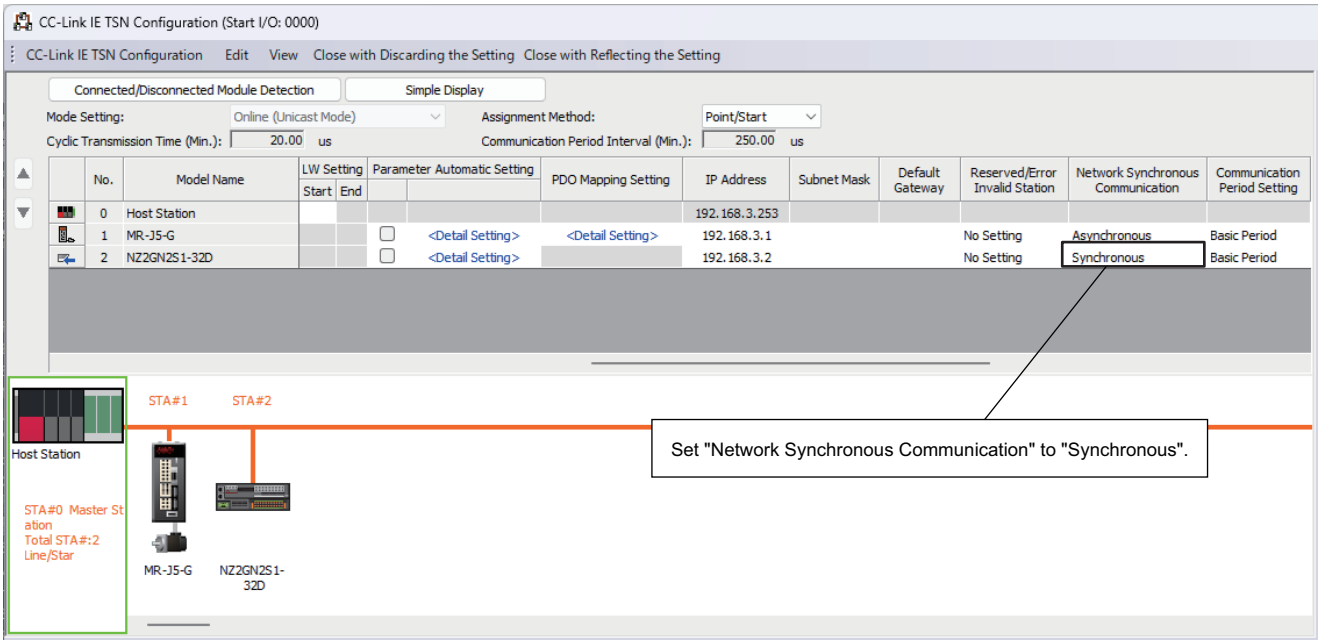
In this example, the signal to be used as a high accuracy input is assigned to RX1.

■Network configuration setting

In the network configuration settings of GX Works3, expand the number of points by setting RWr for input module NZ2GN2S1-32D/station address 192.168.3.2. Refer to the following manual for the number of points required. (In this example, 24 points are required because synchronous input timing information X1 is used.)

📖CC-Link IE TSN Remote I/O Module User's Manual (CC-Link IE TSN Communication Mode)





The following link device is used in this example.

• Remote input (RX)

Device No.	Application
RX1	Use as high accuracy input.

• Remote register (RWr)

Device No.	Specification for synchronous timing control mode
RWr18	Module status area
RWr19	Error code
RWr20	Function selection status
RWr28, RWr29	Synchronous input timing information X0 is turned OFF to ON
RWr2A, RWr2B	Synchronous input timing information X0 is turned ON to OFF
RWr2C, RWr2D	Synchronous input timing information X0 is turned OFF to ON
RWr2E, RWr2F	Synchronous input timing information X0 is turned OFF to ON

■Inter-module synchronization

Refer to the following for details on inter-module synchronization.

Inter-module synchronization of the Motion module is enabled.

☞ Page 191 INTER-MODULE SYNCHRONIZATION FUNCTION

■Setting for CC-Link IE TSN network synchronous communication function

Set the CC-Link IE TSN network synchronous communication function of the remote I/O module to synchronous timing control mode. Refer to the following manual for details on the setting method.

📖CC-Link IE TSN Remote I/O Module User's Manual (CC-Link IE TSN Communication Mode)

■How to check synchronous timing control mode

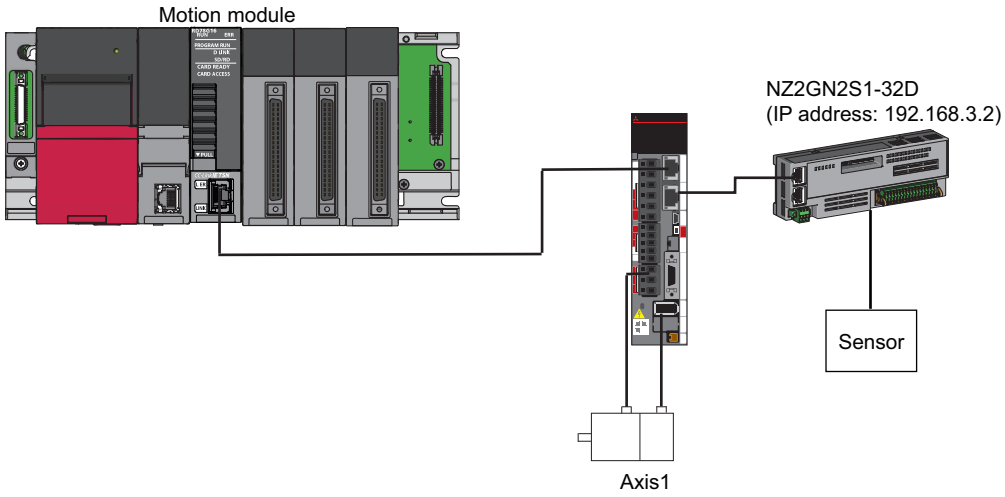
Whether or not the synchronous timing control mode is set can be checked in the CC-Link IE TSN network synchronous communication setting status (in this example: RWr20.b4, RWr20.b5). Refer to the following manual for details.

📖CC-Link IE TSN Remote I/O Module User's Manual (CC-Link IE TSN Communication Mode)

Setting example of link device assignment of external command signal

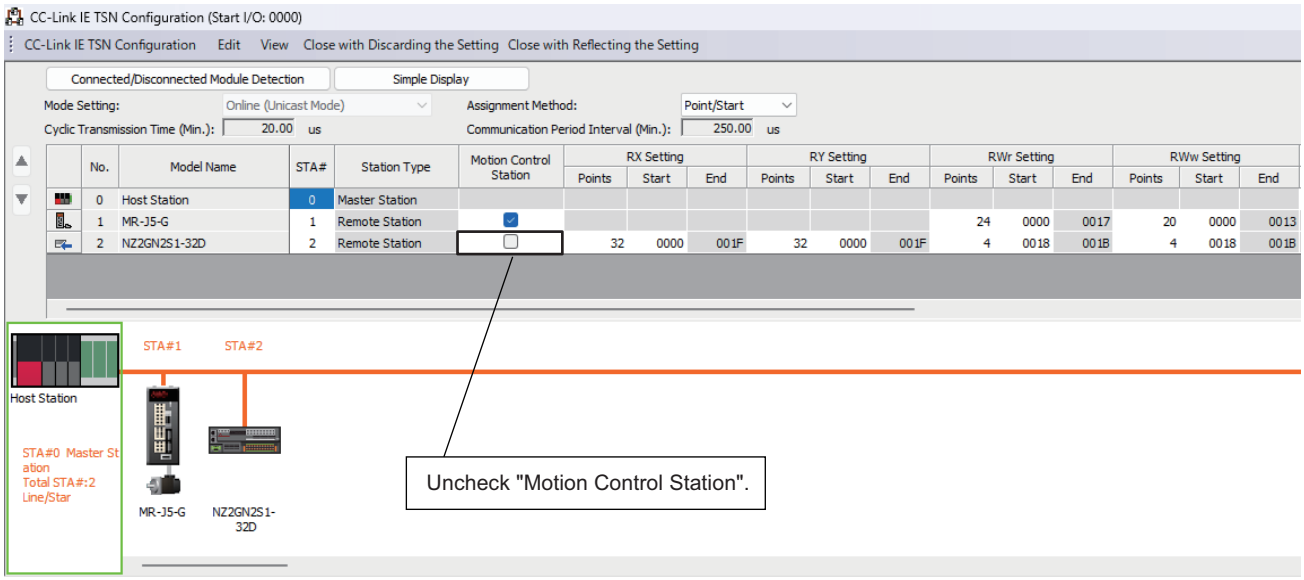
Ex.

When using a link device as an external positioning start request



In this example, the signal to be used as an external positioning start request is assigned to RX1.

■Network configuration setting



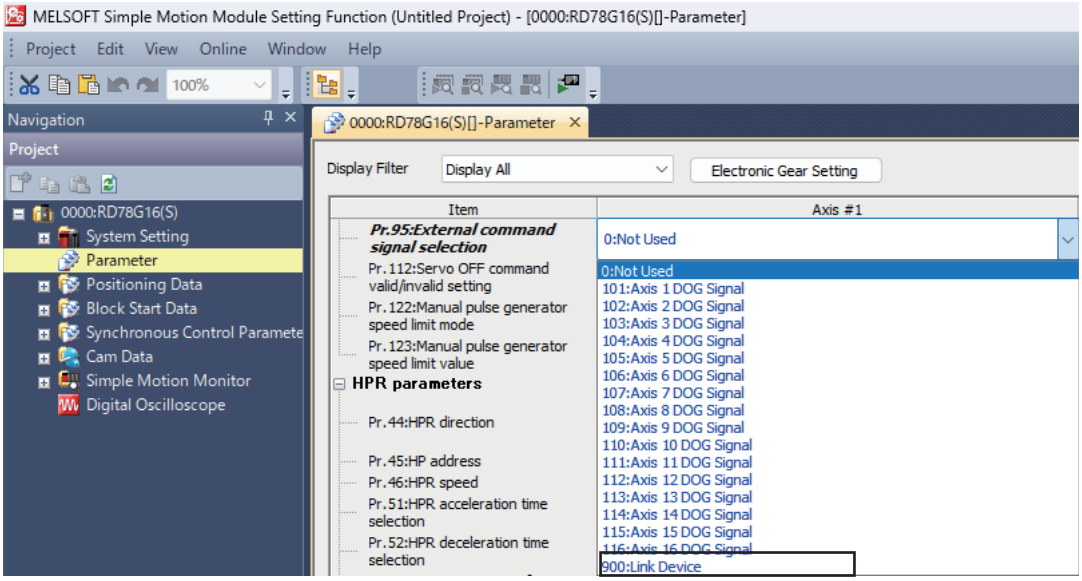
The following link device is used in this example.

- Remote input (RX)

Device No.	Application
RX1	Use as an external positioning start request.

■External command signal selection

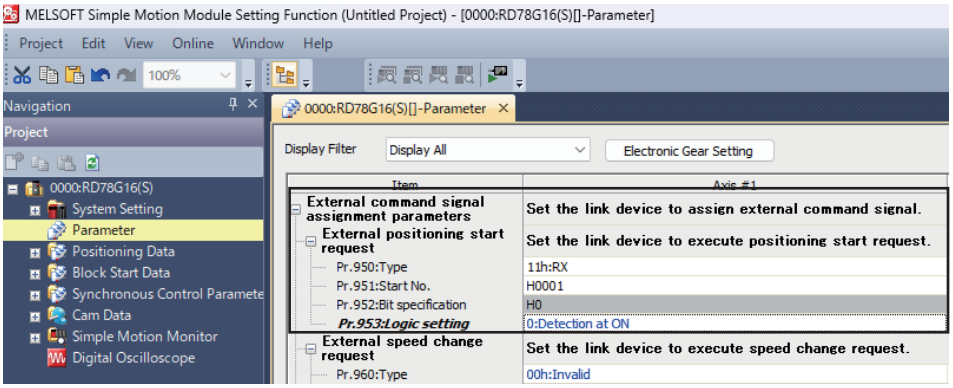
Select "900: Link device" in "[Pr. 95] External command signal selection".



■Link device external command signal assignment parameters

Set the link device to be used as the external positioning start request.

Parameter	Setting value
[Pr.950] External positioning start request: Link device type	11h: RX
[Pr.951] External positioning start request: Link device start No.	H0001
[Pr.952] External positioning start request: Link device bit specification	Not necessary when "11h: RX" or "12h: RY" is selected for link device type.
[Pr.953] External positioning start request: Link device logic setting	0: Detection at ON



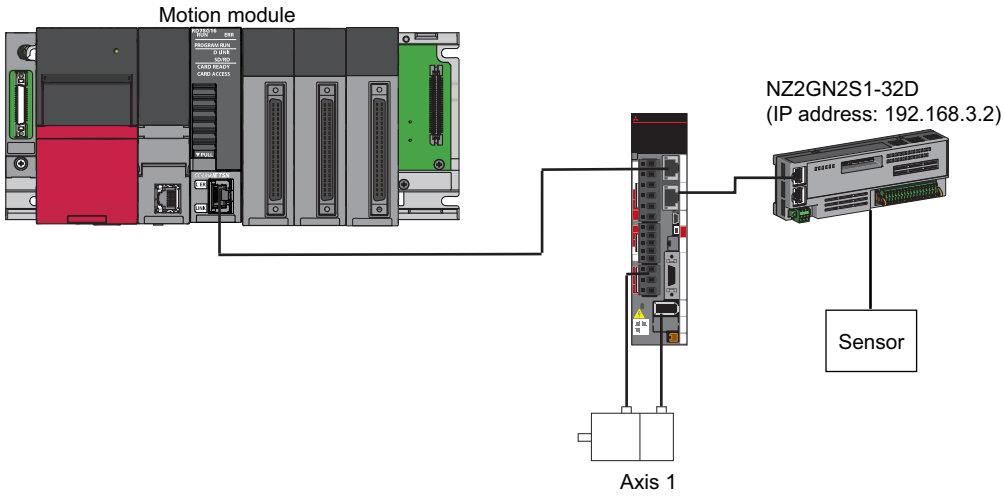
■Control data

To use the assigned link device as an external command signal, set "1: Validates an external command." in "[Cd.8] External command valid".

Setting example of link device external signal assignment

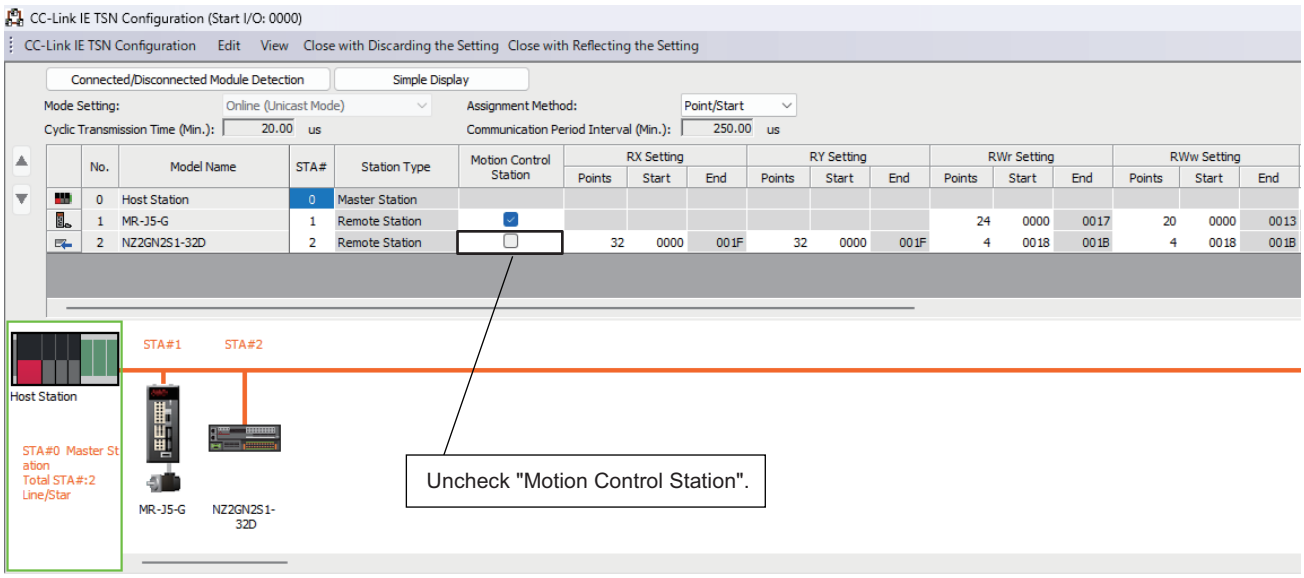
Ex.

When using link device as upper/lower limit signal (FLS/RLS)



In this example, the signal used as the upper limit signal (FLS) is assigned to RX0 and the signal used as the lower limit signal (RLS) is assigned to RX1.

■Network configuration setting



In this example, the following link devices are used.

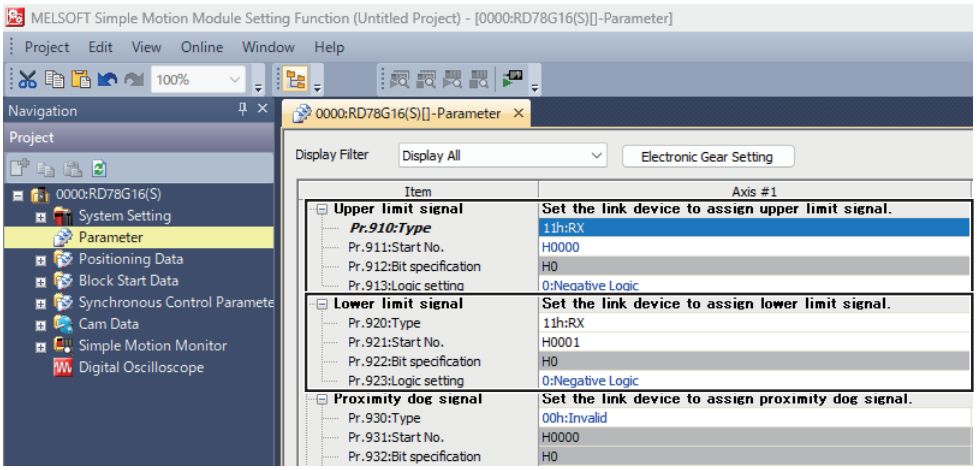
- Remote input (RX)

Device No.	Application
RX0	Used as the upper limit signal (FLS).
RX1	Used as the lower limit signal (RLS).

■Link device external input signal assignment parameter

Set the link device to be used as the upper/lower limit signal (FLS/RLS).

Parameter	Setting value
[Pr.910] Upper limit signal (FLS): Link device type	11h: RX
[Pr.911] Upper limit signal (FLS): Link device start No.	H0000
[Pr.912] Upper limit signal (FLS): Link device bit specification	Not necessary when "11h: RX" or "12h: RY" is selected for link device type.
[Pr.913] Upper limit signal (FLS): Link device logic setting	0: Negative logic
[Pr.920] Lower limit signal (RLS): Link device type	11h: RX
[Pr.921] Lower limit signal (RLS): Link device start No.	H0001
[Pr.922] Lower limit signal (RLS): Link device bit specification	Not necessary when "11h: RX" or "12h: RY" is selected for link device type.
[Pr.923] Lower limit signal (RLS): Link device logic setting	0: Negative logic



Restrictions

- Use the communication cycle setting of the network configuration settings in the basic cycle. If not used in the basic cycle, the signal detection accuracy will be poor.
- When the network synchronous communication is disabled, the fetch timing of the link device fluctuates by 1 operation cycle.

Detailed event history codes for external signal assignment parameter errors

When an external signal assignment parameter error occurs, the following information is stored in the detailed event history.

■External signal assignment parameter error

- Outside the link device start No. range (error code: 1F10H)
- Outside the link device bit specification range (error code: 1F11H)
- Outside the link device maximum/minimum value specification range (error code: 1F12H)

■Detail information 1

Axis No. on which the error occurred

■Detail information 2

Parameter No. on which the error occurred

External signal		
External signal	External input signal	Forced stop signal (EMI)
		Upper limit signal (FLS)
		Lower limit signal (RLS)
		Proximity dog signal (DOG)
		Stop signal (STOP)
	External command signal	External positioning start request
		External speed change request
		Skip request
		Speed-position control switching request
		Main shaft clutch control request (ON control mode)
		Main shaft clutch control request (OFF control mode)
		Auxiliary shaft clutch control request (ON control mode)
		Auxiliary shaft clutch control request (OFF control mode)
		Synchronous encoder axis start request
		Block No.7000 start request
		Block No.7001 start request
		Block No.7002 start request
		Block No.7003 start request
		Block No.7004 start request
Word device	External input signal	Synchronous encoder input

For mark detection, refer to the following.

☞ Page 359 Mark Detection Function

9.6 History Monitor Function

This function monitors start history and current value history stored in the buffer memory of the Motion module on the operation monitor of an engineering tool.

Start history

The start history logs of operations such as positioning operation, JOG operation, and manual pulse generator operation can be monitored. The latest 64 logs[*1] are stored all the time. This function allows users to check the operation sequence (whether the operations have been started in a predetermined sequence) at system start-up.

For the starting history check method, refer to "Help" in the "Simple Motion Module Setting Function" of an engineering tool.

*1 GX Works3 can be monitored 256 times.

Point

Set the clock of CPU module.

Refer to the following manual for setting method.

GX Works3 Operating Manual

There may be an error in tens of ms between the clock data of the CPU and the time data of the Motion module.

Current value history

The current value history data of each axis can be monitored. The following shows about the current value history data of each axis.

Monitor details	Monitor item
Latest backup data The number of backup: Once	Command position value
	Servo command value
	Encoder position within one revolution*1
	Encoder multiple revolution counter
	Time 1 (Year: month)*2
	Time 2 (Day: hour)*2
	Time 3 (Minute: second)*2
	Latest backup data pointer
Backup data at the power disconnection The number of backup: 10 times	Command position value
	Servo command value
	Encoder position within one revolution*1
	Encoder multiple revolution counter
	Time 1 (Year: month)*2
	Time 2 (Day: hour)*2
	Time 3 (Minute: second)*2
	Backup data pointer
Backup data at the power on The number of backup: 10 times	Command position value
	Servo command value
	Encoder position within one revolution*1
	Encoder multiple revolution counter
	Time 1 (Year: month)*2
	Time 2 (Day: hour)*2
	Time 3 (Minute: second)*2
Home position return data The number of backup: 1 times	Command position value
	Servo command value
	Encoder position within one revolution*1
	Encoder multiple revolution counter
	Time 1 (Year: month)*2
	Time 2 (Day: hour)*2
	Time 3 (Minute: second)*2

*1 The value equal to the multiplied inverse number of the electronic gear ratio of the servo amplifier (the command unit) is displayed.
*2 Displays a value set by the clock function of the CPU module.

■Latest backup data

The latest backup data outputs the following data saved in the fixed cycle to the buffer memory.

- Command position value
- Servo command value
- Encoder position within one revolution*1
- Encoder multiple revolution counter
- Time 1 (Year: month) data
- Time 2 (Day: hour) data
- Time 3 (Minute: second) data
- Latest backup data pointer

*1 The value equal to the multiplied inverse number of the electronic gear ratio of the servo amplifier (the command unit) is displayed.

The latest backup data starts outputting the data after the power on.

After the home position is established in the absolute system, the data becomes valid and outputs the current value.

■Backup data at the power disconnection

- The detail of the latest backup data right before the power disconnection is output to the buffer memory.
- The backup data at the power disconnection starts being output after the power on.
- The detail of the latest backup data right before the power disconnection used in the absolute system setting is output, regardless of the setting of the absolute system or incremental system.
- If the data has never been used in the absolute system in the incremental system setting, "0" is output in all storage items.

■Backup data at the power on

- After the power on, the detail of the data which restored the current value is output to the buffer memory.
- The backup data at the power on starts being output after the power on.
- If the current value cannot be restored in the absolute system, "0" is set to the command position value, encoder position within one revolution, and encoder multiple revolution counter, and the feedback value from the servo amplifier is set to the servo command value. "Home position return data incorrect" (warning code: 0D3CH) is set in the error/warning code at current value restoration.
- When the incremental system is set, the detail of the backup data at the power on used in the absolute system setting is output. If the data has never been used in the absolute system, "0" is output in all storage items.

■Home position return data

The following data saved at home position return completion to the buffer memory.

- Command position value at home position return completion
- Servo command value at home position return completion
- Encoder position within one revolution of absolute position reference point data*1
- Encoder multiple revolution counter of absolute position reference point data
- Time 1 (Year: month) data
- Time 2 (Day: hour) data
- Time 3 (Minute: second) data

*1 The value equal to the multiplied inverse number of the electronic gear ratio of the servo amplifier (the command unit) is displayed.

The data becomes valid only when the absolute system is set.

If the data has never been used in the absolute system in the incremental system setting, "0" is output in all storage items.

9.7 Virtual Servo Amplifier Function

This function executes the operation virtually without connecting servo amplifiers (regarded as connected). The synchronous control with virtually input command is possible by using the virtual servo amplifier axis as servo input axis of synchronous control. Also, it can be used as simulation operation for axes without servo amplifiers.

Control details

- The servo amplifier is operated as a virtual servo amplifier when the value of "[Pr.101] Virtual servo amplifier setting" is "1: Use as virtual servo amplifier" immediately after power cycling.
- When the value of "[Pr.101] Virtual servo amplifier setting" is other than "1: Use as virtual servo amplifier" immediately after power cycling, the servo amplifier is not operated as a virtual servo amplifier even if "[Pr.101] Virtual servo amplifier setting" in the buffer memory is set to "1: Use as virtual servo amplifier" and PLC READY [Y0] is turned OFF to ON after power cycling.
- Virtual servo amplifiers are connected with the absolute position detection system enabled. The command position value and machine feed value are as follows.

  - When the servo amplifier is turned on for the first time as a virtual servo amplifier, "Home position return data incorrect" (warning code: 0D3CH) occurs, the home position return request turns ON, and the command position value and feed machine value both become "0". Following this, establishing the home position and then turning the power OFF → ON causes the address to become the address from the last time that the module power was disconnected.

Restrictions

- The following monitor data of virtual servo amplifier differ from the actual servo amplifier.

n: Axis No. - 1

Item		Storage details	Buffer memory address
			Axis 1 to axis 16
[Md.30]	External input signal	When "1: Servo amplifier" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection": • Lower limit signal (b0): Always ON • Upper limit signal (b1): Always ON • Proximity dog signal (b6): Always OFF	2416+100n
[Md.102]	Deviation counter value	Always "0".	2452+100n 2453+100n
[Md.104]	Motor current value	Outputs the command torque during torque control and continuous operation to torque control mode.	2456+100n
[Md.108]	Servo status1	• READY ON (b0), Servo ON (b1): Changed depending on the all axis servo ON [Y1] and "[Cd.100] Servo OFF command". • Control mode (b2, b3): Indicates control mode. • Gain switching (b4): Always OFF • Fully closed loop control switching (b5): Always OFF • Servo alarm (b7): Always OFF • In-position (b12): Always ON during Servo ON, always OFF during Servo OFF • Torque limit (b13): Changed depending on the command torque value • Absolute position lost (b14): Turns ON when the connected device is not the MR-J5-G at establishment of the home position when connected to a virtual servo amplifier axis, and turns OFF when home position return is performed. • Servo warning (b15): Always OFF	2477+100n
[Md.109]	Regenerative load ratio/Optional data monitor output 1	Always "0".	2478+100n
[Md.110]	Effective load torque/Optional data monitor output 2	Always "0".	2479+100n
[Md.111]	Peak torque ratio/Optional data monitor output 3	Always "0".	2480+100n
[Md.112]	Optional data monitor output 4	Always "0".	2481+100n

Item		Storage details	Buffer memory address
			Axis 1 to axis 16
[Md.119]	Servo status2	• Zero point pass (b0): Always ON • Zero speed (b3): Changed depending on the command speed • Speed limit (b4): Turns ON when the speed exceeds the limit value at torque control mode. • PID control (b8): Always OFF	2476+100n
[Md.514]	HPR operating status	Changed depending on the HPR (home position return) status	2457+100n

• The operation of the following function of virtual servo amplifier differs from the actual servo amplifier.

Function	Operation
External signal selection function	When "1: Servo amplifier" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", this function cannot be used to emulate the upper/lower limit signal (FLS, RLS) and proximity dog signal (DOG). When "2: Buffer memory" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection", the upper/lower limit switch signal (FLS, RLS) and proximity dog signal (DOG) follow the buffer memory status of the Motion module even with a virtual servo amplifier.
External command function selection	This function cannot be used to emulate "[Pr.95] External command signal selection".
Torque limit function	Turns ON/OFF torque limit ([Md.108] Servo status1: b13) depending on the command torque value.

• When a device is connected to an axis or station that is operating as a virtual servo amplifier, the relevant device is connected to the CC-Link IE TSN network, but does not enter the in synchronous communication status.

• An axis being operated as a virtual servo amplifier emulate the following servo amplifier types.

• Servo amplifier type: MR-J5-G

The specification of the emulated MR-J5-G is as follows.

Function		Support	Description
Reception check	WDC check	×	Check of reception WDC (the master station → the device station) is not carried out.
PDO-related	Emulation of feedback	○	Emulates and returns the data received from the MR-J5-G.
	Variable mapping	×	When the emulate function is valid, the default mapping of MR-J5-G is used. For the default mapping, refer to MR-J5-G manuals. The following functions cannot be used with the virtual servo amplifier function. • External input signal • Synchronous encoder via servo amplifier • Optional data monitor
SLMP-related	Response data simulation	×	SLMP communication simulation is not supported.
Servo alarm-related		×	Servo alarms cannot be detected.
Motor type	Standard rotary type	○	Operates as a rotary type servo motor (resolution: 4194304). A speed unit of the servo amplifier is fixed to 0.01r/min.
Operation mode	csp	○	Position control operation by csp is available.
	csv	○	Velocity control operation by csv is available.
	cst	○	Torque control operation by cst is available.
	hm	○	Homing by hm is available. The homing method supports the driver homing method (data set method) only.
	ct	○	Continuous operation to torque control by ct is available. (The operation is the same as cst.)
External signal-related	FLS	○	• Only input via the controller is available. Stop operation of the device station when the FLS is OFF is not simulated. The command from the master station stops by FLS detection, following which the servo motor stops as well. • In the case of input via the servo amplifier, the input value is always OFF.
	RLS	○	• Only input via the controller is available. Stop operation of the device station when the RLS is OFF is not simulated. The command from the master station stops by RLS detection, following which the servo motor stops as well. • In the case of input via the servo amplifier, the input value is always OFF.

[Servo parameter specification]

No.	Servo parameter	Description
PA03	Absolute position detection system	Fixed to "1: Enabled (absolute position detection system)".
PA14	Travel direction selection	Fixed to "0".
PC07	Zero speed	50r/min
PC29	Function selection C-B	1000H ×_ _ _: Torque POL reflection selection 1: Disabled
PC76	Function selection C-E	0011H _ _ × _: ZSP disabled selection at control switching 1: Disabled (control mode switching regardless of the range of ZSP)
PT07	Home position shift distance	0
PT45	Home position return type	37 (Data set type)

Setting method

Set "[Pr.101] Virtual servo amplifier setting" as follows.

n: Axis No. - 1

Storage item		Storage details	Buffer memory address
			Axis 1 to axis 16
[Pr.101]	Virtual servo amplifier setting	Set if use as virtual servo amplifier axis. It will be read when the power supply is ON. 0: Use real servo amplifier 1: Use as virtual servo amplifier*1	58022+32n

*1 When set to a value other than "1: Use as virtual servo amplifier", the axis is used as a real axis.

9.8 Driver Communication Function

"Driver communication function" uses "Master-slave operation function" of the servo amplifier. The master axes are controlled by the Motion module and the slave axes are controlled by data communication between servo amplifiers (driver communication) without the Motion module.

The available functions are limited depending on the version of the servo amplifier. For details, refer to the manual of each servo amplifier.

The following shows the number of axes that can be set as the master axis and slave axis.

Network	Servo amplifier	Module	Combination of number of settable axes		Remark
			Number of master axes	Number of slave axes	
CC-Link IE TSN	MR-J5-_G_(-RJ) MR-J5D1-_G_ *1	RD78G4	1 to 2 axes	At least 1 axis for each master axis	Axes other than the master axis and slave axis can be used as independent axes.
		RD78G8	1 to 4 axes		
		RD78G16	1 to 8 axes		

*1 If a servo amplifier that does not support the driver communication or a servo amplifier installed with a version that does not support it is used by mistake, [AL.037.1_Parameter setting error] will occur in the servo amplifier.

The following shows the number of axes that can be set as the slave axis for each operation cycle.*1

Communication cycle interval	Number of slave axes	Remark
250.00μs	3	When the number of master axes is set to 1
500.00μs	8	
1000.00μs	14	When the number of master axes is set to 2
2000.00μs		
4000.00μs		

*1 According to "When using a module in positioning control (recommended setting)" described in Part 2 "PROCEDURES BEFORE OPERATIONS" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Startup)

The following shows the standard number of stations that can be set as the standard station when the maximum number of master axes and maximum number of slave axes are set for each operation cycle.*1

Operation cycle*2	Driver communication cycle	Motion control station		Number of standard stations*3	Total number of stations*3
		Number of master axes	Number of slave axes		
250.00μs	125.00μs	2	2	8	12
500.00μs		4	5	8	17
	250.00μs	4	5	24	33
1000.00μs		8	8	26	42
2000.00μs		8	8	34	50
4000.00μs		8	8	39	55

*1 According to "When using a module in positioning control (recommended setting)" described in Part 2 "PROCEDURES BEFORE OPERATIONS" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Startup)

*2 For the operation cycle that can be set for the system configuration to be used, refer to the following.
Page 352 Communication cycle interval setting

*3 It is the number of stations when the communication mode is set to unicast mode, communication speed is set to 1Gbps, and MR-J5-_G_ is connected without using an industrial switch (for CC-Link IE TSN Class B). If stations more than the standard number of stations are set, connection becomes unstable. (Example: Problems such as cyclic transfer failure occur.)

Control

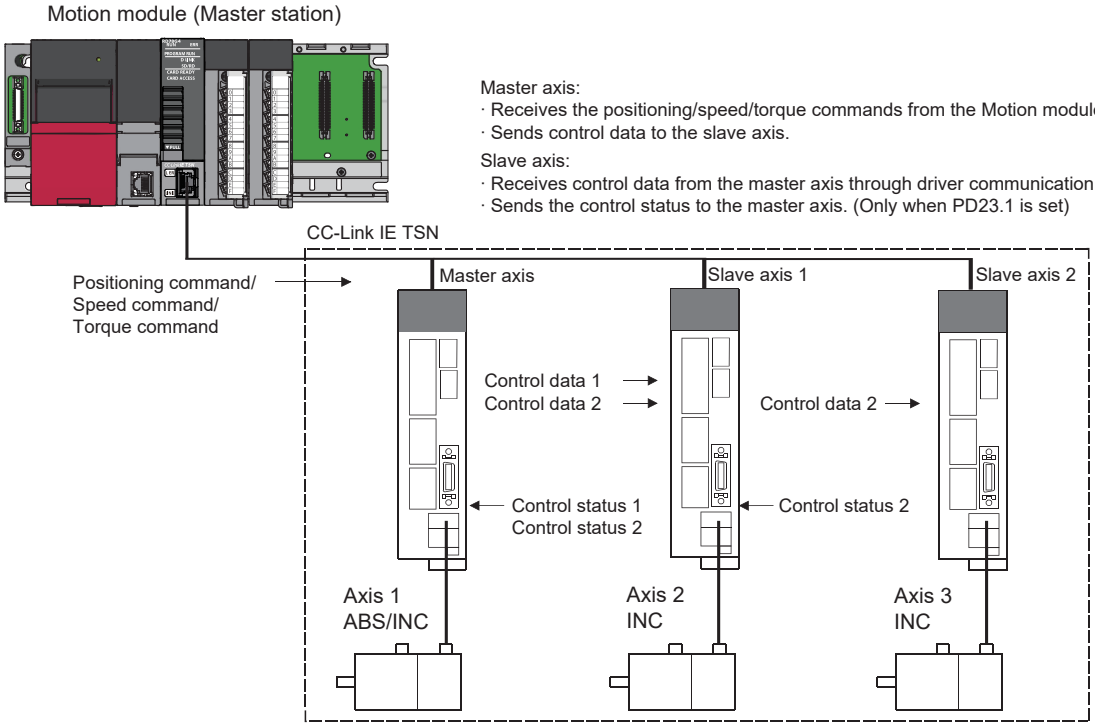
Configure the settings of the master axis and slave axis with servo parameters.

Configure each control setting for the Motion module on the master axis. (However, it is necessary to use the slave axis for servo ON/OFF of the slave axis and error reset when a servo alarm occurs.)

A servo amplifier set as a master axis receives commands (position command, speed command, and torque command) from the Motion module and sends control data to a servo amplifier set as a slave axis in the driver communication of the servo amplifier.

The servo amplifier set as a slave axis is controlled by the control data sent from the master axis through the driver communication of the servo amplifier.

• Control example on CC-Link IE TSN



Point

- For CC-Link IE TSN, there is no restriction on the connection order. Make setting to allow the master axis to control the slave axis so that the master axis can detect errors on the slave axis and stop control. (Set the servo parameter "Master axis 1 control slave axis No. setting when the slave for driver communication is set (PD23.1)" to "1 to 8 (Master axis control station)").
- It is used when multiple motors are used to drive one mechanism. The master axis and slave axis should be coupled to prevent slippage.

■Device station that can be set as the master axis or slave axis for the driver communication

Only the device stations set as the motion control station can be set as the master axis and slave axis. Do not make settings of the driver communication for the standard station. The servo amplifier functions (such as profile mode) that cannot be used for axes are not applicable to the driver communication.

■Communication cycle interval setting

The communication cycle interval setting and cyclic transmission time in the module parameters (network) are set as follows.

<Communication cycle interval setting>

The driver communication function supports the following communication cycle interval settings.

250.00μs
500.00μs
1000.00μs
2000.00μs
4000.00μs

Set one of the above communication cycle even when setting in the unit of 1μs.

If the set value is other than the above, "Driver Communication Period Interval Setting Error" (error code: 3236H)*1 occurs.

If this error occurs, change the communication cycle interval setting according to the procedure on the module diagnosis screen.

For the communication cycle interval setting, set a value greater than or equal to the following formula.

(Cyclic transmission time [μs]*2 × Driver communication magnification (Basic)*3 + Cyclic process time other than driver communication [μs]*4 + (Number of valid axes for driver communication*5 × 1.39 [μs])

If the value specified for the communication cycle interval setting is smaller than the value calculated by the above-mentioned formula, "Driver Communication Period Interval Setting Error" (error code: 3236H)*1 occurs.

If this error occurs, change the communication cycle interval setting according to the procedure on the module diagnosis screen.

*1 This error code is supported by Add-on baseSystem version "Ver.1.30" or later. For versions prior to "Ver.1.30", "Driver communication setting error 2" (error code: 3231H) occurs.

*2 This refers to the cyclic transmission time set to the basic communication cycle setting.

*3 This refers to the value obtained by dividing driver communication cycle by communication cycle interval setting.
For the driver communication cycle, refer to the following.
☞ Page 353 Driver communication cycle

*4 For the calculation method of cyclic process time other than driver communication, refer to "Processing time" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Network)

*5 This refers to the sum of the number of master axes and slave axes.

<Cyclic transmission time>

To the cyclic transmission time, set a value greater than or equal to the following formula and less than or equal to 216.00μs.

Cyclic transmission time other than driver communication [μs] *1 + (Number of valid axes for driver communication × 2.715 [μs])

If a value outside the above range is set for the cyclic transmission time, "Driver Communication Cyclic Transmission Time Setting Error" (error code: 3235H)*2 will occur.

If this error occurs, change the cyclic transmission time according to the procedure on the module diagnosis screen.

*1 Cyclic transmission time other than driver communication is shown in "Cyclic transmission time (minimum value)" on the "CC-Link IE TSN Configuration" screen.
For the calculation method of "Cyclic transmission time (minimum value), refer to "Processing time" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Network)

*2 This error code is supported by Add-on baseSystem version "Ver.1.30" or later. For versions prior to "Ver.1.30", "Driver communication setting error 2" (error code: 3231H) occurs.

■Driver communication cycle

The communication cycle for driver communication is automatically set to 125.00μs or 250.00μs by calculating the bandwidth based on the number of master axes and slave axes and "Communication Period Interval Setting" in "Basic Period Setting".

Communication cycle interval [μs]	Driver communication cycle [μs]	Driver communication magnification (Basic)
250.00	125.00	2
500.00*1	125.00	4
500.00*1	250.00	2
1000.00	250.00	4
2000.00	250.00	8
4000.00	250.00	16

*1 Even if the driver communication cycle 250.00μs is used for calculation, when it is determined to be fit inside the Motion module 125.00μs, the driver communication cycle 125.00μs is used for operation.

The current operating status of driver communication can be checked with the following link special register (SW).

- SW04C0: Driver communication cycle interval [μs]
- SW04C1: Driver communication cycle system reservation time [μs]
- SW04C2: Driver communication cycle cyclic transmission time [μs]
- SW04C3: Driver communication cycle transient transmission time [μs]
- SW04C4: Driver communication magnification (basic)
- SW04C5: Driver communication magnification (medium-speed)
- SW04C6: Driver communication magnification (low-speed)

■Communication speed of CC-Link IE TSN

Specify 1Gbps for the communication speed set with GX Works3.

If 100Mbps is specified, "Driver communication setting error 2" (error code: 3231H) occurs in the Motion module.

■Connection with a device station of CC-Link IE TSN Class A

When connecting a device station of CC-Link IE TSN Class A, set "TSN HUB Setting" to "Use TSN HUB" in "Module Parameter (Network)". In addition, set the total cyclic data size of the CC-Link IE TSN Class A stations within 2K bytes.

If "Not to Use TSN HUB" is set, "Driver communication setting error 2" (error code: 3231H) occurs.

■Control data / control status of the master axis and slave axis for drive communication

The control data / control status of the master axis and slave axis for drive communication is transmitted by the cyclic transmission dedicated for driver communication.

Precautions for control

⚠CAUTION

• Even if a servo alarm occurs on a slave axis during operation of driver communication, positioning control and JOG operation of the master axis are not interrupted. Stop operation by using the user program.

■Servo amplifier

- Use servo amplifiers that support driver communication for the axes used for driver communication.
- Set the combinations of the master axes and slave axes with servo parameters. After the servo parameters are written to the Motion module, they become effective when the system power is turned on again or reset.
- Check whether the driver communication can be operated with "[Md.52] Communication between amplifiers axes searching flag" of the system monitor data.
- If any axis to be used for driver communication is disconnected, disconnect all axes in the group of the driver communication to which the disconnected axis belongs in order to reconnect the axis.
- If all axes set for driver communication are not detected at the start of communication with servo amplifiers, all the connected axes including the independent axes cannot be operated. (The LED display on the servo amplifier remains "b".) Check whether the axes can be operated with "[Md.52] Communication between amplifiers axes searching flag". When all the independent operation axes and axes of the driver communication setting are connected, "[Md.52] Communication between amplifiers axes searching flag" becomes "0: Completed searching driver communication setting axes".

Monitor item		Monitor value	Setting details	Buffer memory address
				Axis 1 to axis 16
[Md.52]	Communication between amplifiers axes searching flag	→	The detection state of the axis set for driver communication is stored. 0: Completed searching driver communication setting axes 1: Searching all driver communication setting axes	4234

Point

- If communication is interrupted due to failure of a servo amplifier, communication cannot be established after the failed servo amplifier. For this reason, take measures such as star topology using an industrial switch (for CC-Link IE TSN Class B) to minimize the affected range.
- When an axis is disconnected, the Motion module issues "Quick stop" defined in CiA402 to all the axes belong to the same group as the disconnected axis. To stop the issuance of "Quick stop", disconnect all the axes belong to the driver communication group to which the disconnected axis belongs and then reconnect the group.

■Home position return control, positioning control, manual control, expansion control, and synchronous control

- Do not start the slave axis. Even if the slave axis is started, the command to the servo amplifier will be invalid.
- Although the home position return request flag ([Md.31] Status: b3) is always ON, this does not affect the control of the slave axis.
- There are restrictions on data used for positioning control of the slave axis. External input signals such as FLS and RLS and parameters such as software stroke limits are invalid. For details, refer to the following.
  ☞ Page 355 I/O signal of slave axis, ☞ Page 355 Data used for positioning control of the slave axis
- When setting a slave axis as the servo input axis, set "[Pr.300] Servo input axis type" to "2: Actual position value" or "4: Feedback value". Otherwise, the slave axis does not operate as the input axis.
- During driver communication operation, only the positioning control mode, speed control mode, and torque control mode can be switched. If the control mode is switched to continuous operation to torque control mode for the master axis, "Control mode switching not possible" (warning code: 0DABH) occurs and the control mode is not switched.

■Absolute position system

For the slave axis, set the servo parameter "Absolute position detection system selection (PA03.0)" to "0: Invalid (incremental system)". Even if it is set to "1: Enabled (absolute position detection system)", the absolute position system is disabled and "Invalid absolute position system setting" (warning code: 0D3DH) occurs.

■I/O signal of slave axis

- Input signal: All signals are unavailable. The error detection signal is "Error detection" ([Md.31] Status: b13).
- Output signal: All signals are unavailable.

■Data used for positioning control of the slave axis

- For the slave axis, only the following axis monitor data is valid.

Item		Remark
[Md.23]	Axis error No.	Only the servo error detection is valid.
[Md.35]	Torque limit stored value/forward torque limit stored value	—
[Md.103]	Motor rotation speed	—
[Md.104]	Motor current value	—
[Md.108]	Servo status 1	The following bits are valid. • b0: READY ON • b1: Servo ON • b7: Servo alarm Since the slave axis is always controlled in torque control mode, "Control mode (b2, b3)" shows torque control mode (0, 1).
[Md.109]	Regenerative load ratio/Optional data monitor output 1	—
[Md.110]	Effective load torque/Optional data monitor output 2	—
[Md.111]	Peak torque ratio/Optional data monitor output 3	—
[Md.112]	Optional data monitor output 4	—
[Md.114]	Servo alarm	—
[Md.120]	Reverse torque limit stored value	—

- For the slave axis, only the following axis control data is valid.

Item		Remark
[Cd.5]	Axis error reset	Only servo alarm detection can be reset.
[Cd.22]	New torque value/forward new torque value	—
[Cd.100]	Servo OFF command	—
[Cd.101]	Torque output setting value	—
[Cd.112]	Torque change function switching request	—
[Cd.113]	New reverse torque value	—

Setting method

■Setting procedure

The setting for driver communication can be roughly divided into the following two settings.

- Setting for servo network configuration parameter
  Set the parameter for the generated axis in the Simple Motion Module setting (module extended parameter) of GX Works3. Select the axis for which driver communication is enabled with the servo network configuration parameter "[Pr.143] Driver communication setting".
- Setting of servo parameter for device station parameter automatic setting
  Set the servo parameter in the device station parameter automatic setting in the module parameter (network) of GX Works3. Select the master axis and slave axis for driver communication and set the control data to be sent and received by driver communication.

The following describes the setting procedure. When using an industrial switch (for CC-Link IE TSN Class B), refer to the following.

☞ Page 358 Detailed communication cycle setting for industrial switch (for CC-Link IE TSN Class B)

1. Open the module information in the Navigation window of GX Works3, select the basic settings in the module parameter (network), and open the network configuration. Then, configure the network configuration according to the system configuration.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ "Target module" ⇨ "Module Parameter (Network)" ⇨ "Basic Settings" ⇨ "Network Configuration Settings"

2. In the device station parameter automatic setting, set the parameter of each driver communication axis. For details of the parameter to be set, refer to the following.

☞ Page 357 Details of servo parameters

3. Set parameters such as the communication cycle setting for master-slave operation in the basic and application settings of the module parameters (network).

4. Select the axis for which driver communication is enabled in "Servo network configuration parameter" of "Simple Motion Module setting (module extended parameter)". For the axis for which driver communication is enabled, set "[Pr.143] Driver communication setting" to "1: Driver communication enabled".

5. Write the project to the CPU module and Motion module, and turn on the power again.

6. After turning on the power again, when CC-Link IE TSN communication is started, set the driver communication for the servo amplifier using the parameter distribution of the device station parameter automatic setting. It is normal that "Power not turned on after parameter distribution" (error code: 1EE4H) occurs in the Motion module at this time. Power on the Motion module and servo amplifier again. After the Motion module and servo amplifier are connected, driver communication starts.

7. After the Motion module and servo amplifier are connected, driver communication starts.

■Details of servo network configuration parameter

Select the axis for which driver communication is enabled.

n: Axis No. - 1

Item		Setting details	Buffer memory address
			Axis 1 to axis 16
[Pr.143]	Driver communication setting	Set whether to enable or disable driver communication. 0: Driver communication disabled 1: Driver communication enabled	58029+32n

Restriction

- When driver communication is enabled, inter-module synchronization cannot be used. "Driver communication setting error 2" (error code: 3231H) occurs in the Motion module.
- If driver communication is enabled for the station set to "Motion Mode (Safety)" in the station-specific mode setting of the network configuration, "Driver communication setting error 1" (error code: 3230H) occurs in the Motion module.

■Details of servo parameters

In the device station parameter automatic setting of GX Works3, set the servo parameter for each driver communication axis. (For details of the setting, refer to the manual of the servo amplifier.)

[MR-J5-_G_(-RJ), MR-J5D1-_G_]

- Driver communication operation setting

Parameter No.	Name	Setting details	Setting target	Setting example			
				Axis 1	Axis 2	Axis 3	Axis 4
PD15.0	Selection of master axis operation for this servo amplifier	Set the master axis and slave axis.	Master	1h (Master axis)	0h	0h	0h
PD15.1	Selection of slave axis operation for this servo amplifier		Slave	0h	1h (Slave axis)	1h (Slave axis)	1h (Slave axis)

- Driver communication slave axis setting (Network setting)

Parameter No.	Name	Setting details	Setting target	Setting example			
				Axis 1	Axis 2	Axis 3	Axis 4
PD22	Master axis 1 station No. setting when driver communication slave is set	Set the station number of the master axis to which the slave axis belongs.	Slave	0 (Invalid)	1 (Axis 1)	1 (Axis 1)	1 (Axis 1)
PD23.1	Master axis 1 control slave axis No. setting when driver communication slave is set	Set the identifier (control slave axis No.) of the own slave axis for the slave axis. Set identifiers in order from 1 in a driver communication group (master axis to which the slave axis belongs).	Slave	0 (Invalid)	1 (Slave axis No.1)	2 (Slave axis No.2)	3 (Slave axis No.3)

Point

- The servo parameter is transferred from the Motion module to the servo amplifier after the power is switched ON or the CPU module is reset.
- The servo parameters for driver communication setting (PD15, PD22, PD23) are enabled by turning the power of the servo amplifier OFF → ON. After the above actions, turn the power of the servo amplifier OFF → ON, and then power on the system or reset the CPU module.
- In the driver communication function, the torque generation direction can be set for the slave axis in the servo parameter "Travel direction selection (PA14)".

■Detailed communication cycle setting for industrial switch (for CC-Link IE TSN Class B)

When using an industrial switch (for CC-Link IE TSN Class B), the communication cycle interval and the time for each time slot are set by referring to the value of the following link special register (SW) while the parameters for driver communication are set normally.

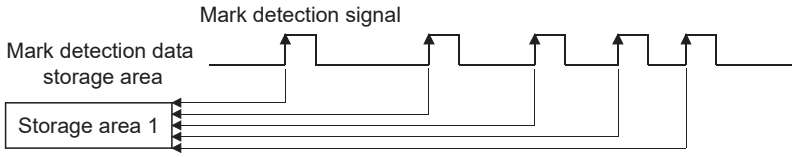
- SW04C0: Driver communication cycle interval [μs]
- SW04C1: Driver communication cycle system reservation time [μs]
- SW04C2: Driver communication cycle cyclic transmission time [μs]
- SW04C3: Driver communication cycle transient transmission time [μs]

9.9 Mark Detection Function

Any data can be latched at the input timing of the mark detection signal (DI).
Also, only data within a specific range can be latched by specifying the data detection range.
The following three modes are available for execution of mark detection.

Continuous detection mode

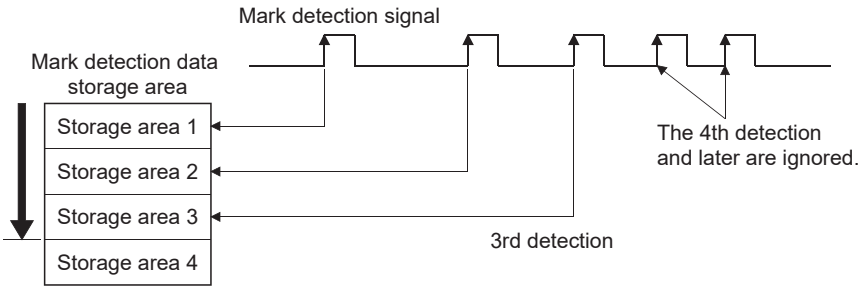
The latched data is always stored to the first of mark detection data storage area at mark detection.



Specified number of detections mode

The latched data from a specified number of detections is stored.
The detected position for a specified number of detections can be collected when the mark detection signal is continuously input at high speed.

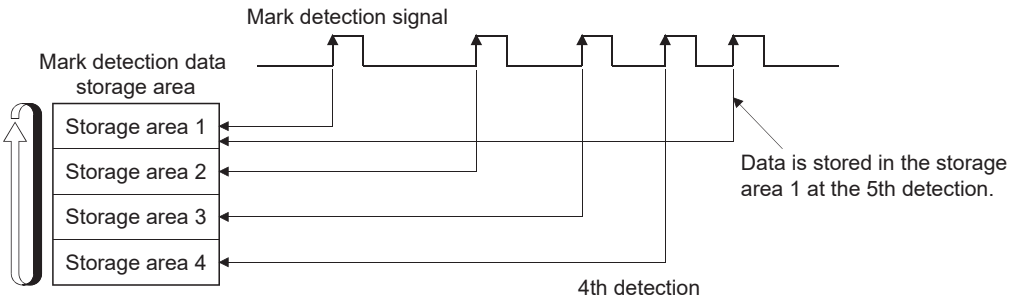
Ex.
Number of detections: 3



Ring buffer mode

The latched data is stored in a ring buffer for a specified number of detections.
The latched data is always stored at mark detection.

Ex.
Number of detections: 4



Point

For Add-on SimpleMotion version "Ver.1.33" or later, a link device can be used for mark detection signals.

Performance specifications

Item	Performance specifications		
	RD78G4	RD78G8	RD78G16
Number of mark detection settings	Up to 16		
Input signal	External input signal DOG and TPR1 (touch probe 1) of the servo amplifier, link device		
Input signal detection direction	When using the DOG signal of the servo amplifier: Detection at leading edge/detection at trailing edge are selectable in "b4: External command/switching signal" of "[Pr.22] Input signal logic selection" When using the TPR1 signal of the servo amplifier and link device: Detection at leading edge/detection at trailing edge are selectable in "[Pr.811] Mark detection signal detection direction setting"		
Input signal compensation time	Correctable within the range of -32768 to 32767μs		
Detection accuracy	When using the DOG signal: operation cycle When using the TPR1 signal: High accuracy When using the link device: operation cycle, high accuracy*1		
Latch data	13 types + Optional buffer memory data (2 words) (Command position value, Machine feed value, Actual position value, Servo input axis position value, Synchronous encoder axis position value, Synchronous encoder axis position value per cycle, Position value after composite main shaft gear, Position value per cycle after main shaft gear, Position value per cycle after auxiliary shaft gear, Cam axis position value per cycle, Cam axis position value per cycle (real position), Command position value of command generation axis, Position value per cycle of command generation axis)		
Number of continuous latch data storage	Up to 32		
Latched data range	Settable in the range of -2147483648 to 2147483647		

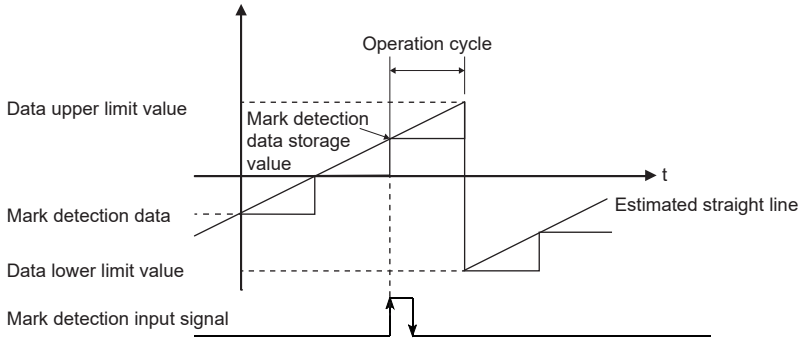
*1 When using remote I/O that supports the synchronous timing control mode.

■Calculation by estimation

The mark detection value during operation cycle interval is calculated by estimation. The value calculated by estimation when the mark detection input signal is inputted is stored in the buffer memory as the mark detection data. The value is calculated as shown in the figure below.

• When using the DOG signal of the servo amplifier

The detection timing is the operation cycle.



• When using TPR1 of the servo amplifier

By using the following signal of the touch probe function of the MR-J5(W)-G series, highly accurate calculation by estimation using the signal detection time is performed.

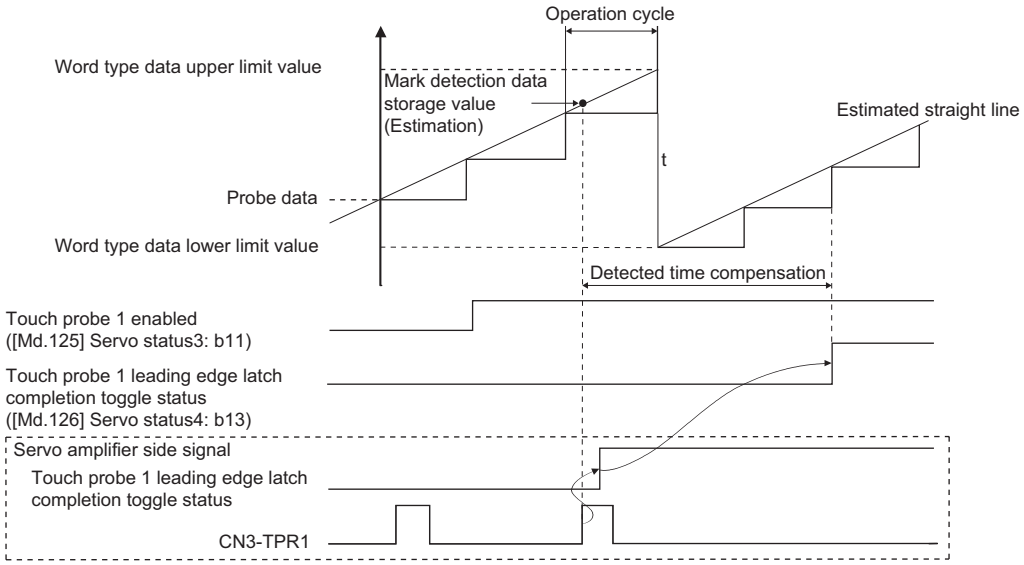
For details on the signal and the accuracy of the signal detection time, refer to the manual of the servo amplifier.

For MR-J5(W)-G: MR-J5 User's Manual (Function)

[Touch probe status (Obj. 60B9h)]

Bit6: Touch probe 1 leading edge latch completion toggle status

Bit7: Touch probe 1 trailing edge latch completion toggle status



Point

- Check the servo parameters of the MR-J5(W)-G series before the connection, and check whether TPR1 is assigned to CN3.*1 For the multi-axis servo amplifier, check that the axis where TPR1 is used is selected. Even when TPR1 is not assigned to CN3, the touch probe 1 becomes enabled, but the signal cannot be detected. For details of the servo parameter setting, refer to "4.4 Touch probe [G]" in the following manual.
  For MR-J5(W)-G: MR-J5 User's Manual (Function)
- The touch probe function of the MR-J5(W)-G series have restrictions on the usable models and versions. The following shows an example of the supported versions. For details and the servo amplifier models not listed in the following, check the manual of the corresponding servo amplifier.
  MR-J5-_G*2: It can be used with servo amplifiers of C0 version or later and those manufactured in June 2021 or later.*3
  MR-J5-_G_-RJ*2: B6 or later
  MR-J5W2-_G/MR-J5W3-_G*4: B6 or later
  When TPR1 is used as a mark detection input signal and a servo amplifier that does not support the touch probe function is connected, "PDO mapping setting error" (error code: 1C48H) will occur and the connection with the servo amplifier cannot be established.
- To detect TPR1 on the Motion module, the touch probe function on the servo amplifier side is needed to be enabled after the connection. Even if operating the cycle for enabling function and the TPR1 input before enabling function, as the signal for mark detection input signal is ignored. Therefore, the Motion module automatically executes enabling by using SLMP after the servo amplifier using TPR1 is connected. If the function cannot be enabled, "Mark detection - Driver touch probe function invalid" (warning: 0D3FH) will occur and the mark detection setting specifying TPR1 of the axis which has error is disabled. Whether the servo amplifier is in touch probe enabled function or not can be checked with the following monitor.
  "[Md.125] Servo status 3", "b11: Touch probe 1 enabled"
- About two communication cycles of delay will occur until "[Md.800] Number of mark detection" or "[Md.801] Mark detection data storage area (1 to 32)" is updated from the servo amplifier TPR1 input.

- The status of TPR1 for the servo amplifier can be checked by one of these methods below.
  - Specify "Touch probe status" by optional data monitor*5
  - Check Toggle status for latch completion at the rising/falling edge of touch probe 1 received from the servo amplifier*6
- If TPR1 is used for the axis that is not set in the axis setting or the axis set as virtual servo amplifier, "Outside mark detection signal setting range" (warning code: 0D36H) will occur and the mark detection will be invalid.

*1 Set the servo parameters related to TPR1. Even if the servo parameters related to TPR2 or later are set, the Motion module does not detect the signal.

*2 Since the Motion module uses the touch probe function at the connection with a single axis servo amplifier, the following CiA402 objects are automatically set to the PDO mapping. For details of each object, refer to the manual of the servo amplifier.
For MR-J5(W)-G: MR-J5-G/MR-J5W-G User's Manual (Object Dictionary)
- Touch probe status (Obj. 60B9H)
- Touch probe time stamp 1 positive value (Obj. 60D1H)
- Touch probe time stamp 1 negative value (Obj. 60D2H)

*3 For the manufacturing date of the MR-J5-_G, refer to the following manual.
MR-J5-G/MR-J5W-G User's Manual (Introduction)

*4 When a multi-axis servo amplifier such as the MR-J5W_-_G/MR-J5W3-_G is connected, the PDO mapping for the CiA402 objects of the touch probe function is not automatically performed. When TPR1 of the multi-axis servo amplifier is used as a mark detection input signal, assign TPR1 to CN3 before the connection and select any one of the axes A, B, and C where TPR1 is used. After that, it becomes enabled by specifying the CiA402 objects for the touch probe to the optional data monitor function of the axis for which TPR1 is selected in the Motion module. However, when Touch probe time stamp 1 positive value (Obj. 60D1H) or Touch probe time stamp 1 negative value (Obj. 60D2H) is not set in the optional data monitor, the detection accuracy becomes the operation cycle.

Parameter name	Setting value
[Pr.91] Optional data monitor data type setting 1	Touch probe status (Obj. 60B9H)
[Pr.93] Optional data monitor data type setting 3	When "0: Detection at leading edge" is set in "[Pr.811] Mark detection signal detection direction setting": Touch probe time stamp 1 positive value (Obj. 60D1H) When "1: Detection at trailing edge" is set in "[Pr.811] Mark detection signal detection direction setting": Touch probe time stamp 1 negative value (Obj. 60D2H)
[Pr.591] Optional data monitor data type expansion setting 1	0010H
[Pr.593] Optional data monitor data type expansion setting 3	0020H

*5 When specifying optional data monitor1

Parameter name	Setting value
[Pr.91] Optional data monitor : Data type setting 1	Touch probe status (Obj. 60B9H)
[Pr.591] Optional data monitor : Data type expansion setting 1	0010H

*6 Can be checked by referring to the corresponding bit of "[Md.126] Servo status4".
- b13: Toggle status for latch completion at the rising edge of touch probe 1
- b14: Toggle status for latch completion at the falling edge of touch probe 1

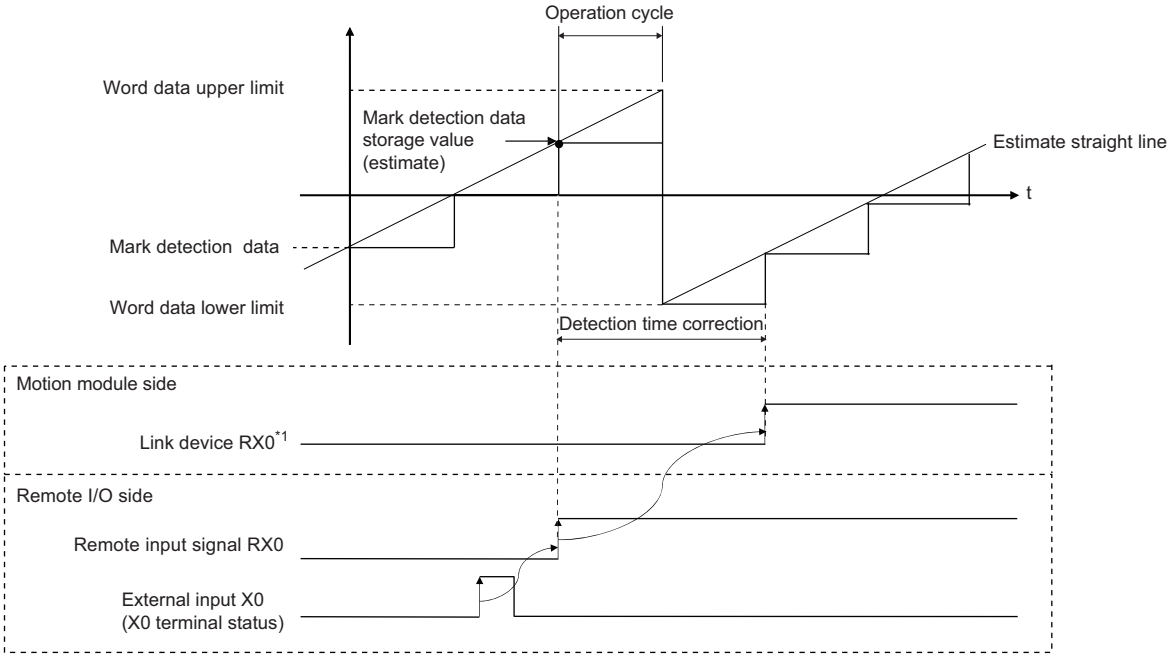
• When using a link device

Point

The signal response time varies depending on the input response time setting value of the remote I/O. Therefore, the signal delay caused by the input response time setting value should be corrected by "[Pr.801] Mark detection signal compensation time".

[Normal]

The detection timing is the calculation cycle.



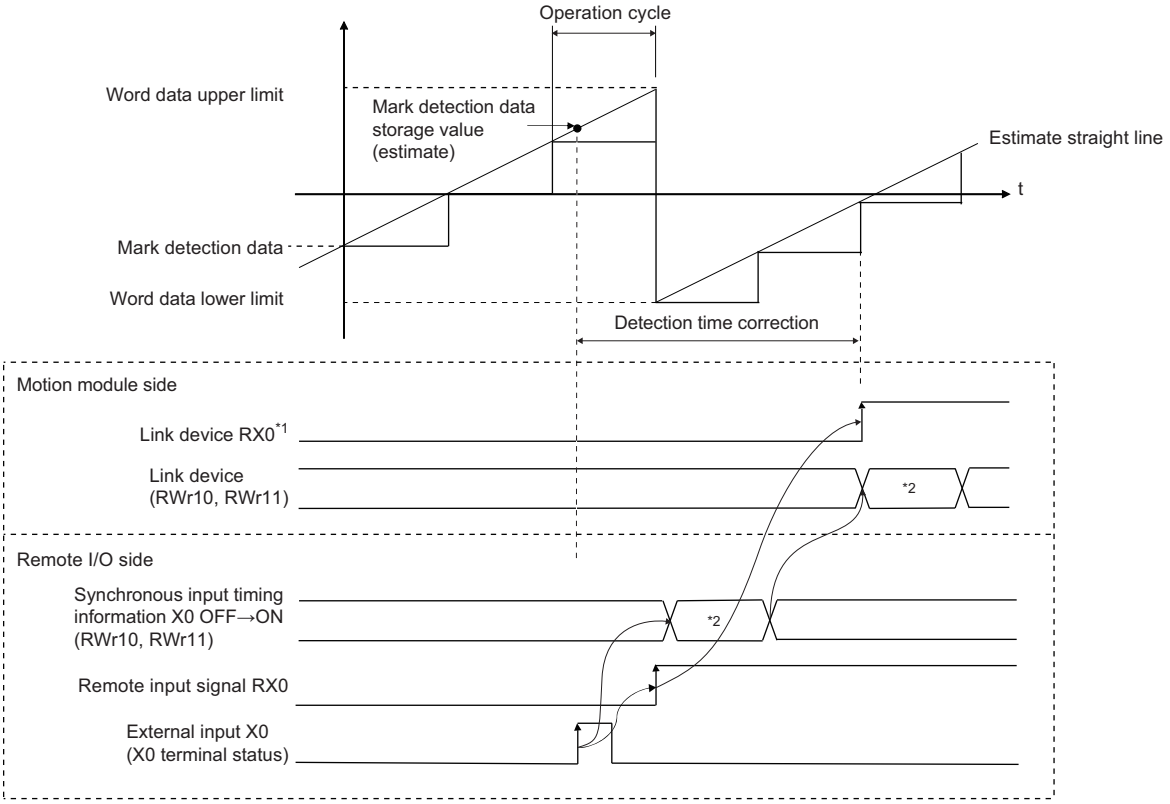
*1 When using RX0 as the link device.

[High accuracy]

Using the RX signal of a remote I/O that supports the synchronous timing control mode, a highly accurate estimation calculation is performed using the synchronous input timing information.

The detection accuracy is determined by the resolution of the synchronous input timing information of the remote I/O. For details, refer to the following manual.

CC-Link IE Field Network Remote I/O Module User's Manual



*1 When using RX0, RWr10 and RWr11 as the link device.

*2 Synchronous timing information will be updated.

Point

On the conditions for possible high accuracy, refer to the following.

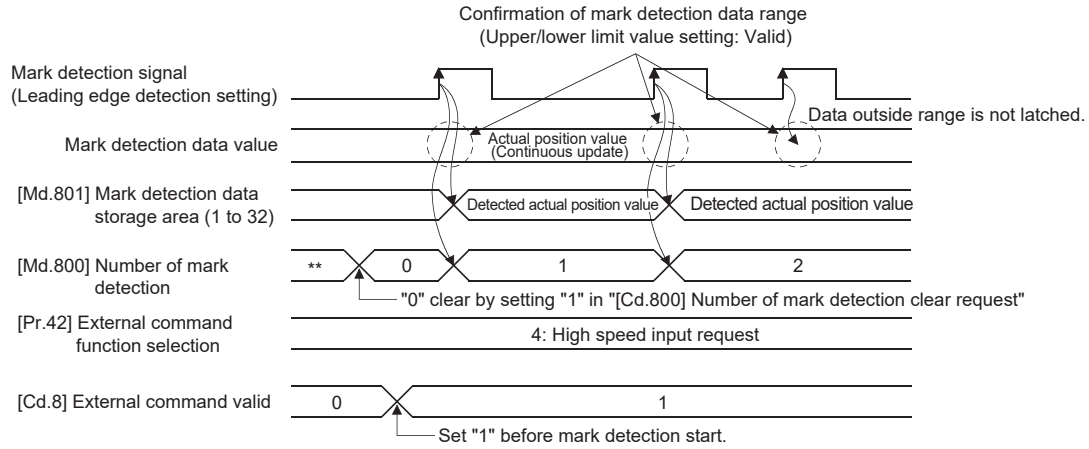
Page 325 Link Device External Signal Assignment Function

Operation for mark detection function

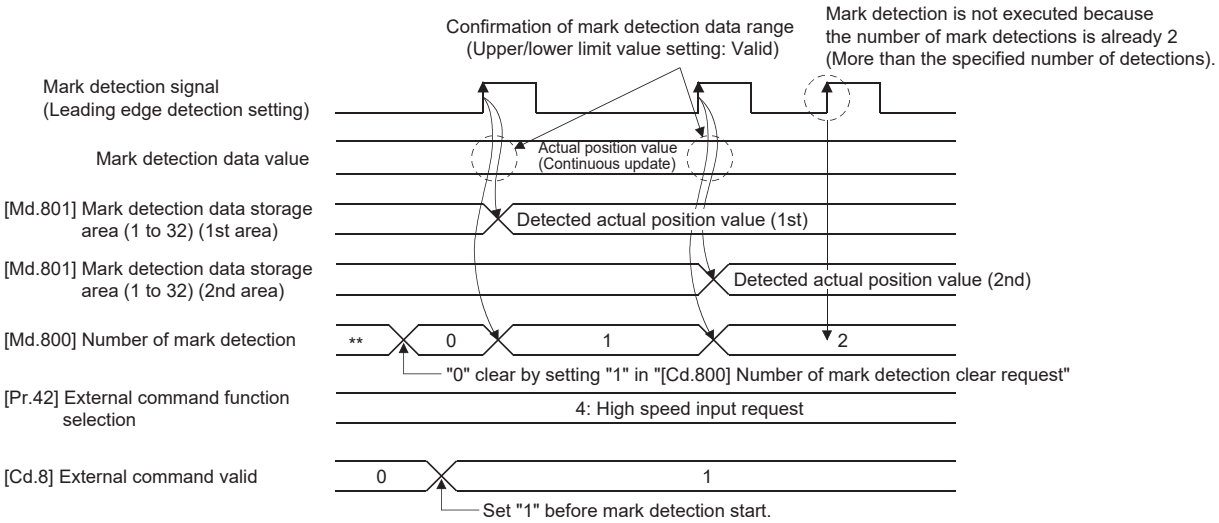
Operations done at mark detection are shown below.

- Calculations for the mark detection data are estimated at leading edge/trailing edge of the mark detection signal. However, when the specified number of detections mode is set, the current number of mark detection is checked, and then it is judged whether to execute the mark detection.
- When a mark detection data range is set, it is first confirmed whether the mark detection data is within the range or not. Data outside the range are not detected.
- The mark detection data is stored in the mark detection data storage area according to the mark detection mode, and then the number of mark detection is updated.

■Continuous detection mode



■Specified number of detection mode (Number of detections: 2)



How to use mark detection function

An example for mark detection using the DOG signal of the MR-J5(W)-G is shown below.

The mark detection target is axis 1 actual position value, and the all range is detected in continuous detection mode.

- Allocate the input signal to the external signal of the device of axis 2, and set the "high speed input request" for mark detection.

n: Axis No. - 1

Setting item		Setting value	Setting details/setting value	Buffer memory address
				Axis 1 to axis 16
[Pr.42]	External command function selection	4	Set "4: High speed input request" as the function used in the external command signal of axis 2.	212(62+150n)
[Pr.95]	External command signal selection	102	Set "102: DOG signal of axis 2" to the external command signal of axis 2.	219(69+150n)

- Set the following mark detection setting parameters. The optional mark detection setting No. can be set.

k: Mark detection setting No. - 1

Setting item		Setting value	Setting details/setting value	Buffer memory address
				Axis 1 to axis 16
[Pr.800]	Mark detection signal setting	2	Set "2: Axis 2" to the external input signal for mark detection.	54000+20k
[Pr.801]	Mark detection signal compensation time	0	Set "0: (No compensation)" to the compensation time such as delay of sensor.	54001+20k
[Pr.802]	Mark detection data type	2	Set "2: Actual position value" to the target data for mark detection.	54002+20k
[Pr.803]	Mark detection data axis No.	1	Set "1: Axis 1" to the axis No. of target data for mark detection.	54003+20k
[Pr.805]	Latch data range upper limit value	0	Set "0" to the valid upper limit value for latch data at mark detection. (Mark detection for all range is executed by setting the same value as lower limit value.)	54006+20k 54007+20k
[Pr.806]	Latch data range lower limit value	0	Set "0" to the valid lower limit value for latch data at mark detection. (Mark detection for all range is executed by setting the same value as upper limit value.)	54008+20k 54009+20k
[Pr.807]	Mark detection mode setting	0	Set "0: Continuous detection mode" to the mark detection mode.	54010+20k

- Turn the power supply OFF or reset of the CPU module to validate the setting parameters.
- The mark detection starts by setting "1: Validates an external command." in "[Cd.8] External command valid" of axis 2 with the program. Refer to "[Md.800] Number of mark detection" or "[Md.801] Mark detection data storage area (1 to 32)" of the set detection setting No. for the number of mark detections and mark detection data.

List of parameters and data

The following shows the configuration of parameters and data for mark detection function.

Buffer memory address	Item	Mark detection setting No.
54000 to 54019	Mark detection setting parameter [Pr.800] to [Pr.811]	Mark detection setting 1
54020 to 54039		Mark detection setting 2
54040 to 54059		Mark detection setting 3
⋮		⋮
54300 to 54319		Mark detection setting 16
54640 to 54649	Mark detection control data [Cd.800], [Cd.801], [Cd.802]	Mark detection setting 1
54650 to 54659		Mark detection setting 2
54660 to 54669		Mark detection setting 3
⋮		⋮
54790 to 54799		Mark detection setting 16
54960 to 55039	Mark detection monitor data [Md.800], [Md.801]	Mark detection setting 1
55040 to 55119		Mark detection setting 2
55120 to 55199		Mark detection setting 3
⋮		⋮
56160 to 56239		Mark detection setting 16

Refer to the following for the range of mark detection setting No. that can be used for each module.

☞ Page 360 Performance specifications

The following shows the parameters and data used in the mark detection function.

Mark detection setting parameters

k: Mark detection setting No. - 1

Setting item		Setting details/setting value	Default value	Buffer memory address
				Axis 1 to axis 16
[Pr.800]	Mark detection signal setting	Set the external input signal (high speed input request) for mark detection. 0: Invalid 1 to 4: External command signal of axis 1 to axis 4 (4-axis module) 1 to 8: External command signal of axis 1 to axis 8 (8-axis module) 1 to 16: External command signal of axis 1 to axis 16 (16-axis module) 301 to 304: Servo amplifier TPR1 of axis 1 to axis 4 (4-axis module) 301 to 308: Servo amplifier TPR1 of axis 1 to axis 8 (8-axis module) 301 to 316: Servo amplifier TPR1 of axis 1 to axis 16 (16-axis module) 901: Link device Fetch cycle: Power supply ON	0	54000+20k
[Pr.801]	Mark detection signal compensation time	Set the compensation time such as delay of sensor. Set a positive value to compensate for a delay. -32768 to 32767 [μs] Fetch cycle: Power supply ON or PLC READY [Y0] OFF to ON	0	54001+20k
[Pr.802]	Mark detection data type	Set the target data for mark detection. 0 to 14: Data type -1: Optional 2 word buffer memory Fetch cycle: Power supply ON	0	54002+20k
[Pr.803]	Mark detection data axis No.	Set the axis No. of target data for mark detection. 1 to 4: Axis 1 to axis 4 (4-axis module) 1 to 8: Axis 1 to axis 8 (8-axis module) 1 to 16: Axis 1 to axis 16 (16-axis module) 201 to 204: Command generation axis 1 to axis 4 (4-axis module) 201 to 208: Command generation axis 1 to axis 8 (8-axis/16-axis module) 801 to 804: Synchronous encoder axis 1 to axis 4 (4-axis module) 801 to 808: Synchronous encoder axis 1 to axis 8 (8-axis module) 801 to 816: Synchronous encoder axis 1 to axis 16 (16-axis module) Fetch cycle: Power supply ON	0	54003+20k
[Pr.804]	Mark detection data buffer memory No.	Set the optional buffer memory No. Set this parameter as an even number. 0 to 16777214: Optional buffer memory Fetch cycle: Power supply ON	0	54004+20k 54005+20k
[Pr.805]	Latch data range upper limit value	Set the valid upper limit value for latch data at mark detection. -2147483648 to 2147483647 Fetch cycle: Power supply ON, PLC READY [Y0] OFF to ON, or request (latch data range change)	0	54006+20k 54007+20k
[Pr.806]	Latch data range lower limit value	Set the valid lower limit value for latch data at mark detection. -2147483648 to 2147483647 Fetch cycle: Power supply ON, PLC READY [Y0] OFF to ON, or request (latch data range change)	0	54008+20k 54009+20k
[Pr.807]	Mark detection mode setting	Set the continuous detection mode or specified number of detection mode. 0: Continuous detection mode 1 to 32: Specified number of detection mode (Set the number of detections.) -1 to -32: Ring buffer mode (Set the value that made the number of buffers into negative value.) Fetch cycle: Power supply ON or PLC READY [Y0] OFF to ON	0	54010+20k
[Pr.808]	Mark detection signal link device type	Set the link device type for use. Others: Invalid 11H: RX 12H: RY 13H: RWr 14H: RWw Fetch cycle: At power supply ON	0	54010+20k
[Pr.809]	Mark detection signal link device start No.	Set the link device No. for use. Fetch cycle: At power supply ON	0	54012+20k

Setting item		Setting details/setting value	Default value	Buffer memory address
				Axis 1 to axis 16
[Pr.810]	Mark detection signal link device bit specification	Set the bit No. to be used when setting "13H: RWr", "14H: RWw" to "[Pr.808] Mark detection signal link device type". 00H to 0FH Fetch cycle: At power supply ON	0	54013+20k
[Pr.811]	Mark detection signal detection direction setting	Set the signal detection direction when TPR1 of the servo amplifier and the link device is specified in "[Pr.800] Mark detection signal setting". Only the setting in bit0 is valid. 0: Detection at leading edge 1: Detection at trailing edge Fetch cycle: Power supply ON	0	54014+20k

Point

The above parameters are valid with the value set in the flash ROM of the Motion module when the power ON or the CPU module reset. Except for a part, the value is not fetched by turning PLC READY [Y0] ON from OFF. Therefore, write to the flash ROM after setting the value in the buffer memory to change.

[Pr.800] Mark detection signal setting

Set the input signal for mark detection.

Setting value	Setting details
0	Invalid
1 to 4	External command signal (DI) of axis 1 to axis 4 (4-axis module)
1 to 8	External command signal (DI) of axis 1 to axis 8 (8-axis module)
1 to 16	External command signal (DI) of axis 1 to axis 16 (16-axis module)
301 to 304	Servo amplifier TPR1 of axis 1 to axis 4 (4-axis module)
301 to 308	Servo amplifier TPR1 of axis 1 to axis 8 (8-axis module)
301 to 316	Servo amplifier TPR1 of axis 1 to axis 16 (16-axis module)
901	Link device

If a value other than the above is set, "Outside mark detection signal setting range" (warning code: 0D36H) occurs and the target mark detection is not available.

- When carrying out the mark detection with an external signal command, set "4: High speed input request" in "[Pr.42] External command function selection" and set "1: Validates an external command." in "[Cd.8] External command valid".
- When carrying out the mark detection with TPR1 of the servo amplifier, assign TPR1 to CN3 of the servo amplifier.
- When using a link device, specify the target link device in [Pr. 808] to [Pr. 811].

Point

- When carrying out the mark detection with an external signal command with this parameter set, also set "[Pr.95] External command signal selection".

Setting example

When "101: DOG signal of axis 1" is set in "[Pr.95] External command signal selection" and "8: External command signal of axis 8 (DI)" is set in "[Pr.800] Mark detection signal setting" of axis 8, mark detection is performed with the DOG signal of the servo amplifier connected to axis 1.

When the DOG signal is selected for use as the external command signal in "[Pr.95] External command signal selection", the accuracy of the mark detection changes to the accuracy of the operation cycle.

- When carrying out the mark detection with TPR1 of the servo amplifier with this parameter set, also set "[Pr.811] Mark detection signal detection direction setting". For the accuracy when using TPR1 of the servo amplifier, refer to the manual of the servo amplifier.

For MR-J5(W)-G: MR-J5 User's Manual (Function)

[Pr.801] Mark detection signal compensation time

Compensate the input timing of the mark detection signal.

Set this parameter to compensate such as delay of sensor input. (Set a positive value to compensate for a delay.)

[Pr.802] Mark detection data type

Set the data that latched at mark detection.

The target data is latched by setting "0 to 14". Set the axis No. in "[Pr.803] Mark detection data axis No.".

Optional 2 word buffer memory is latched by setting "-1". Set the buffer memory No. in "[Pr.804] Mark detection data buffer memory No.".

Setting value	Data name
0	Command position value
1	Machine feed value
2	Actual position value
3	Servo input axis position value
6	Synchronous encoder axis position value
7	Synchronous encoder axis position value per cycle
8	Position value after composite main shaft gear
9	Position per cycle after main shaft gear
10	Position per cycle after auxiliary shaft gear
11	Cam axis position value per cycle
12	Cam axis position value per cycle (Real position)
13	Command position value of command generation axis
14	Position value per cycle of command generation axis
-1	Optional 2 words buffer memory

If a value other than the above is set, "Outside mark detection data type setting range" (warning code: 0D37H) occurs and the target mark detection is not available.

[Pr.803] Mark detection data axis No.

Set the axis No. of data that latched at mark detection.

[Pr.802] Mark detection data type			[Pr.803] Mark detection data axis No.		
Setting value	Data name	Unit	4-axis module	8-axis module	16-axis module
0	Command position value	10^{-1} [μm], 10^{-5} [inch], 10^{-5} [degree], [pulse]	1 to 4	1 to 8	1 to 16
1	Machine feed value				
2	Actual position value				
3	Servo input axis position value				
6	Synchronous encoder axis position value	Synchronous encoder axis position unit	801 to 804	801 to 808	801 to 816
7	Synchronous encoder axis position value per cycle				
8	Position value after composite main shaft gear	Main input axis position unit	1 to 4	1 to 8	1 to 16
9	Position per cycle after main shaft gear	Cam axis cycle unit			
10	Position per cycle after auxiliary shaft gear				
11	Cam axis position value per cycle				
12	Cam axis position value per cycle (Real position)*1				
13	Command position value of command generation axis	Command generation axis position unit	201 to 204	201 to 208	
14	Position value per cycle of command generation axis				

*1 The same value as "11: Cam axis position value per cycle".

If a value other than the above is set, "Outside mark detection data axis No. setting range" (warning code: 0D38H) occurs and the target mark detection is not available.

[Pr.804] Mark detection data buffer memory No.

Set the No. of optional 2 words buffer memory that latched at mark detection.

Set this No. as an even No.

If a value other than the above is set, "Outside mark detection data buffer memory No. setting range" (warning code: 0D39H) occurs and the target mark detection is not available.

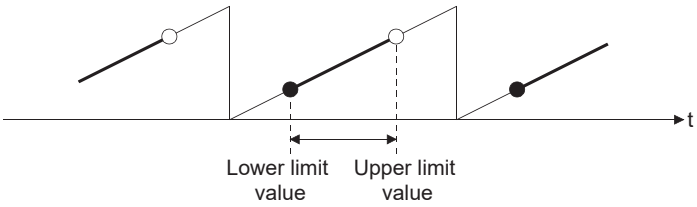
[Pr.805] Latch data range upper limit value, [Pr.806] Latch data range lower limit value

Set the upper limit value and lower limit value of the latch data at mark detection.

When the data at mark detection is within the range, they are stored in "[Md.801] Mark detection data storage area (1 to 32)" and "[Md.800] Number of mark detection" is incremented by 1. When the data is out of the range, the mark detection processing is not executed.

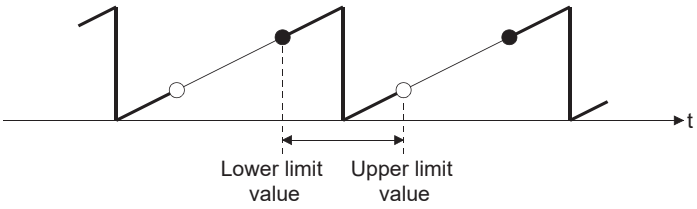
• Upper limit value > Lower limit value

The mark detection is executed when the mark detection data is "greater or equal to the lower limit value and less than the upper limit value".



• Upper limit value < Lower limit value

The mark detection is executed when the mark detection data is "greater or equal to the lower limit value or less than the upper limit value".



• Upper limit value = Lower limit value

The mark detection range is not checked. The mark detection is executed for all range.

[Pr.807] Mark detection mode setting

Set the data storage method of mark detection.

Mode	Setting value	Operation for mark detection	Mark detection data storage method
Continuous detection mode	0	Always	The data is updated in the mark detection data storage area 1.
Specified number of detection mode	1 to 32	Number of detections (If the number of mark detection is the number of detections or more, the mark detection is not executed.)	The data is stored to the mark detection data storage area "n". n = (1 + Number of mark detection)
Ring buffer mode	-1 to -32	Always (The mark detection data storage area 1 to 32 is used as a ring buffer for the number of detections.)	

[Pr.808] Mark detection signal link device type

Set the link device type for use.

Setting value	Setting details
11H	RX
12H	RY
13H	RWr
14H	RWw

Values other than the above are invalid.

[Pr.809] Mark detection signal link device start No.

Set the link device No. for use.
RX/RY: 0 to 3FFFH
RWr/RWw: 0 to 1FFH
When a link device No. outside the range is set, "Mark detection link device start No. specification" (warning code: 0D2EH) occurs and the target mark detection cannot be used.

[Pr.810] Mark detection signal link device bit specification

Set the link device No. to be used when setting "13H: RWr" and "14H: RWw" for "[Pr.808]Mark detection signal link device type".
When a value outside the range is set, "Mark detection link device bit specification" (warning code: 0D2FH) occurs and the target mark detection is disabled.

[Pr.811] Mark detection signal detection direction setting

Set the signal detection direction when TPR1 of the servo amplifier and the link device is specified in "[Pr.800] Mark detection signal setting". Only the setting in bit0 is valid.
0: Detection at leading edge
1: Detection at trailing edge

Mark detection control data

k: Mark detection setting No. - 1

Setting item		Setting details/setting value	Default value	Buffer memory address
				Axis 1 to axis 16
[Cd.800]	Number of mark detection clear request	Set "1" to execute "0" clear of number of mark detections. "0" is automatically set after completion by "0" clear of number of mark detections. 1: 0 clear of number of mark detections Fetch cycle: Operation cycle	0	54640+10k
[Cd.801]	Mark detection invalid flag	Set this flag to invalidate mark detection temporarily. 1: Mark detection: Invalid Others: Mark detection: Valid Fetch cycle: Operation cycle	0	54641+10k
[Cd.802]	Latch data range change request	Request the processing of latch data range change. Set the following value depending on the timing of updating the change value. 1: Change in the next Operation cycle of the requested 2: Change in the next DI input of the requested "0" is automatically set after the change is completed. Fetch cycle: Operation cycle or when condition is satisfied (DI input)	0	54642+10k

[Cd.800] Number of mark detection clear request

Set "1" to execute "0" clear of "[Md.800] Number of mark detection". "0" is automatically set after completion by "0" clear of "[Md.800] Number of mark detection".

[Cd.801] Mark detection invalid flag

Set "1" to invalidate mark detection temporarily. The mark detection signal during invalidity is ignored.

[Cd.802] Latch data range change request

Request the processing of latch data range change. Set the following value depending on the timing of updating the change value.

1: Change in the next Operation cycle of the requested

2: Change in the next DI input of the requested

- "0" is automatically set after receiving the latch data range change request. (It indicates that the latch data range change is completed.)
- "[Pr.805] Latch data range upper limit value" and "[Pr.806] Latch data range lower limit value" at latch data range change request are used as the change value.
- Restrictions according to the type of latch data range change request are shown below.

○: Possible, ×: Not possible

Types of change request	[Cd.801] Mark detection invalid flag	Changing possibility
1: Change in the next Operation cycle of the requested	1: Mark detection: Invalid	○
	Other than 1: Mark detection: Valid	
2: Change in the next DI input of the requested	1: Mark detection: Invalid	×
	Other than 1: Mark detection: Valid	○

Mark detection monitor data

k: Mark detection setting No. - 1

Storage item		Storage details/storage value	Buffer memory address
			Axis 1 to axis 16
[Md.800]	Number of mark detection	The number of mark detections is stored. "0" clear is executed at power supply ON. Continuous detection mode: 0 to 65535 (Ring counter) Specified number of detection mode: 0 to 32 Ring buffer mode: 0 to (number of buffers - 1) Refresh cycle: When condition is satisfied (Mark detection)	54960+80k
[Md.801]	Mark detection data storage area 1 ⋮ Mark detection data storage area 32	The latch data at mark detection is stored. Data for up to 32 times are stored in the specified number of detection mode. Data are stored as a ring buffer for number of detections in the ring buffer mode. -2147483648 to 2147483647 Refresh cycle: When condition is satisfied (Mark detection)	54962+80k 54963+80k ⋮ 55024+80k 55025+80k

[Md.800] Number of mark detection

The counter value is incremented by 1 at mark detection. Preset "0" clear in "[Cd.800] Number of mark detection clear request" to execute the mark detection in specified number of detections mode or ring buffer mode.

[Md.801] Mark detection data storage area (1 to 32)

The latch data at mark detection is stored. Data for up to 32 times can be stored in the specified number of detection mode or ring buffer mode.

Precautions

- When the data of "[Pr.802] Mark detection data type" or "[Pr.803] Mark detection data axis No." is selected incorrectly, the incorrect latch data is stored. For the data of "[Pr.802] Mark detection data type", set the item No. instead of specifying the buffer memory No. directly.
- When "9: Position value per cycle after main shaft gear" or "10: Position value per cycle after auxiliary shaft gear" is set to "[Pr.802] Mark detection data type" and the mark detection is executed right after the cam axis length per cycle is changed during synchronous control, the data before the cam axis length per cycle is changed may be latched. At the time, the latch data is calculated based on the executing cam axis length per cycle. Therefore, the value different from the actual output monitor data may be latched.
- When "8: Position value after composite main shaft gear" to "12: Cam axis position value per cycle (real position)" are set to "[Pr.802] Mark detection data type" and the mark detection is executed other than during synchronous control, the value different from the actual output monitor data may be latched.
- If an operation cycle over occurs before or after inputting the mark detection signal, the estimation accuracy may decrease.
- When using TPR1 of the servo amplifier as the mark detection input, prevent the signal input to the servo amplifier from turning ON/OFF multiple times within a single communication cycle. If the signal is turned ON/OFF multiple times within a single communication cycle, the signal cannot be detected properly.
- If the mark detection signal is input at the timing when the latch target data is changed significantly such as by the current position change or the home position return, the correct data cannot be latched.
  During the current position change or the home position return, use the data such as "[Cd.801] Mark detection invalid flag" to temporarily disable the mark detection.

9.10 Optional Data Monitor Function

Registered monitor

The data of the registered monitor is refreshed every operation cycle.

This function is used to store the data (refer to following table) up to four points per axis to the buffer memory and monitor them.

■Data that can be set

Set the index of the CiA402 object of the device.

Ex.

When monitoring the effective load ratio, set "2B09H".

■List of parameters and data

The parameters and data used in the registered monitor of the optional data monitor function is shown below.

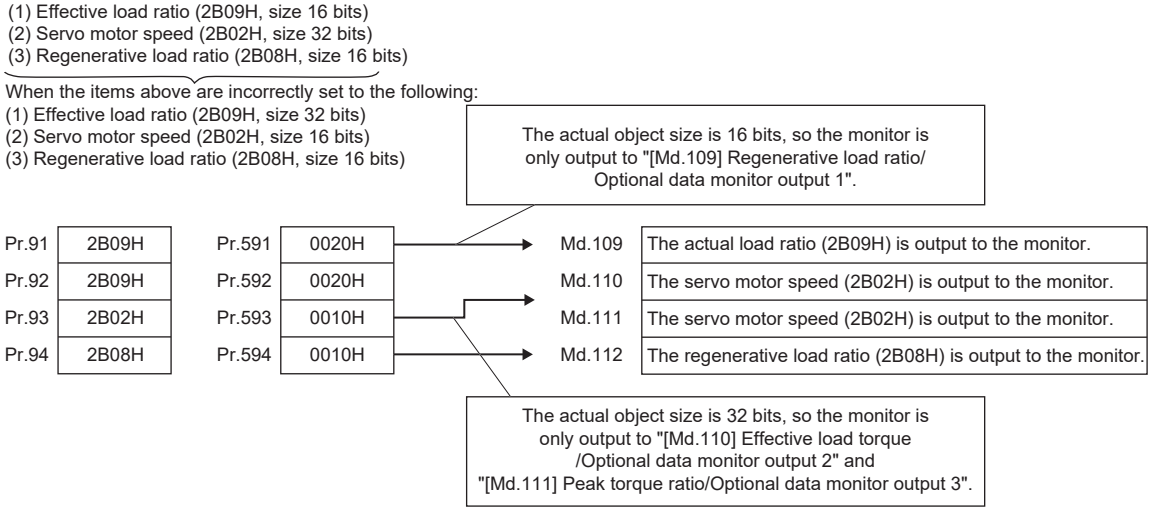
• Extended parameter

n: Axis No. - 1

Setting item		Setting details/setting value	Buffer memory address
			Axis 1 to axis 16
[Pr.91]	Optional data monitor: Data type setting 1	• Set the data type monitored in optional data monitor function every data type setting. (☞ Page 375 Data that can be set) • When "0: No setting" is set, the stored value of "[Md.109] Regenerative load ratio/Optional data monitor output 1" to "[Md.112] Optional data monitor output 4" is different every data type setting 1 to 4.	100+150n
[Pr.92]	Optional data monitor: Data type setting 2		101+150n
[Pr.93]	Optional data monitor: Data type setting 3		102+150n
[Pr.94]	Optional data monitor: Data type setting 4		103+150n
[Pr.591]	Optional data monitor: Data type expansion setting 1	Set the data type monitored in optional data monitor function.	92+150n
[Pr.592]	Optional data monitor: Data type expansion setting 2		93+150n
[Pr.593]	Optional data monitor: Data type expansion setting 3		94+150n
[Pr.594]	Optional data monitor: Data type expansion setting 4		95+150n

Point

- Registered monitor addresses for the optional data monitor are imported after the power is turned ON or the CPU module is reset.
- Set data types that use 2 points in either "[Pr.91] Optional data monitor: Data type setting 1" and "[Pr.591] Optional data monitor: Data type expansion setting 1" or "[Pr.93] Optional data monitor: Data type setting 3" and "[Pr.593] Optional data monitor: Data type expansion setting 3". The setting values of both "[Pr.92] Optional data monitor: Data type setting 2" and "[Pr.592] Optional data monitor: Data type expansion setting 2" and [Pr.94] Optional data monitor: Data type setting 4" and "[Pr.594] Optional data monitor: Data type expansion setting 4"are ignored.
- Confirming the correctness of the object size cannot be performed on the Motion module. As such, the monitor output value will not be stored correctly when the set object size and the actual object size are different. Exercise caution when directly specifying from the engineering tool or setting the optional data monitor from the buffer memory.



- When a value other than 08H, 10H, 20H, or 40H is set in "[Pr.591] Optional data monitor: Data type expansion setting 1" to "[Pr.594] Optional data monitor: Data type expansion setting 4", the value is treated as being 20H.
- When a CiA402 object that cannot be monitored is set, "PDO mapping setting error" (error code: 1C48H) occurs and communication with that axis is not performed.

• Axis monitor data

n: Axis No. - 1

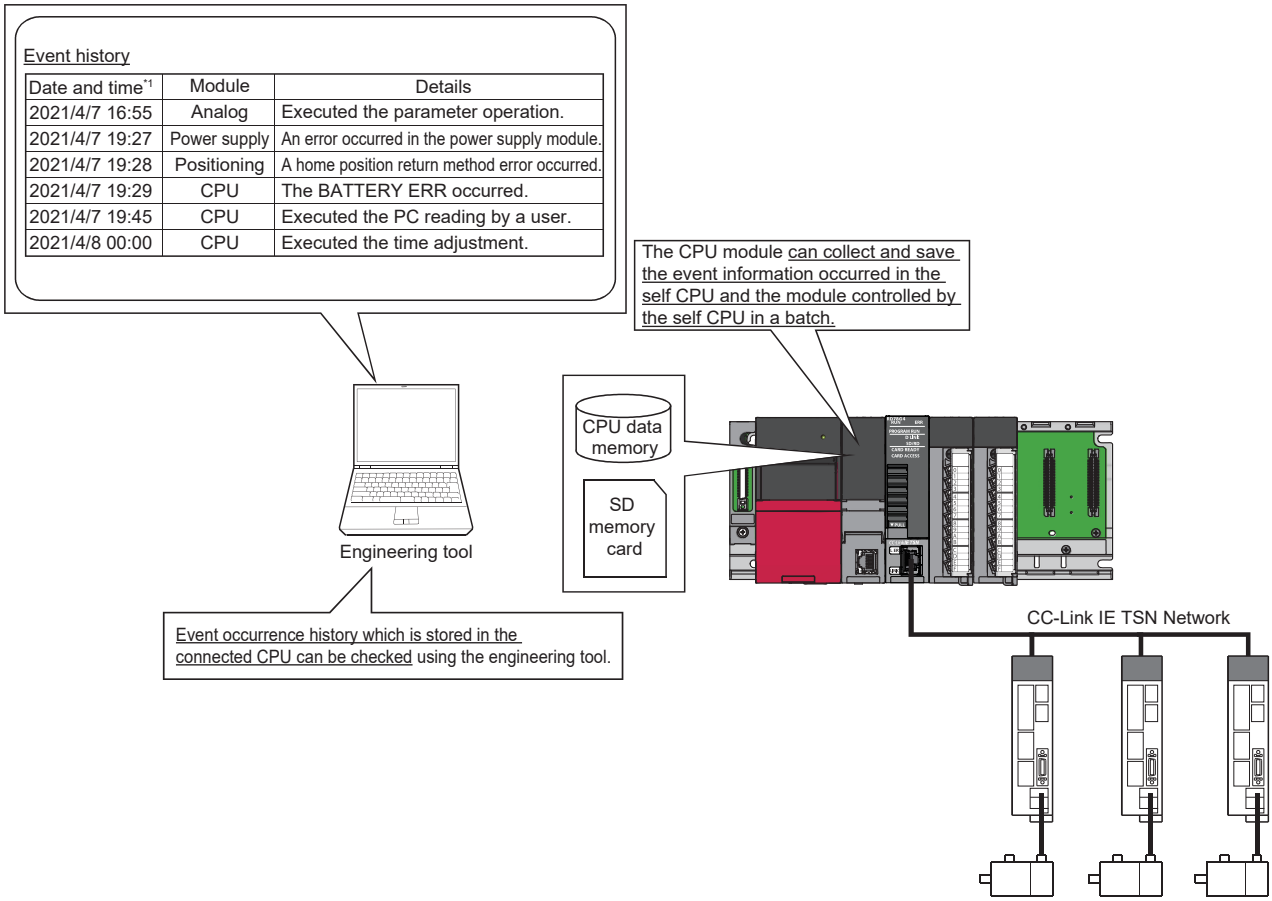
Storage item		Storage details/storage value	Buffer memory address
			Axis 1 to axis 16
[Md.109]	Regenerative load ratio/Optional data monitor output 1	• The content set in "[Pr.91] Optional data monitor: Data type setting 1" and "[Pr.591] Optional data monitor: Data type expansion setting 1" is stored at optional data monitor data type setting. • The regenerative load ratio is stored when nothing is set.	2478+100n
[Md.110]	Effective load torque/Optional data monitor output 2	• The content set in "[Pr.92] Optional data monitor: Data type setting 2" and "[Pr.592] Optional data monitor: Data type expansion setting 2" is stored at optional data monitor data type setting. • The effective load ratio is stored when nothing is set.	2479+100n
[Md.111]	Peak torque ratio/Optional data monitor output 3	• The content set in "[Pr.93] Optional data monitor: Data type setting 3" and "[Pr.593] Optional data monitor: Data type expansion setting 3" is stored at optional data monitor data type setting. • The peak torque ratio is stored when nothing is set.	2480+100n
[Md.112]	Optional data monitor output 4	• The content set in "[Pr.94] Optional data monitor: Data type setting 4" and "[Pr.594] Optional data monitor: Data type expansion setting 4" is stored at optional data monitor data type setting. • "0" is stored when nothing is set.	2481+100n

Point

When the communication interrupted by the servo amplifier's power supply OFF or disconnection of communication cable with servo amplifiers during optional data monitor, "0" is stored in [Md.109] to [Md.112].

9.11 Event History Function

The "event history function" is used to save the error information and the operation for the module as an event in the data memory or an SD card of the CPU module. The saved event information can be displayed with an engineering tool and the occurrence history can be checked in chronological order. The detail information of the error also can be checked by referring to "Optional information" in event history.



*1 Displays a value set by the clock function of the CPU module.

Events that occur on the Motion module

The items saved in the event history are shown in the table below.

For events related to the CC-Link IE TSN network, refer to "Event List" in the following manual.

MELSEC iQ-R Motion Module User's Manual (Network)

Event type	Category	Details	Event item	Event code
System	Error	An error was detected on the Motion module.	Major error	03C00 to 03FFF
			Moderate error	02000 to 03BFF
			Minor error	01000 to 01FFF
	Warning	A warning was detected on the Motion module.	Warning	00800 to 00FFF
	Information	The operation shown on the right column is detected by the Motion module.	Home position return request ON	00000 to 007FF

Detailed information of error/warning event

The items displayed in the detailed information, which vary depending on each error category, are configured by the items shown in the table below.

Error category	Detailed information 1	Detailed information 2	Detailed information 3
H/W error	—	—	—
Positioning control in common Home position return Absolute position restoration Manual control Positioning operation Block start data Positioning data Speed-torque control Cam data operation	Axis information • Axis type • Axis in which an event occurred[*1] • Axis operation status • Start No. [*6] • Data No. in which an event occurred[*6] • Factor axis • Block start Point No. at start[*6] • Block start Point No. at occurrence[*6]	Current value • Command position value • Actual position value • Speed command • Unit	Signal • PLC READY [Y0] • All axis servo ON [Y1] • BUSY • External input signal [Md.30] • Servo status 1 • Servo status 2 • Servo status 3
Synchronous control (Input axis)	Axis information • Axis in which an event occurred (For a synchronous encoder axis, 800 + Axis No.) • Axis operation status (For a synchronous encoder axis, always "0")	—	—
Synchronous control (Output axis)	Axis information • Axis in which an event occurred • Axis operation status • Cam data No. when an error occurred	Current value • Command position value • Unit	—
Servo amplifier	Axis information • Axis in which an event occurred • Axis operation status • Start No. [*2*6] • Data No. in which an event occurred[*2*6] • Block start Point No. at start[*6] • Block start Point No. at occurrence[*6] • Servo alarm • Servo alarm detail number	Current value • Command position value • Actual position value • Unit • Motor rotation speed (0.01r/min)[*3] • Motor current value (0.1%)	Signal • Servo status 1 • Servo status 2 • Servo status 3
I/F • Hold error • Flash ROM error • CPU module error • Dedicated instruction	System information • Number of write accesses to flash ROM	—	—
Parameter setting range error • Common parameter • Basic parameter • Detailed parameter • Home position return parameter • Extended parameter • Servo parameter	Axis information • Axis type • Axis in which an event occurred[*4] • Detail code	Setting value • Parameter 1 • Setting value 1 • Parameter 2 • Setting value 2 • Parameter 3 • Setting value 3 Displays the number of parameters in which an error occurred.	Setting value • Parameter 4 • Setting value 4 • Parameter 5 • Setting value 5 • Parameter 6 • Setting value 6 Displays the number of parameters in which an error occurred.
Driver home position return	Axis information • Axis in which an event occurred • Operation alarm • Absolute position detection system • Rotation direction selection	Signal • External input signal [Md.30] • Servo status 1 • Servo status 2 • Servo status 7 • Home position return status[*5]	—
SLMP communication	Axis information • Axis in which an event occurred • Request object Index • Request object Sub Index • SDO Abort Code	—	—

*1 For an error code which is independent of an axis, the information for an axis in which an event occurred is not displayed.
(For an error code which is independent of an axis, refer to the following.
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*2 Output only at positioning control.
At the time other than the positioning control (during home position return or JOG operation, etc.), judge the timing of when an error occurred by the axis operation status.

*3 The unit is mm/s at a linear servo motor use.

*4 For common parameters, an axis in which an event occurred is set to "Axis 1".

*5 Home position return status (Statusword: b10, b12, b13)
The home position return status is displayed based on the bit values of Statusword.

Statusword bit value	Home position return status
b13 = 0, b12 = 0, b10 = 0	Homing procedure is in progress
b13 = 0, b12 = 0, b10 = 1	Homing procedure is interrupted or not started
b13 = 0, b12 = 1, b10 = 0	Homing is attained, but target is not reached
b13 = 0, b12 = 1, b10 = 1	Homing procedure is completed successfully
b13 = 1, b12 = 0, b10 = 0	Homing error occurred, velocity is not 0
b13 = 1, b12 = 0, b10 = 1	Homing error occurred, velocity is 0

*6 The following table shows the display of the start No., data No. in which an event occurred, block start point No. at start, and block start point No. at occurrence.

Details of start (Positioning start No.)		Start No.	Occurred data No.	Point No. at block start	No. at block start occurrence
Positioning start (1 to 600)	At start (Analyzing)	Started positioning No. (1 to 600)	← (Same as start No.)*1	Not displayed	
	Operating		Data No. in which an error occurred (1 to 600)		
Block start (7000 to 7004)	At start (Analyzing)	Started block start No. (7000 to 7004)	Start data No. of point No. at block start (1 to 600)*1	Started block start point No. (1 to 50)	← (Same as point No. at block start)
	Operating		Data No. in which an error occurred (1 to 600)	Started block start point No. (1 to 50)	Block start point No. in which an error occurred (1 to 50)
Home position return (9001)	At start (Analyzing)	9001	Not displayed	Not displayed	
	Operating				
Fast home position return (9002)	At start (Analyzing)	9002			
	Operating				
Current value changing (9003)	At start (Analyzing)	9003			
	Operating				
Multiple axes simultaneous start (9004)	At start (Analyzing)	9004	Data No. at start (1 to 600)*1		
	Operating		Data No. in which an error occurred (1 to 600)		
JOG operation	At start (Analyzing)	9010	Not displayed		
	Operating				
Manual pulse generator operation	At start (Analyzing)	9011			
	Operating				
Speed-torque control	Mode switching	9030 to 9042			
	Operating				
Positioning start No. outside the setting range		Setting value out of the range			

Details of start (Positioning start No.)		Start No.	Occurred data No.	Point No. at block start	No. at block start occurrence
Test mode JOG operation	At start (Analyzing)	The number of operation axes 1 axis: 1 2 to 4 axes: 9004	1	Not displayed	
	Operating				
Test mode Current value changing		The number of operation axes 1 axis: 1 2 to 4 axes: 9004	1		
Test mode Positioning operation	At start (Analyzing)	The number of operation axes 1 axis: 1 2 to 4 axes: 9004	1		
	Operating				

*1 At start (during analyzing), "0" is displayed when the error processing is executed before fetching the start data No. from the buffer memory.
When a value outside the setting range is set, a setting value outside the range is displayed.

Detailed information of event

The items displayed in the detailed information, which vary depending on each operation, are configured by the items shown in the table below.

System event details	Optional information 1	Optional information 2	Optional information 3
Home position return request ON	■System information • Axis type • Axis in which an event occurred	■System information • The cause of home position return request ON	—

Event information skipped

When the module errors of the Motion module frequently occur in the intervals shorter than the event history collection intervals of the CPU module, the event history storage area in the Motion module might be full of error information which the CPU module has not collected. If a new module error occurs in this state, the Motion module discards the module error information and outputs the message "*HST.LOSS*" (The event information has been erased.) which indicates the event information has been erased.

9.12 Servo Transient Transmission Function

The "servo transient transmission function" reads and writes objects of a device with transient transmission. The transient transmission is appropriate for communication of the data that does not need to be read or written at a fixed cycle and the large data.

For the objects that can be read and written with the transient transmission, refer to the manual of the device.

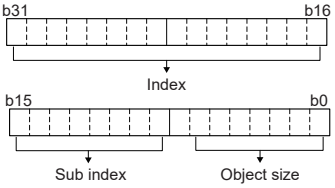
With the servo transient transmission, up to four points can be set per axis and the setting can be changed at any time.

Control details

The following shows the parameters and data used in the "servo transient transmission function".

■Extended parameter

n: Axis No. - 1

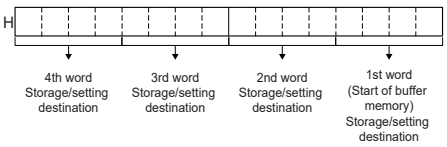
Setting item		Setting details/setting value	Initial value	Buffer memory address
				Axis 1 to axis 16
[Pr.512]	Optional SDO 1	Specify an object to which the servo transient transmission is executed.  At reading: Reads an object using SDO Upload of SLMP. The writing object size [byte] is ignored. Size of the read object is stored in the response object of the optional SDO transfer status. At writing: Writes an object using the Download command of SLMP. "0x01 to 0x7E" can be specified as the object size [byte]. "0x01, 0x02, 0x04, or 0x08" can be specified as the object size [byte] according to the object to be written. Example) To specify an UNSIGNED32 object with object index "6099H" and subindex "02H", specify the following values. Reading: "60990200H" (default size) Writing: "60990204H" (size of 4 bytes) Fetch cycle: At request (Servo transient request)	0	460024+256n 460025+256n
[Pr.513]	Optional SDO 2		0	460026+256n 460027+256n
[Pr.514]	Optional SDO 3		0	460028+256n 460029+256n
[Pr.515]	Optional SDO 4		0	460030+256n 460031+256n

Point

- The servo transient processing is a set of operations from a request send to a response reception. This operation is performed in the order of setting Nos.
- For the index, subindex, and object size that can be specified, refer to the manual of the device. When an object not supported by the device is specified, the processing is completed with an error.

■Axis control data

n: Axis No. - 1

Setting item		Setting details/setting value	Initial value	Buffer memory address
				Axis 1 to axis 16
[Cd.160]	Optional SDO transfer request 1	Requests the servo transient transmission. • Changes to values are not accepted during processing. • The setting value is automatically cleared to "0" when the processing is completed. 1: Self read request 11: Self write request Others: No request Fetch cycle: Main cycle	0	534796+2048n
[Cd.161]	Optional SDO transfer request 2		0	534797+2048n
[Cd.162]	Optional SDO transfer request 3		0	534798+2048n
[Cd.163]	Optional SDO transfer request 4		0	534799+2048n
[Cd.164]	Optional SDO transfer data 1	Stores up to 8 bytes (4 words) of data as follows from the start of the buffer memory according to the specified object.  Example) When writing "1234H" and "5678H" to "[Cd.164] Optional SDO transfer data 1" from the start of the buffer memory, set "H56781234" in G534800. • When an object is read, a read value is stored when communication is normally completed. When an error occurs, the value is not updated. • To write an object, specify data to be written. Do not change the setting until the processing is completed. Fetch cycle: At request (Command request)	0	534800+2048n ⋮ 534862+2048n
[Cd.165]	Optional SDO transfer data 2		0	534864+2048n ⋮ 534926+2048n
[Cd.166]	Optional SDO transfer data 3		0	534928+2048n ⋮ 534990+2048n
[Cd.167]	Optional SDO transfer data 4		0	534992+2048n ⋮ 535054+2048n

■Axis monitor data

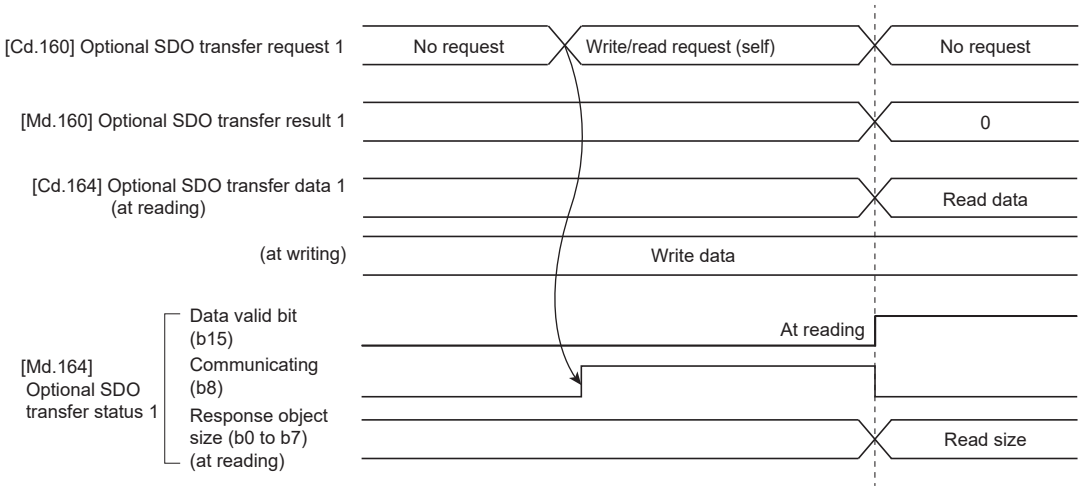
n: Axis No. - 1

Storage item		Storage details/storage value	Initial value	Buffer memory address
				Axis 1 to axis 16
[Md.160]	Optional SDO transfer result 1	Stores a response code (SDO Abort code) of a device for the transient request. For details of the code, refer to "Response Code (SDO Abort Code)" of the following manual. MELSEC iQ-R Motion Module User's Manual (Network) When a response code cannot be acquired because of a communication error or other causes, "0" is stored. Refresh cycle: At request (Command request)	0	468192+2048n 468193+2048n
[Md.161]	Optional SDO transfer result 2		0	468194+2048n 468195+2048n
[Md.162]	Optional SDO transfer result 3		0	468196+2048n 468197+2048n
[Md.163]	Optional SDO transfer result 4		0	468198+2048n 468199+2048n
[Md.164]	Optional SDO transfer status 1	Stores the processing status of the transient request. • b7 to 0: Response object size (byte) Stores the size of objects that the device has responded when the processing is completed. • b8: Communicating Turns ON during the transient transmission. • b9: Communication error detection Turns ON when an error is detected with the transient transmission. It remains ON until the transient transmission is normally completed. Error causes are as follows. - Normal error - Receiving an error response from a device (SDO Abort code) (Example: When the index, subindex, or size specified with "[Pr.512] Optional SDO 1" to "[Pr.515] Optional SDO 4" is incorrect) • b10: Not used • b15: Data valid bit Turns ON when a read request is normally completed. Turns OFF when a read error is detected. Refresh cycle: At request (Command request)	0	468200+2048n
[Md.165]	Optional SDO transfer status 2		0	468201+2048n
[Md.166]	Optional SDO transfer status 3		0	468202+2048n
[Md.167]	Optional SDO transfer status 4		0	468203+2048n

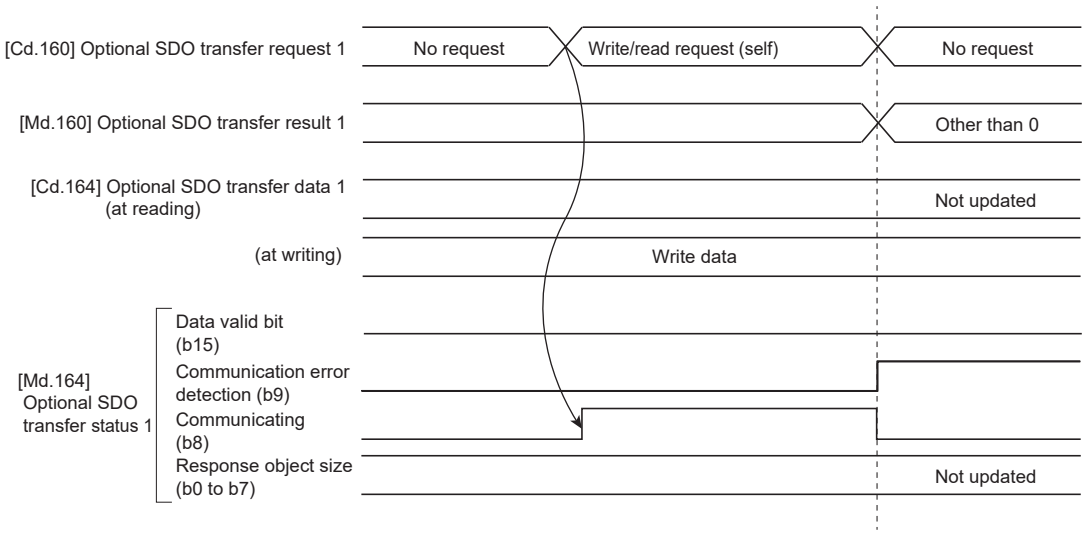
■Sending/receiving timing

The following shows sending/receiving timing of the servo transient transmission.

- Self sending/receiving timing of read/write (Normal operation)



- Self sending/receiving timing of read/write (Operation failure)



Precautions

The driver homing method obtains home position data of the driver by the transient transmission function. Therefore, if read/write of the device object is executed with transient transmission while driver homing is being carried out, "ABS reference point read error" (error code: 1A75H) may occur.

9.13 Test mode

The "test mode" is used to execute the test operation and adjustment of axes using an engineering tool. This mode can execute the test operation and adjustment for multiple axes simultaneously. Therefore, a system such as a tandem configuration can be started up smoothly.

The test mode request for the Motion module is carried out by starting the test operation using the engineering tool.

When the test mode request is accepted correctly, the test display is displayed and each function of the test mode can be selected.

For details of the operation method of the test mode, refer to "Help" in the "Simple Motion Module Setting Function" of an engineering tool.

List of specifications

The following shows the list of function specifications of the test mode.

Function	Operation
Operation axis selection	Select the axis to execute the test operation up to 4 axes.
Servo ON	Execute servo ON for the axis to execute the test operation. Execute the magnetic pole detection when the linear servo or direct drive motor is included in the selected operation axis.
Servo OFF	Execute servo OFF for the axis to execute the test operation.
JOG operation	Execute the JOG operation up to 4 axes simultaneously.*1
Home position return	Execute the home position return of the axis No. selected as the start axis.
Current value changing	Execute the current value changing up to 4 axes simultaneously.*1
Positioning operation	Execute the positioning operation up to 4 axes simultaneously.*1
Stop	Execute the stop request for the axis during the test operation.
Rapid stop	Execute the rapid stop request for the axis during the test operation.
Error reset	Execute the error clear request and reset the warning/error/servo alarm.
Software stroke limit check valid/invalid	Stroke limit check valid/invalid is can be selected when the software stroke limit is valid.
Hardware stroke limit check valid/invalid	Stroke limit check valid/invalid is can be selected when FLS or RLS signal setting is valid.

*1 If the operation axis selection is set to 2 to 4 axes, the operation starts at multiple axes simultaneous start (9004).

Precautions

When the JOG operation or the positioning operation from the test mode is started, "1" is stored in "[Md.44] Positioning data No. being executed". However, the positioning data No.1 of buffer memory is not used.

Differences from normal operation

The following shows differences between the normal operation and the operation during the test mode.

Item			During test mode	During normal operation
JOG operation	—		JOG operation is executed based on the setting values on the JOG operation display.*1	JOG operation is executed based on the setting values of the positioning parameters.
	Axis monitor data	[Md.44] Positioning data No. being executed	"1" is stored when the JOG operation is executed.	"0" is stored when the JOG operation is executed.
		[Md.46] Last executed positioning data No.		
		[Md.47] Positioning data being executed: Positioning identifier	"04h" is stored during forward JOG run and "05h" is stored during reverse JOG run.	"0" is stored during JOG operation.
	Event history	Data No. in which an event occurred	"1" is displayed.	Not displayed.
Current value changing			The current value changing is executed based on the setting values on the current value changing display.	[For a new current value using the positioning data] The current value changing is executed based on the setting values of "[Da.6] Positioning address/movement amount". [For a new current value using the current value changing start No. (No.9003)] The current value changing is executed based on the setting values of "[Cd.9] New position value".
Positioning operation			Positioning operation is executed based on the setting values on the positioning operation display.*1	Positioning operation is executed based on the setting values of the positioning data.

*1 Refer to the following for the parameters used in JOG operation and positioning operation.
☞ Page 386 Parameters to be used during the test mode

Parameters to be used during the test mode

During the test mode, the test operation is executed using the parameters set on each test function display of the engineering tool.

■List of the parameters to be used during JOG operation

Parameter item	During test mode	During normal operation
JOG operation	The setting values on the JOG operation display	The value set in "[Cd.17] JOG speed"
Acceleration time constant		The value set in the positioning parameters
Deceleration time constant		
Rapid stop deceleration time constant		
S-curve ratio*1		The value set in "[Pr.34] Acceleration/deceleration process selection" and "[Pr.35] S-curve ratio"
Torque limit value		The value set in "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value"
Stop process at error occurrence		The value set in "[Pr.37] Stop group 1 rapid stop selection", "[Pr.38] Stop group 2 rapid stop selection", "[Pr.39] Stop group 3 rapid stop selection"
Stroke limit valid/invalid setting		The software stroke limit upper/lower limit value set with the fixed parameter The FLS/RLS signal set with the external input signal parameters

*1 During the test mode operation, the operation differs depending on the S-curve ratio setting.
0%: Trapezoidal acceleration/deceleration, 1 to 100%: S-curve acceleration/deceleration

■List of the parameters to be used during positioning operation

Parameter item	During test mode	During normal operation
Movement amount	The setting values on the positioning operation display	The value set in the positioning data
Command speed		
Acceleration time constant		The value set in the positioning parameters
Deceleration time constant		
Rapid stop deceleration time constant		
S-curve ratio*1		The value set in "[Pr.34] Acceleration/deceleration process selection" and "[Pr.35] S-curve ratio"
Torque limit value		The value set in "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value"
Stop process at error occurrence		The value set in "[Pr.37] Stop group 1 rapid stop selection", "[Pr.38] Stop group 2 rapid stop selection", "[Pr.39] Stop group 3 rapid stop selection"
Stroke limit valid/invalid setting		The software stroke limit upper/lower limit value set with the fixed parameter The FLS/RLS signal set with the external input signal parameters
Operation permission for incompletion of home position return		The operation setting for incompletion of home position return set in the home position return data

*1 During the test mode operation, the operation differs depending on the S-curve ratio setting.
0%: Trapezoidal acceleration/deceleration, 1 to 100%: S-curve acceleration/deceleration

Precautions

- Parameters not described above operate with the value set in the buffer memory before the shift to the test mode.
- The torque limit value cannot be changed during JOG/positioning operation that is started from the test mode.

Request of the shift to/cancel of the test mode

The data transmission process of parameters is executed when the shift to the test mode is requested.
Refer to the following for the parameters whose data is transferred.
☞ Page 591 (3) Valid parameters when PLC READY [Y0] changes from OFF to ON
The operation cannot be shifted to the test mode in the following cases.

- When PLC READY [Y0] is ON
- When any of axes is in operation
- When a parameter error occurs during the shift to the test mode

When canceling the test mode, execute the cancel request after stopping all axes. The test mode cannot be canceled if any of axes is in operation.

Precautions

- When the data transmission process is executed, "b0: READY ON" is turned ON and "b1: Servo ON" is turned OFF in "[Md.108] Servo status1".
- When the cancel request of the test mode is executed, "b0: READY ON" ([Md.108] Servo status1) and "b1: Servo ON" ([Md.108] Servo status1) are turned ON/OFF following to the setting of all axis servo ON [Y1] and "[Cd.100] Servo OFF command".

Stop operation of the test mode operation axes

When the following stop causes occur for the test mode operation axes, the stop process is performed for the all axes in which the test mode is in operation.

When the test operation is executed for multiple axes, the stop process is performed for the test mode operation axes in which a stop command or stop cause does not occur even if a stop command or stop cause occurs for each test mode operation axis.

Stop cause	Stop process	
	Axis in which a stop cause occurs	Axis in which a stop cause does not occur
Servo READY OFF[*1] • Servo amplifier power supply OFF • Servo alarm • Forced stop input to servo amplifier[*2]	Immediate stop For the stop method of the servo amplifier, refer to each servo amplifier instruction manual.	Deceleration stop/rapid stop Select with the "Stop process at error occurrence".
"All axes rapid stop request" from the test mode	Rapid stop	
Hardware stroke limit Hardware stroke limit upper/lower limit error occurrence[*1*3]	Deceleration stop/rapid stop Select with the "Stop process at error occurrence".	
Error occurs in a CPU module		
Error in test mode[*4*5]		
Axis error detection (Error other than stop group 1 or 2)[*1]		
"Deceleration stop requested" input from the test mode		
"Axis stop signal" ON from a CPU module[*1]		

*1 The stop process is not executed for the axes in which a stop cause does not occur during home position return.

*2 Since "[Pr.82] Forced stop valid/invalid selection" only supports "2: Valid (Buffer memory)", "Forced stop input signal" cannot be operated while in the test mode. Configure a safety circuit using the forced stop input to the servo amplifier while in the test mode.

*3 When the hardware stroke limit function is not used, the software stroke limit range check is not performed.

*4 If a stop cause occurs, the test mode is canceled.

*5 An error in test mode occurs when the personal computer cannot communicate with the CPU module.

Precautions

When the test mode operation axis is servo OFF by servo OFF from the test display or the servo alarm occurrence, etc, "b0: READY ON" is turned ON and "b1: Servo ON" is turned OFF in "[Md.108] Servo status1".

To execute the test operation again, execute servo ON of the test mode operation axis from the test display.

9.14 Software Installation to the Own Module

This section describes details of the installation method of the motion system software.

Installation of the motion system software

Installation of the software is not required since it is already installed to the motion system at the time of shipment. To update or change to the latest software, however, reinstallation is required. The latest version of the software can be downloaded from the Mitsubishi Electric FA Global Website.

Point

- Programs, parameters, and absolute position data will not be overwritten by installation.
- If the installation is interrupted by the following operations, installation files will be deleted. In that case, execute the installation again.
  "Powering OFF the motion system",
  "Turning the RUN/STOP/RESET switch of the CPU module to RESET",
  "Removing the SD memory card (when an SD memory card is used)"
- The installed software will be applied when the power is turned ON again.
- Model name and version of the motion system software installed to the motion system can be checked using the engineering tool.
- Software files are protected by CRC. File integrity is verified when the power of the motion system is turned ON, and if any abnormality is detected, "Add-on library load error" (error code: 3205H) will result, and the system will not be started. Carry out the installation again to install correct files.
- Match the combination of the software versions with the description in the Mitsubishi Electric FA Global Website or the following pages: ☞ Page 730 List of Add-on Libraries, ☞ Page 733 List of Boot Software.
  If the version combination is mismatched, "Add-on library load error" (error code: 3205H) will result, and the system will not be started. Carry out the installation again with the correct version combination.

File configuration of the motion system software

This section describes the configuration of the motion system software downloaded from the Mitsubishi Electric FA Global Website. The motion system software (sw12dnn-rmtufw_xx.zip) includes the following files.

File		
Motion system software for RD78G (sw12dnn-rmtufw_xx.zip)*1		
	Motion software package (RD78GSW.smpk)	
	instnew	
		Basic system software (baseSystem.smpk)
		Each add-on library (.mpk)
	instboot	
		Boot software (.img)

*1 "xx" indicates the version of the basic system software.

The motion software package (RD78GSW.smpk) includes the following files.

File	
Motion software package for RD78G (RD78GSW.smpk)	
	Basic system software
	Each add-on*2

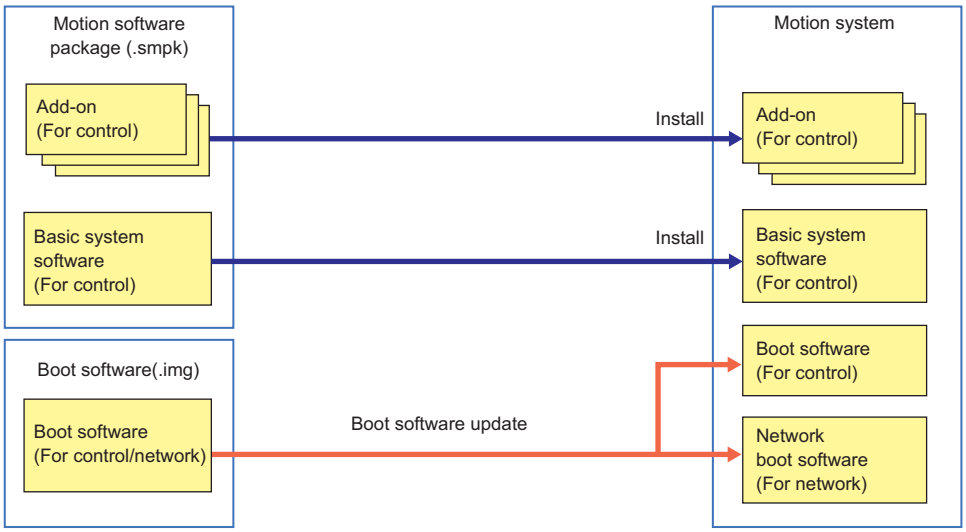
*2 For the add-ons included in the motion software package (RD78GSW.smpk), refer to the following.

☞ Page 730 List of Add-on Libraries

At the installation, unzip the files in the motion system as follows.

File	
/sys drive	
	Basic system software
	Each add-on

The boot software is not recognized as a drive.

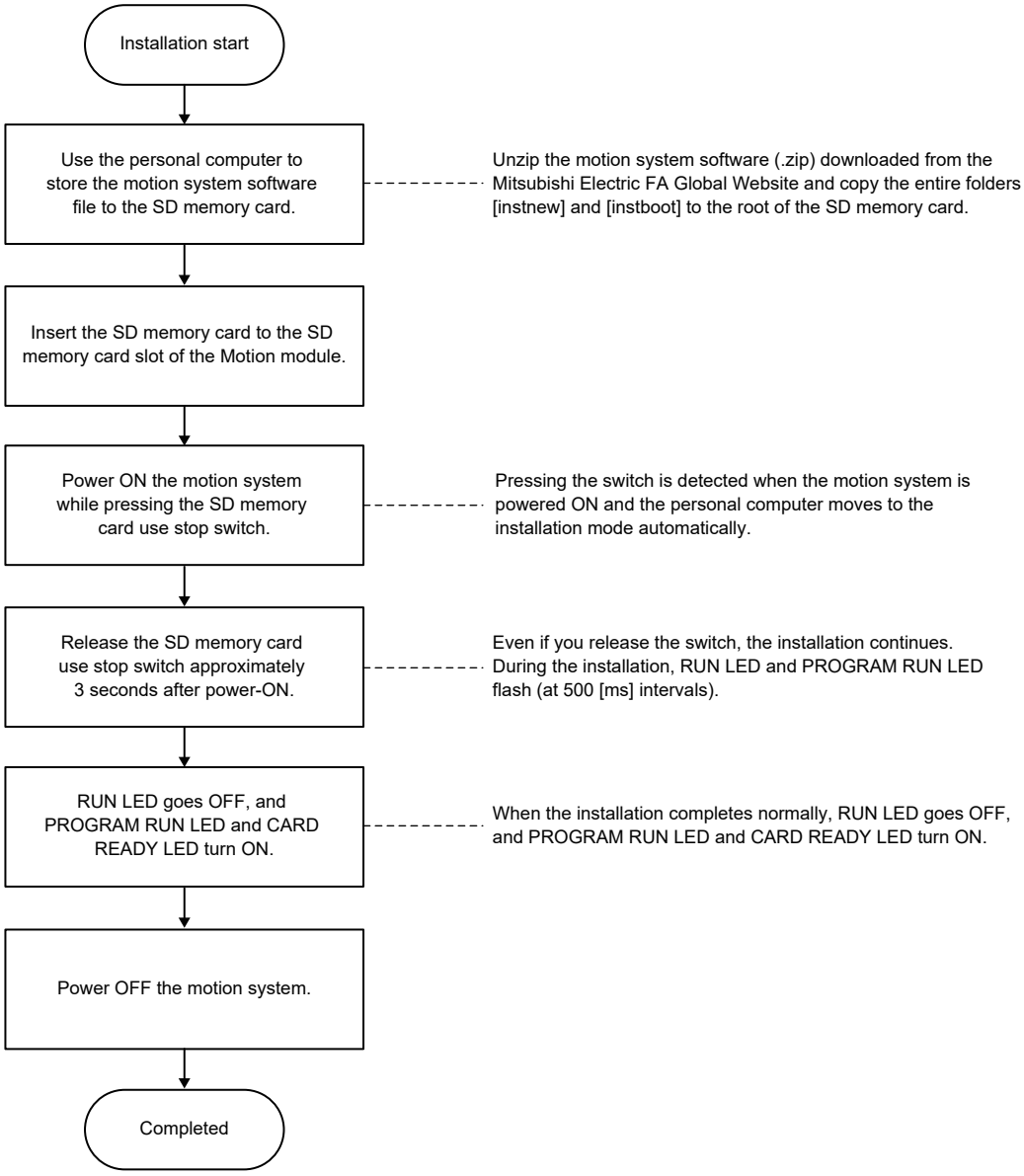


Batch installation method of the motion system software

This section describes the batch installation method of the motion system software.
Use an SD memory card for the installation.

Installation method using an SD memory card

This section describes the procedure for the batch installation of the motion system software using an SD memory card.
Install the software and boot software at the same time by batch installation.



Point

- Use an SD memory card formatted on the CPU module. If an SD memory card formatted on a PC or other device is used, installation of the motion system software may fail.
- To format the SD memory card on the CPU module, use the CPU memory operation function of the Engineering Tool. For details, refer to the following manual.
  GX Works3 Operating Manual
- Do not install by combining [instnew] and [instboot] from motion software packages of different versions.
- If the installation could not be completed normally due to an error detected after starting the installation, the RUN LED goes off, and the PROGRAM RUN LED and CARD READY LED flash (at 200 [ms] intervals). Solve the error, and retry installation.*1*2
- If the boot software update could not be completed normally, the RUN LED goes off and the ERR LED goes off or flashes (at 200 [ms] intervals) even when the power supply of the motion system is turned ON, and the Motion module may not be recognized. In that case, insert the SD memory card where the boot software is stored to the SD memory card slot of the Motion module, and power ON the motion system while pressing the SD memory card use stop switch. If the ERR LED flashes (at 200 [ms] intervals), release your hand from the SD memory card use stop switch and power OFF and ON the motion system after five minutes or more have passed to recover the boot software. To recover the boot software, temporarily change the system configuration so that the overall system startup time is within 15 seconds, and then perform the above procedure.
- The SD memory card forced stop function is unavailable while installation from the SD memory card is in progress. Do not remove the SD memory card while installation is in progress.
- The READY signal and synchronization flag will not turn ON while installation from the SD memory card is in progress.

*1 If the SD memory card reading is abnormal, check the SD memory card.
*2 If the installation file is abnormal or cannot be detected, check the installation file.

☐: OFF, ■: ON, ●: Flashing

Motion system status	LED display	Description	Remedy
Normal	RUN● P RUN● C RDY☐	Flashing (at 500 [ms] intervals): Executing installation	Wait until the installation is complete.
	RUN☐ P RUN■ C RDY■	ON: Installation normal completion	Power OFF → ON the motion system, and check if RUN/STOP of the CPU module can be performed normally.
Error	RUN☐ P RUN● C RDY●	Flashing (at 200 [ms] intervals): Installation abnormal completion	Power OFF → On the motion system, and execute the installation again.

Checking the software versions

Versions of the installed software can be checked using the engineering tool (GX Works3).

■Checking using GX Works3

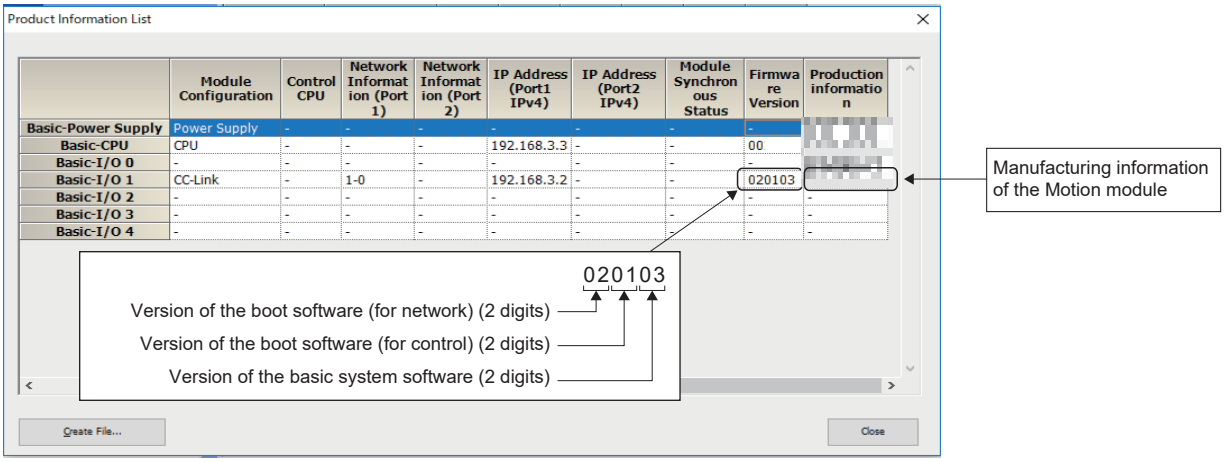
Software versions can be checked from the Product Information List window.

[Diagnostics] ⇨ [System Monitor] ⇨ [Product Information List]

Versions of the basic system software and boot software (for control/for network) are displayed.

Refer to the following for the versions of each boot corresponding to the basic system software.

☞ Page 733 List of Boot Software



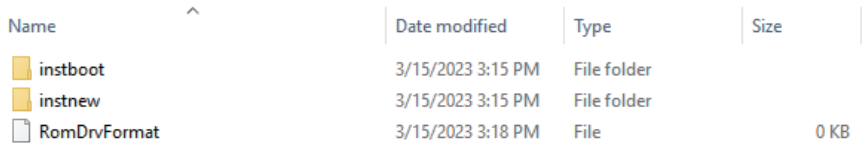
Formatting a drive

When GX Works3 is unable to write the project data due to occurring drive errors, the drive is required to be formatted.
The drive can be formatted by the following methods.

- How to format a drive at the motion system software installation
- How to format a drive by switching to PLCopen® motion control FB mode

How to format a drive at the motion system software installation

1. Create a RomDrvFormat file using a device such as a personal computer. (Create an empty file without extension.)



2. Save the RomDrvFormat file directly under the SD memory card.
3. Follow normal motion system software installation procedure.

How to format a drive by switching to PLCopen® Motion control FB mode

1. Create a new project by GX Works3 and start it as PLCopen® Motion control FB mode.
2. Perform "Clear" from the Remote Operation of Motion Control Setting Function.
3. After completion of "Clear", write the project of Simple Motion mode again, and start it as Simple Motion mode.

Point

The data of the project in the module must be written to the flash ROM again as it is deleted in both procedures.

Precautions

If the same error occurs again even after following the procedures above, the hardware of the Motion module is faulty. Please consult your local Mitsubishi representative.

10 PARAMETER SETTING

This chapter describes the parameter setting of the Motion module. By setting parameters, the parameter setting by program is not needed.
The parameter setting has two types including the module parameter setting and Simple Motion module setting.

10.1 Parameter Setting Procedure

1. Add the Motion module in the engineering tool.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Right-click ⇨ [Add New Module]

2. The parameter setting has two types including the module parameter setting and Simple Motion module setting. Select either of them from the tree on the following window.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Target module

3. Write the settings to the CPU module with the engineering tool.

[Online] ⇨ [Write to PLC]

4. The settings are reflected by resetting the CPU module or powering off and on the system.

10.2 Module Parameter

Set the module parameter. The module parameter has the following settings.

Module parameter (Motion)

- Refresh settings

Module parameter (Network)*1

- Required settings
- Basic settings
- Application settings

*1 For details, refer to "PARAMETER SETTINGS" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Network)

Select the module parameter from the tree on the following window.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Target module ⇨ "Module Parameter"

Refresh settings

Configure the setting to transfer the values in the buffer memory of the Motion module to devices or module labels in the CPU module. By configuring these refresh settings, reading the data by program is not needed.

Select the transfer destination from the following at "Target".

- Module label (☞ Page 396 Module label)
- Refresh data register (RD) (☞ Page 396 Refresh data register (rd))
- Device (☞ Page 396 Device)

Module label

Transfer the setting of the buffer memory to the corresponding module label of each buffer memory area. Items of all axes are automatically set to "Enable" by setting "Command position value" of the axis 1 to "Enable".

Refresh data register (rd)

Transfer the setting of the buffer memory to the refresh data register (RD) of the CPU module. All transfer destinations are automatically set by setting the top device to "Top Device Name".

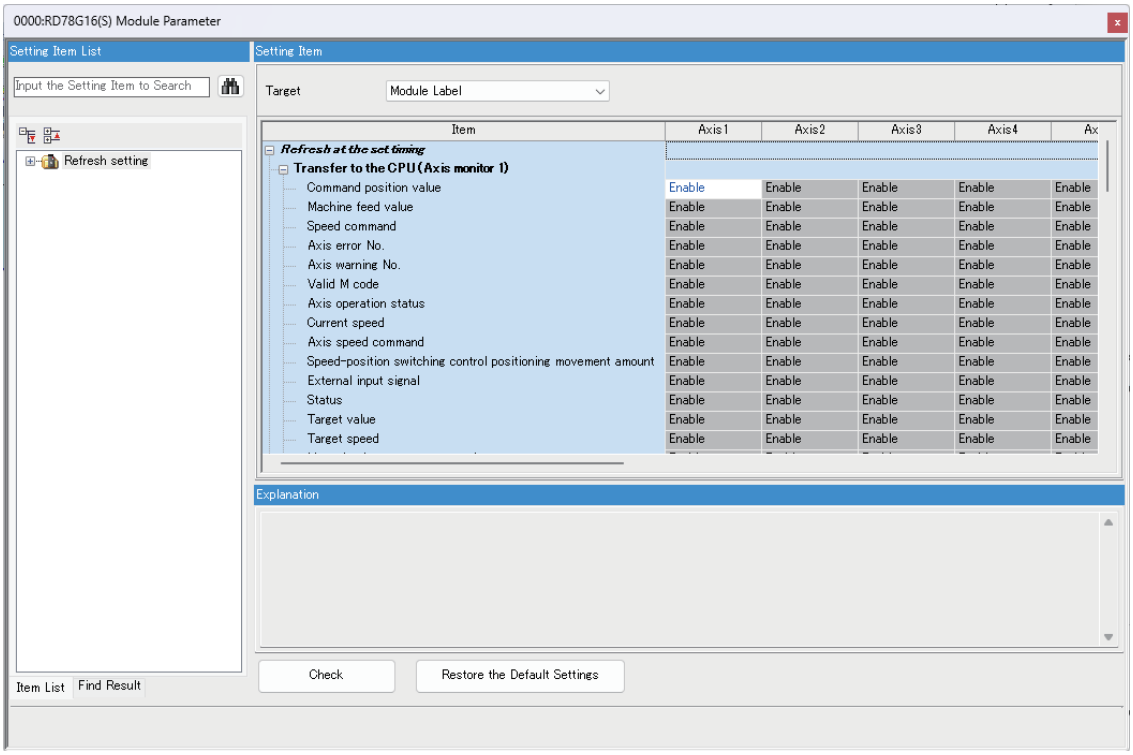
Device

Transfer the setting of the buffer memory to the specified device of the CPU module. The devices X, Y, M, L, B, D, W, R, ZR, and RD can be specified. To use the bit device X, Y, M, L, or B, set a No. which is divisible by 16 points (example: X10, Y120, M16). The data in the buffer memory is stored in devices for 16 points from the set No.

Ex.
When X10 is set, data is stored in X10 to X1F.

Setting items

The refresh setting has the following items.



Item			Reference
Refresh at the set timing.	Transfer to the CPU.	Command position value	Page 523 [Md.20] Command position value
		Machine feed value	Page 524 [Md.21] Machine feed value
		Speed command	Page 525 [Md.22] Speed command
		Axis error No.	Page 525 [Md.23] Axis error No.
		Axis warning No.	Page 526 [Md.24] Axis warning No.
		Valid M code	Page 526 [Md.25] Valid M code
		Axis operation status	Page 527 [Md.26] Axis operation status
		Current speed	Page 527 [Md.27] Current speed
		Axis speed command	Page 528 [Md.28] Axis speed command
		Speed-position switching control positioning amount	Page 529 [Md.29] Speed-position switching control positioning movement amount
		External input signal	Page 530 [Md.30] External input signal
		Status	Page 531 [Md.31] Status
		Target value	Page 532 [Md.32] Target value
		Target speed	Page 533 [Md.33] Target speed
		Amount of the manual pulser driving carrying over movement	Page 538 [Md.62] Amount of the manual pulser driving carrying over movement
		Torque limit stored value/forward torque limit stored value	Page 534 [Md.35] Torque limit stored value/forward torque limit stored value
		Special start data instruction code setting value	Page 534 [Md.36] Special start data instruction code setting value
		Special start data instruction parameter setting value	Page 534 [Md.37] Special start data instruction parameter setting value
		Start positioning data No. setting value	Page 534 [Md.38] Start positioning data No. setting value
		In speed limit flag	Page 535 [Md.39] In speed limit flag
		In speed change processing flag	Page 535 [Md.40] In speed change processing flag
		Special start repetition counter	Page 535 [Md.41] Special start repetition counter
		Control system repetition counter	Page 535 [Md.42] Control system repetition counter
		Start data pointer being executed	Page 536 [Md.43] Start data pointer being executed

Item			Reference
Refresh at the set timing.	Transfer to the CPU.	Positioning data No. being executed	Page 536 [Md.44] Positioning data No. being executed
		Block No. being executed	Page 536 [Md.45] Block No. being executed
		Last executed positioning data No.	Page 536 [Md.46] Last executed positioning data No.
		Positioning data being executed (Positioning identifier)	Page 537 [Md.47] Positioning data being executed
		Positioning data being executed (M code)	
		Positioning data being executed (Dwell time)	
		Positioning data being executed (Positioning option)	
		Positioning data being executed (Command speed)	
		Positioning data being executed (Positioning address)	
		Positioning data being executed (Arc address)	
		Actual position value	Page 539 [Md.101] Actual position value
		Deviation counter value	Page 540 [Md.102] Deviation counter value
		Motor rotation speed	Page 541 [Md.103] Motor rotation speed
		Motor current value	Page 541 [Md.104] Motor current value
		Home position return operating status	Page 548 [Md.514] Home position return operating status
		Servo status3	Page 547 [Md.125] Servo status3
		Servo status4	Page 547 [Md.126] Servo status4
		Statusword	Page 545 [Md.117]Statusword
		Servo status2	Page 545 [Md.119] Servo status2
		Servo status1	Page 542 [Md.108] Servo status1
		Regenerative load ratio/Optional data monitor output 1	Page 542 [Md.109] Regenerative load ratio/Optional data monitor output 1
		Effective load torque/Optional data monitor output 2	Page 543 [Md.110] Effective load torque/Optional data monitor output 2
		Peak torque ratio/Optional data monitor output 3	Page 543 [Md.111] Peak torque ratio/Optional data monitor output 3
		Optional data monitor output 4	Page 543 [Md.112] Optional data monitor output 4
		Semi/Fully closed loop status	Page 543 [Md.113] Semi/Fully closed loop status
		Servo alarm	Page 544 [Md.114] Servo alarm
		Servo alarm detail number	Page 544 [Md.115] Servo alarm detail number
		Encoder option information	Page 545 [Md.116] Encoder option information
		Reverse torque limit stored value	Page 546 [Md.120] Reverse torque limit stored value
		Speed during command	Page 546 [Md.122] Speed during command
		Torque during command	Page 546 [Md.123] Torque during command
		Control mode switching status	Page 547 [Md.124] Control mode switching status
		Positioning data being executed (Axis to be interpolated)	Page 537 [Md.47] Positioning data being executed
		Deceleration start flag	Page 537 [Md.48] Deceleration start flag
		Pre-reading data analysis status	Page 548 [Md.503] Pre-reading data analysis status
		Controller position value restoration completion status	Page 548 [Md.190] Controller position value restoration complete status
		Command generation axis_Command position value	Page 523 [Md.20] Command position value
		Command generation axis_Speed command	Page 525 [Md.22] Speed command
		Command generation axis_Axis error No.	Page 525 [Md.23] Axis error No.
		Command generation axis_Axis warning No.	Page 526 [Md.24] Axis warning No.
		Command generation axis_Valid M code	Page 526 [Md.25] Valid M code
		Command generation axis_Axis operation status	Page 527 [Md.26] Axis operation status
		Command generation axis_Current speed	Page 527 [Md.27] Current speed
		Command generation axis_Axis speed command	Page 528 [Md.28] Axis speed command
		Command generation axis_Speed-position switching control positioning amount	Page 529 [Md.29] Speed-position switching control positioning movement amount
		Command generation axis_Status	Page 531 [Md.31] Status
		Command generation axis_Target value	Page 532 [Md.32] Target value
		Command generation axis_Target speed	Page 533 [Md.33] Target speed

Item			Reference
Refresh at the set timing.	Transfer to the CPU.	Command generation axis_Start positioning data No. setting value	Page 534 [Md.38] Start positioning data No. setting value
		Command generation axis_In speed limit flag	Page 535 [Md.39] In speed limit flag
		Command generation axis_In speed change processing flag	Page 535 [Md.40] In speed change processing flag
		Command generation axis_Control system repetition counter	Page 535 [Md.42] Control system repetition counter
		Command generation axis_Positioning data No. being executed	Page 536 [Md.44] Positioning data No. being executed
		Command generation axis_Last executed positioning data No.	Page 536 [Md.46] Last executed positioning data No.
		Command generation axis_Positioning data being executed_Positioning identifier	Page 537 [Md.47] Positioning data being executed
		Command generation axis_Positioning data being executed_M code	
		Command generation axis_Positioning data being executed_Dwell time	
		Command generation axis_Positioning data being executed_Command speed	
		Command generation axis_Positioning data being executed_Positioning address	
		Command generation axis_Speed during command	Page 546 [Md.122] Speed during command
		Command generation axis_Deceleration start flag	Page 537 [Md.48] Deceleration start flag
		Command generation axis_Accumulative position value	For details, refer to "Command Generation Axis" in the following manual. MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)
		Command generation axis_Position value per cycle	
		Command generation axis_BUSY signal	
Refresh group		Refresh group	Page 399 Refresh group
		Group [n] (n: 1-64)	
Refresh timing (I/O)*1		Refresh timing	—

*1 The setting cannot be changed from the default in the Motion module.

■Refresh group

Set the refresh timing of the specified refresh destination.

Setting value	Description
At the Execution Time of END Instruction	Performs refresh at END processing of the CPU module.
At the Execution Time of Specified Program	Performs refresh at the execution of the program specified with "Group [n] (n: 1-64)".

Refresh processing time

The refresh processing time [μs] is included in the scan time of the CPU module. For the scan time, refer to the following.

MELSEC iQ-R CPU Module User's Manual (Application)

The refresh processing time [μs] for refresh settings is as follows.

- Refresh processing time [μs] = Refresh read (transfer to the CPU) time

The refresh read time varies depending on the refresh destination selected in "Target".

■When "Target" is a module label or a refresh data register (RD)

The following table lists the refresh read time of when the R_CPU is used.

Classification	Number of set axes	With refresh settings
Refresh read time	4	69μs
	8	138μs
	10	276μs

■When "Target" is "Device"

The refresh read time is calculated from the number of items with refresh settings and their number of transfers (words). For the calculation method, refer to the following.

MELSEC iQ-R CPU Module User's Manual (Application)

For calculation, replace the items in a calculation formula with the following items in Description.

The settings required for the Motion module are configured.

Item	Description
Number of refresh settings	Number of items with refresh settings
Refresh time for 1st to nth setting items (A)	0.05μs per word for 1st to nth setting items*1

*1 The value is the time of when the R_CPU is used.

10.3 Simple Motion Module Setting

Set the required setting for the Motion module. Refer to the "Simple Motion Module Setting Function Help" of the engineering tool for details.

Select the Simple Motion module setting from the tree on the following window.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Target module ⇨ "Simple Motion module setting"

11 SPECIFICATIONS OF I/O SIGNALS WITH CPU MODULES

11.1 List of Input/Output Signals with CPU Modules

The Motion module uses the following input/output points for exchanging data with the CPU module.*1

• 4-axis module/8-axis module/16-axis module...32 points

The input/output signals of the Motion module are shown below.

*1 The input/output signals, whose axis Nos. exceed the number of controlled axes, cannot be used.

Point

• The following input/output Nos. (X/Y) are shown in the case that the start input/output No. of the Motion module is 0.

• The use prohibited signals are used by the system, and cannot be used by a customer. If these signals are used (turned from OFF to ON), the function of the Motion module will not be guaranteed.

Signal direction: Motion module → CPU module		
Device No.	**Signal name**	
X0	READY	
X1	Synchronization flag	
X2	Use prohibited	
⋮		
XF		
X10	Axis 1	BUSY*1
X11	Axis 2	
X12	Axis 3	
X13	Axis 4	
X14	Axis 5	
X15	Axis 6	
X16	Axis 7	
X17	Axis 8	
X18	Axis 9	
X19	Axis 10	
X1A	Axis 11	
X1B	Axis 12	
X1C	Axis 13	
X1D	Axis 14	
X1E	Axis 15	
X1F	Axis 16	

Signal direction: CPU module → Motion module		
Device No.	**Signal name**	
Y0	PLC READY	
Y1	All axis servo ON	
Y2	Use prohibited	
⋮		
YF		
Y10	Axis 1	Positioning start*1
Y11	Axis 2	
Y12	Axis 3	
Y13	Axis 4	
Y14	Axis 5	
Y15	Axis 6	
Y16	Axis 7	
Y17	Axis 8	
Y18	Axis 9	
Y19	Axis 10	
Y1A	Axis 11	
Y1B	Axis 12	
Y1C	Axis 13	
Y1D	Axis 14	
Y1E	Axis 15	
Y1F	Axis 16	

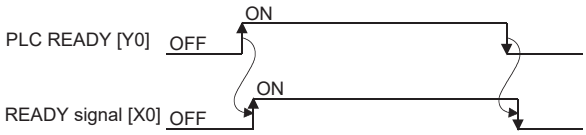
*1 The BUSY signal and positioning start signal, whose axis Nos. exceed the number of controlled axes, cannot be used.

Point

- The M code ON signal, error detection signal, start complete signal and positioning complete signal are assigned to the bit of "[Md.31] Status".
- The axis stop signal, forward run JOG start signal, reverse run JOG start signal, execution prohibition flag are assigned to the buffer memory [Cd.180] to [Cd.183].

11.2 Details of Input Signals

The ON/OFF timing and conditions of the input signals are shown below.

Device No.	Signal name			Details
X0	READY		ON: READY OFF: Not READY/Watch dog timer error	• When PLC READY [Y0] turns from OFF to ON, the parameter setting range is checked. If no error is found, this signal turns ON. • When PLC READY [Y0] turns OFF, this signal turns OFF. • When watch dog timer error occurs, this signal turns OFF. • This signal is used for interlock in a program, etc. 
X1	Synchronization flag		OFF: Module access disabled ON: Module access enabled	• After the CPU module is turned ON or the CPU module is reset, this signal turns ON if the access from the CPU module to the Motion module is possible. • When "Asynchronous" is selected in the module synchronization setting of the CPU module, this signal can be used as interlock for the access from a program to the Motion module.
X10 ⋮ X1F	Axis 1 ⋮ Axis 16	BUSY*1	OFF: Not BUSY ON: BUSY	• This signal turns ON at the start of positioning, home position return or JOG operation. It turns OFF when "[Da.9] Dwell time/JUMP destination positioning data No." has passed after positioning stops. (This signal remains ON during positioning.) • This signal turns OFF when the positioning is stopped with step operation. • During manual pulse generator operation, this signal turns ON while "[Cd.21] Manual pulse generator enable flag" is ON. • This signal turns OFF at error completion or positioning stop.

*1 The BUSY signal, whose axis No. exceeds the number of controlled axes, cannot be used.

Point

The BUSY signal turns ON even when position control of movement amount 0 is executed. However, since the ON time is short, the ON status may not to be detected in the program.

11.3 Details of Output Signals

The ON/OFF timing and conditions of the output signals are shown below.

Device No.	Signal name			Details
Y0	PLC READY		OFF: PLC READY OFF ON: PLC READY ON	(a) This signal notifies the Motion module that the CPU module is normal. • It is turned ON/OFF with the program. (b) When the data (parameter, etc.) are changed, this signal is turned OFF depending on the parameter. (☞ Page 586 Memory Configuration and Data Process) (c)The following processes are carried out when this signal turns from OFF to ON. • The parameter setting range is checked. • The READY signal [X0] turns ON. (d) The following processes are carried out when this signal turns from ON to OFF. In these cases, the OFF time should be set to 100ms or more. • The READY signal [X0] turns OFF. • The operating axis stops. • The M code ON signal ([Md.31] Status: b12) for each axis turns OFF, and "0" is stored in "[Md.25] Valid M code". (e) When parameters or positioning data (No.1 to 600) are written from the engineering tool or CPU module to the flash ROM, this signal will turn OFF.
Y1	All axis servo ON		OFF: Servo OFF ON: Servo ON	• All the servo amplifiers connected to the Motion module are set to servo ON or servo OFF.
Y10 ⋮ Y1F	Axis 1 ⋮ Axis 16	Positioning start*1	OFF: Positioning start not requested ON: Positioning start requested	• Home position return operation or positioning operation is started. • The positioning start signal is valid at the rising edge, and the operation is started. • When this signal turns ON during BUSY, "Start during operation" (warning code: 0D00H) will occur.

*1 The positioning signal, whose axis No. exceeds the number of controlled axes, cannot be used.

12 DATA USED FOR POSITIONING CONTROL

The parameters and data used to carry out positioning control with the Motion module are explained in this chapter.
With the positioning system using the Motion module, the various parameters and data explained in this chapter are used for control. The parameters and data include parameters set according to the device configuration, such as the system configuration, and parameters and data set according to each control.
Read this section thoroughly and make settings according to each control or application.

12.1 Types of Data

Parameters and data required for control

The parameters and data required to carry out control with the Motion module include the "setting data", "monitor data", and "control data" shown below.

Setting data

The data is set beforehand according to the machine and application. Set the data with programs or engineering tools. The data set for the buffer memory can also be saved in the flash ROM or internal memory (nonvolatile) in the Motion module.

Restriction

The setting data can be backed up only in the flash ROM/internal memory (nonvolatile) of the Motion module. It cannot be backed up in the CPU module and the SD memory card mounted to the CPU module.

The setting data is classified as follows.

Classification		Item		Description
Motion module setting	Parameters	Servo network composition parameters		Parameters for the network. Perform settings for the devices used and the network according to the system configuration.
		Common parameters		Parameters that are independent of axes and related to the overall system. Set according to the system configuration when the system is started up.
		Positioning parameters	Basic parameters 1*1	Set according to the machine and applicable motor when the system is started up.
			Basic parameters 2	
			Detailed parameters 1	Set according to the system configuration when the system is started up.
			Detailed parameters 2*2	
		Home position return parameters	Home position return basic parameters	Set the values required for carrying out home position return control.
			Home position return detailed parameters	
		Extended parameters		Set according to the system configuration when the system is started up.
		Link device external signal assignment parameters		Set according to the network configuration when the system is started up.
		Servo object specification parameters		Set the data that is determined by the specification of the servo being used when the system is started up.
	Mark detection	Mark detection setting parameters		Set the parameters for mark detection.
	Positioning data	Positioning data		Set the data for "major positioning control".
	Block start data	Block start data		Set the block start data for "high-level positioning control".
		Condition data		Set the condition data for "high-level positioning control".
		Memo data		Set the condition judgment values for the condition data used in "high-level positioning control".
	Synchronous control parameters	Servo input axis parameters		Set the parameters for synchronous control.
		Synchronous encoder axis parameters		
		Synchronous encoder axis parameters via link device		
		Command generation axis parameters		
		Command generation axis positioning data		
		Synchronous parameters		
	Cam data			Set the cam data to be used for synchronous control

*1 If the setting of the basic parameters 1 is incorrect, the rotation direction may be reversed, or no operation may take place.
*2 Detailed parameters 2 are data items for using the functions of the Motion module to the fullest. Set as required.

- The following methods are available for data setting. In this manual, the method using the engineering tool will be explained.

  - Set using the engineering tool.
  - Create the program for data setting and execute it.

- The basic parameters 1, detailed parameters 1, home position return parameters, "[Pr.83] Speed control 10 × multiplier setting for degree axis", "[Pr.90] Operation setting for speed-torque control mode", "[Pr.95] External command signal selection", "[Pr.122] Manual pulse generator speed limit mode", "[Pr.123] Manual pulse generator speed limit value" and "[Pr.127] Speed limit value input selection at control mode switching" become valid when PLC READY [Y0] turns from OFF to ON.
- The basic parameters 2, detailed parameters 2 (excluding "[Pr.83] Speed control 10 × multiplier setting for degree axis", "[Pr.90] Operation setting for speed-torque control mode", "[Pr.95] External command signal selection", "[Pr.122] Manual pulse generator speed limit mode", "[Pr.123] Manual pulse generator speed limit value" and "[Pr.127] Speed limit value input selection at control mode switching") become valid immediately when they are written to the buffer memory, regardless of the state of PLC READY [Y0].
- Even when PLC READY [Y0] is ON, the values or contents of the following can be changed: basic parameters 2, detailed parameters 2, positioning data, and block start data.
- The servo parameter is transmitted from the Motion module to the servo amplifier when the initialized communication carried out after the power supply is turned ON or the CPU module is reset. Turn ON the power supply or reset the CPU module after writing the servo parameter in the flash ROM of the Motion module if the servo parameter is transmitted to the servo amplifier.
- The only valid data assigned to basic parameter 2, detailed parameter 2, positioning data or block start data are the data read at the moment when a positioning or JOG operation is started. Once the operation has started, any modification to the data is ignored. Exceptionally, however, modifications to the following are valid even when they are made during a positioning operation: acceleration time 0 to 3, deceleration time 0 to 3, and external command function.

Setting data that can be changed during operation	Details
Acceleration time 0 to 3, deceleration time 0 to 3	Positioning data are pre-read and pre-analyzed. Modifications to the data four or more steps after the current step are valid.
External command function selection	The value at the time of detection is valid.

Point

- The "setting data" is created for each axis.
- The "setting data" parameters have determined default values, and are set to the default values before shipment from the factory. (Parameters related to axes that are not used are left at the default value.)
- The "setting data" can be initialized with the engineering tool or the program.
- It is recommended to set the "setting data" with the engineering tool. The program for data setting is complicated and many devices must be used. This will increase the scan time.

Monitor data

The data indicates the control status. The data is stored in the buffer memory. Monitor the data as necessary.
The monitor data is classified as follows.

Item	Description
System monitor data	Monitors the specifications and the operation history of the Motion module.
Axis monitor data	Monitors the data related to the operating axis, such as the current position and speed.
Synchronous control monitor data	Monitors the data for synchronous control.
Mark detection monitor data	Monitors the data for mark detection.
Axis monitor data (device station operation)	Monitors the data of when device stations are operated.

- The following methods are available for data monitoring:

  - Set using the engineering tool.
  - Create the program for monitoring and execute it.

- In this manual, the method using the engineering tool will be explained.

Control data

The data is used by users to control the positioning system.

The control data is classified as follows.

Item	Description
System control data	Writes/initializes the "positioning data" in the module. Sets the setting for operation of all axes.
Axis control data	Makes settings related to the operation, and controls the speed change during operation, and stops/restarts the operation for each axis. Output signals (axis stop signal, JOG start signal, and execution prohibition flag) from the CPU module to the Motion module.
Synchronous control data	Sets the data for synchronous control.
Mark detection control data	Sets the data for mark detection control.
Axis control data (device station operation)	Sets the control data to operate device stations.

- Control using the control data is carried out with the program. "[Cd.41] Deceleration start flag valid" become valid only when PLC READY [Y0] turns from OFF to ON.

Setting items for servo network composition parameters

The setting items for the "servo network composition parameters" are shown below.

Servo network composition parameters		Remark
[Pr.101]	Virtual servo amplifier setting	Sets if use as virtual servo amplifier axis. It will be read when the power supply is ON.
[Pr.140]	Driver command discard detection setting	When bit 12 in "[Md.117] Statusword" of the drive unit is turned ON → OFF during the actual servo amplifier axis operation, "Driver command discard detection" (error code: 1BE6H) is outputted to stop the command before the motor stops.
[Pr.141]	IP address	Specify the IP address.
[Pr.142]	Multidrop number	When one station includes multiple logic axes, specify the No. in order to distinguish logic axes.
[Pr.143]	Driver communication setting	Sets whether to enable or disable driver communication.

Setting items for common parameters

The setting items for the "common parameters" are shown below. The "common parameters" are independent of axes and related to the overall system.

○: Set as required ("—" when not required)

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Common parameter		Home position return control	Major positioning control			
			Position control			
			1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control
[Pr.82]	Forced stop valid/invalid selection	○	○	○	○	○
[Pr.152]	Maximum number of control axes	○	○	○	○	○
[Pr.156]	Manual pulse generator smoothing time constant	—	—	—	—	—

Common parameter		Major positioning control			
		1 to 4 axis speed control	Speed-position or position-speed control	Other control	
				Current value changing	JUMP instruction, NOP instruction, LOOP to LEND
[Pr.82]	Forced stop valid/invalid selection	○	○	○	○
[Pr.152]	Maximum number of control axes	○	○	○	○
[Pr.156]	Manual pulse generator smoothing time constant	—	—	—	—

Common parameter		Manual control			Expansion control	Related sub function
		Manual pulse generator operation	Inching operation	JOG operation	Speed-torque control	
[Pr.82]	Forced stop valid/invalid selection	○	○	○	○	☞ Page 253 Forced stop function
[Pr.152]	Maximum number of control axes	○	○	○	○	—
[Pr.156]	Manual pulse generator smoothing time constant	○	—	—	—	—

Setting items for positioning parameters

The setting items for the "positioning parameters" are shown below. The "positioning parameters" are set for each axis for all controls achieved by the Motion module.

Home position return control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted,

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning parameter		Home position return control
Basic parameters 1	[Pr.1] Unit setting	◎
	[Pr.2] Number of pulses per rotation (AP) (Unit: pulse)	◎
	[Pr.3] Movement amount per rotation (AL)	◎
	[Pr.4] Unit magnification (AM)	◎
	[Pr.7] Bias speed at start	○
Basic parameters 2	[Pr.8] Speed limit value	◎
	[Pr.9] Acceleration time 0	◎
	[Pr.10] Deceleration time 0	◎

Positioning parameter		Home position return control
Detailed parameters 1	[Pr.11] Backlash compensation amount	○
	[Pr.12] Software stroke limit upper limit value	—
	[Pr.13] Software stroke limit lower limit value	—
	[Pr.14] Software stroke limit selection	—
	[Pr.15] Software stroke limit valid/invalid setting	—
	[Pr.16] Command in-position width	—
	[Pr.17] Torque limit setting value	△
	[Pr.18] M code ON signal output timing	—
	[Pr.19] Speed switching mode	—
	[Pr.20] Interpolation speed designation method	—
	[Pr.21] Command position value during speed control	—
	[Pr.22] Input signal logic selection	◎
	[Pr.81] Speed-position function selection	—
	[Pr.116] FLS signal selection	○
	[Pr.117] RLS signal selection	○
	[Pr.118] DOG signal selection	○
	[Pr.119] STOP signal selection	○
Detailed parameters 2	[Pr.25] Acceleration time 1	○
	[Pr.26] Acceleration time 2	○
	[Pr.27] Acceleration time 3	○
	[Pr.28] Deceleration time 1	○
	[Pr.29] Deceleration time 2	○
	[Pr.30] Deceleration time 3	○
	[Pr.31] JOG speed limit value	—
	[Pr.32] JOG operation acceleration time selection	—
	[Pr.33] JOG operation deceleration time selection	—
	[Pr.34] Acceleration/deceleration process selection	○
	[Pr.35] S-curve ratio	○
	[Pr.36] Rapid stop deceleration time	○
	[Pr.37] Stop group 1 rapid stop selection	○
	[Pr.38] Stop group 2 rapid stop selection	○
	[Pr.39] Stop group 3 rapid stop selection	○
	[Pr.40] Positioning complete signal output time	—
	[Pr.41] Allowable circular interpolation error width	—
	[Pr.42] External command function selection	○
	[Pr.83] Speed control 10 × multiplier setting for degree axis	○
	[Pr.84] Restart allowable range when servo OFF to ON	○
	[Pr.90] Operation setting for speed-torque control mode	—
	[Pr.95] External command signal selection	○
	[Pr.112] Servo OFF command valid/invalid setting	—
	[Pr.122] Manual pulse generator speed limit mode	—
	[Pr.123] Manual pulse generator speed limit value	—
	[Pr.127] Speed limit value input selection at control mode switching	—

Major positioning control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning parameter		Major positioning control							
		Position control				1 to 4 axis speed control	Speed-position or position-speed control	Other control	
		1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control			Current value changing	JUMP instruction, NOP instruction, LOOP to LEND
Basic parameters 1	[Pr.1] Unit setting	◎	◎	△	△	◎	◎	◎	◎
	[Pr.2] Number of pulses per rotation (AP) (Unit: pulse)	◎	◎	◎	◎	◎	◎	◎	◎
	[Pr.3] Movement amount per rotation (AL)	◎	◎	◎	◎	◎	◎	◎	◎
	[Pr.4] Unit magnification (AM)	◎	◎	◎	◎	◎	◎	◎	◎
	[Pr.7] Bias speed at start	○	○	○	○	○	○	—	—
Basic parameters 2	[Pr.8] Speed limit value	◎	◎	◎	◎	◎	◎	—	—
	[Pr.9] Acceleration time 0	◎	◎	◎	◎	◎	◎	—	—
	[Pr.10] Deceleration time 0	◎	◎	◎	◎	◎	◎	—	—

Positioning parameter		Major positioning control							
		Position control				1 to 4 axis speed control	Speed-position or position-speed control	Other control	
		1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control			Current value changing	JUMP instruction, NOP instruction, LOOP to LEND
Detailed parameters 1	[Pr.11] Backlash compensation amount	○	○	○	○	○	○	—	—
	[Pr.12] Software stroke limit upper limit value	○	○	○	○	○	○	○	—
	[Pr.13] Software stroke limit lower limit value	○	○	○	○	○	○	○	—
	[Pr.14] Software stroke limit selection	○	○	○	○	○	○	○	—
	[Pr.15] Software stroke limit valid/ invalid setting	—	—	—	—	—	—	—	—
	[Pr.16] Command in-position width	○	○	○	○	—	○	—	—
	[Pr.17] Torque limit setting value	○	○	○	○	○	○	—	—
	[Pr.18] M code ON signal output timing	○	○	○	○	○	○	○	—
	[Pr.19] Speed switching mode	○	○	○	○	—	—	—	—
	[Pr.20] Interpolation speed designation method	△	△	△	△	△	—	—	—
	[Pr.21] Command position value during speed control	—	—	—	—	○	○	—	—
	[Pr.22] Input signal logic selection	◎	◎	◎	◎	◎	◎	◎	◎
	[Pr.81] Speed-position function selection	—	—	—	—	—	◎	—	—
	[Pr.116] FLS signal selection	○	○	○	○	○	○	—	—
	[Pr.117] RLS signal selection	○	○	○	○	○	○	—	—
	[Pr.118] DOG signal selection	—	—	—	○	—	○	—	—
	[Pr.119] STOP signal selection	○	○	○	○	○	○	○	○

Positioning parameter		Major positioning control							
		Position control				1 to 4 axis speed control	Speed-position or position-speed control	Other control	
		1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control			Current value changing	JUMP instruction, NOP instruction, LOOP to LEND
Detailed parameters 2	[Pr.25] Acceleration time 1	○	○	○	○	○	○	—	—
	[Pr.26] Acceleration time 2	○	○	○	○	○	○	—	—
	[Pr.27] Acceleration time 3	○	○	○	○	○	○	—	—
	[Pr.28] Deceleration time 1	○	○	○	○	○	○	—	—
	[Pr.29] Deceleration time 2	○	○	○	○	○	○	—	—
	[Pr.30] Deceleration time 3	○	○	○	○	○	○	—	—
	[Pr.31] JOG speed limit value	—	—	—	—	—	—	—	—
	[Pr.32] JOG operation acceleration time selection	—	—	—	—	—	—	—	—
	[Pr.33] JOG operation deceleration time selection	—	—	—	—	—	—	—	—
	[Pr.34] Acceleration/ deceleration process selection	○	○	○	○	○	○	—	—
	[Pr.35] S-curve ratio	○	○	○	○	○	○	—	—
	[Pr.36] Rapid stop deceleration time	○	○	○	○	○	○	—	—
	[Pr.37] Stop group 1 rapid stop selection	○	○	○	○	○	○	—	—
	[Pr.38] Stop group 2 rapid stop selection	○	○	○	○	○	○	—	—
	[Pr.39] Stop group 3 rapid stop selection	○	○	○	○	○	○	—	—
	[Pr.40] Positioning complete signal output time	○	○	○	○	○	○	○	—

Positioning parameter		Major positioning control							
		Position control				1 to 4 axis speed control	Speed-position or position-speed control	Other control	
		1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control			Current value changing	JUMP instruction, NOP instruction, LOOP to LEND
Detailed parameters 2	[Pr.41] Allowable circular interpolation error width	—	—	○	○	—	—	—	—
	[Pr.42] External command function selection	○	○	○	○	○	◎	○	—
	[Pr.83] Speed control 10 × multiplier setting for degree axis	○	○	○	○	○	○	—	—
	[Pr.84] Restart allowable range when servo OFF to ON	○	○	○	○	○	○	○	○
	[Pr.90] Operation setting for speed-torque control mode	—	—	—	—	—	—	—	—
	[Pr.95] External command signal selection	○	○	○	○	○	◎	○	—
	[Pr.112] Servo OFF command valid/invalid setting	—	—	—	—	—	—	—	—
	[Pr.122] Manual pulse generator speed limit mode	—	—	—	—	—	—	—	—
	[Pr.123] Manual pulse generator speed limit value	—	—	—	—	—	—	—	—
	[Pr.127] Speed limit value input selection at control mode switching	—	—	—	—	—	—	—	—

Manual control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted,

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning parameter		Manual control		
		Manual pulse generator operation	Inching operation	JOG operation
Basic parameters 1	[Pr.1] Unit setting	◎	◎	◎
	[Pr.2] Number of pulses per rotation (AP) (Unit: pulse)	◎	◎	◎
	[Pr.3] Movement amount per rotation (AL)	◎	◎	◎
	[Pr.4] Unit magnification (AM)	◎	◎	◎
	[Pr.7] Bias speed at start	—	—	○
Basic parameters 2	[Pr.8] Speed limit value	—	◎	◎
	[Pr.9] Acceleration time 0	—	—	◎
	[Pr.10] Deceleration time 0	—	—	◎
Detailed parameters 1	[Pr.11] Backlash compensation amount	○	○	○
	[Pr.12] Software stroke limit upper limit value	○	○	○
	[Pr.13] Software stroke limit lower limit value	○	○	○
	[Pr.14] Software stroke limit selection	○	○	○
	[Pr.15] Software stroke limit valid/invalid setting	○	○	○
	[Pr.16] Command in-position width	—	—	—
	[Pr.17] Torque limit setting value	△	△	△
	[Pr.18] M code ON signal output timing	—	—	—
	[Pr.19] Speed switching mode	—	—	—
	[Pr.20] Interpolation speed designation method	—	—	—
	[Pr.21] Command position value during speed control	—	—	—
	[Pr.22] Input signal logic selection	◎	◎	◎
	[Pr.81] Speed-position function selection	—	—	—
	[Pr.116] FLS signal selection	○	○	○
	[Pr.117] RLS signal selection	○	○	○
	[Pr.118] DOG signal selection	—	—	—
	[Pr.119] STOP signal selection	○	○	○

Positioning parameter		Manual control		
		Manual pulse generator operation	Inching operation	JOG operation
Detailed parameters 2	[Pr.25] Acceleration time 1	—	—	○
	[Pr.26] Acceleration time 2	—	—	○
	[Pr.27] Acceleration time 3	—	—	○
	[Pr.28] Deceleration time 1	—	—	○
	[Pr.29] Deceleration time 2	—	—	○
	[Pr.30] Deceleration time 3	—	—	○
	[Pr.31] JOG speed limit value	—	◎	◎
	[Pr.32] JOG operation acceleration time selection	—	—	◎
	[Pr.33] JOG operation deceleration time selection	—	—	◎
	[Pr.34] Acceleration/deceleration process selection	—	—	○
	[Pr.35] S-curve ratio	—	—	○
	[Pr.36] Rapid stop deceleration time	—	—	○
	[Pr.37] Stop group 1 rapid stop selection	—	—	○
	[Pr.38] Stop group 2 rapid stop selection	—	—	○
	[Pr.39] Stop group 3 rapid stop selection	—	—	○
	[Pr.40] Positioning complete signal output time	—	—	—
	[Pr.41] Allowable circular interpolation error width	—	—	—
	[Pr.42] External command function selection	—	—	○
	[Pr.83] Speed control 10 × multiplier setting for degree axis	○	○	○
	[Pr.84] Restart allowable range when servo OFF to ON	○	○	○
	[Pr.90] Operation setting for speed-torque control mode	—	—	—
	[Pr.95] External command signal selection	—	—	○
	[Pr.112] Servo OFF command valid/invalid setting	—	—	—
	[Pr.122] Manual pulse generator speed limit mode	○	—	—
	[Pr.123] Manual pulse generator speed limit value	○	—	—
	[Pr.127] Speed limit value input selection at control mode switching	—	—	—

Expansion control

◎: Always set, ○: Set as required ("—" when not required), △: Setting restricted, ×: Setting not possible

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning parameter		Expansion control
		Speed-torque control
Basic parameters 1	[Pr.1] Unit setting	◎
	[Pr.2] Number of pulses per rotation (AP) (Unit: pulse)	◎
	[Pr.3] Movement amount per rotation (AL)	◎
	[Pr.4] Unit magnification (AM)	◎
	[Pr.7] Bias speed at start	×
Basic parameters 2	[Pr.8] Speed limit value	◎
	[Pr.9] Acceleration time 0	—
	[Pr.10] Deceleration time 0	—
Detailed parameters 1	[Pr.11] Backlash compensation amount	—
	[Pr.12] Software stroke limit upper limit value	○
	[Pr.13] Software stroke limit lower limit value	○
	[Pr.14] Software stroke limit selection	○
	[Pr.15] Software stroke limit valid/invalid setting	—
	[Pr.16] Command in-position width	—
	[Pr.17] Torque limit setting value	○
	[Pr.18] M code ON signal output timing	—
	[Pr.19] Speed switching mode	—
	[Pr.20] Interpolation speed designation method	—
	[Pr.21] Command position value during speed control	—
	[Pr.22] Input signal logic selection	◎
	[Pr.81] Speed-position function selection	—
	[Pr.116] FLS signal selection	○
	[Pr.117] RLS signal selection	○
	[Pr.118] DOG signal selection	—
	[Pr.119] STOP signal selection	○

Positioning parameter		Expansion control
		Speed-torque control
Detailed parameters 2	[Pr.25] Acceleration time 1	—
	[Pr.26] Acceleration time 2	—
	[Pr.27] Acceleration time 3	—
	[Pr.28] Deceleration time 1	—
	[Pr.29] Deceleration time 2	—
	[Pr.30] Deceleration time 3	—
	[Pr.31] JOG speed limit value	—
	[Pr.32] JOG operation acceleration time selection	—
	[Pr.33] JOG operation deceleration time selection	—
	[Pr.34] Acceleration/deceleration process selection	—
	[Pr.35] S-curve ratio	—
	[Pr.36] Rapid stop deceleration time	—
	[Pr.37] Stop group 1 rapid stop selection	—
	[Pr.38] Stop group 2 rapid stop selection	—
	[Pr.39] Stop group 3 rapid stop selection	—
	[Pr.40] Positioning complete signal output time	—
	[Pr.41] Allowable circular interpolation error width	—
	[Pr.42] External command function selection	—
	[Pr.83] Speed control 10 × multiplier setting for degree axis	○
	[Pr.84] Restart allowable range when servo OFF to ON	—
	[Pr.90] Operation setting for speed-torque control mode	○
	[Pr.95] External command signal selection	—
	[Pr.112] Servo OFF command valid/invalid setting	○
	[Pr.122] Manual pulse generator speed limit mode	—
	[Pr.123] Manual pulse generator speed limit value	—
	[Pr.127] Speed limit value input selection at control mode switching	○

Checking the positioning parameters

[Pr.1] to [Pr.90], [Pr.95], [Pr.116] to [Pr.119], [Pr.122], [Pr.123], [Pr.127] are checked with the following timing.

• When "PLC READY [Y0]" output from the CPU module to the Motion module changes from OFF to ON

[Pr.112] is checked at the timing of control mode switching.

Point

"High-level positioning control" is carried out in combination with the "major positioning control".
Refer to the "major positioning control" parameter settings for details on the parameters required for "high-level positioning control".

Setting items for home position return parameters

When carrying out "home position return control", the "home position return parameters" must be set. The setting items for the "home position return parameters" are shown below.

The "home position return parameters" are set for each axis.

◎: Always set

○: Set as required

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Home position return parameters			Machine home position return control	Fast home position return control
Home position return basic parameters	[Pr.43]	Home position return method*1	Driver home position return method	—
	[Pr.44]	Home position return direction	○*2	—
	[Pr.45]	Home position address	◎	◎
	[Pr.46]	Home position return speed	—	◎
Home position return detailed parameters	[Pr.51]	Home position return acceleration time selection	—	◎
	[Pr.52]	Home position return deceleration time selection	—	◎
	[Pr.55]	Operation setting for incompletion of home position return	○	—

*1 For details, refer to the following.
☞ Page 481 [Pr.43] Home position return method

*2 The home position return operation follows the home position return direction set in the driver (servo amplifier) and does not refer to "[Pr.44] Home position return direction". However, "[Pr.44] Home position return direction" must be set when using the backlash compensation function.
When the positioning is executed in the reverse direction against "[Pr.44] Home position return direction", the backlash compensation is executed in the axis operation such as positioning after the driver home position return. Set the same direction to "[Pr.44] Home position return direction" of the Motion module and the last home position return direction of the driver (servo amplifier).

Checking the home position return parameters

[Pr.43] to [Pr.55] are checked with the following timing.

- When "PLC READY [Y0]" output from the CPU module to the Motion module changes from OFF to ON

Setting items for extended parameters

The setting items for the "extended parameters" are shown below. The "extended parameters" are set for each axis.

Extended parameter		Related sub function
[Pr.91]	Optional data monitor: Data type setting 1	☞ Page 375 Optional Data Monitor Function
[Pr.92]	Optional data monitor: Data type setting 2	
[Pr.93]	Optional data monitor: Data type setting 3	
[Pr.94]	Optional data monitor: Data type setting 4	
[Pr.591]	Optional data monitor: Data type expansion setting 1	
[Pr.592]	Optional data monitor: Data type expansion setting 2	
[Pr.593]	Optional data monitor: Data type expansion setting 3	
[Pr.594]	Optional data monitor: Data type expansion setting 4	

Setting items for positioning data

Positioning data must be set for carrying out any "major positioning control". The table below lists the items to be set for producing the positioning data.

One to 600 positioning data items can be set for each axis.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur at start.)

△: Setting limited

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning data			Position control				1 to 4 axis speed control
			1-axis linear control 2/3/4-axis linear interpolation control	1/2/3/4-axis fixed-feed control	2-axis circular interpolation control	3-axis helical interpolation control	
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	◎	◎	◎	◎	◎
		Continuous positioning control	◎	◎	◎	◎	×
		Continuous path control	◎	×	◎	◎	×
[Da.2]	Control method		Linear 1 Linear 2 Linear 3 Linear 4 *1	Fixed-feed 1 Fixed-feed 2 Fixed-feed 3 Fixed-feed 4	Circular sub Circular right Circular left *1	Helical sub Helical right Helical left *1	Forward run speed 1 Reverse run speed 1 Forward run speed 2 Reverse run speed 2 Forward run speed 3 Reverse run speed 3 Forward run speed 4 Reverse run speed 4
[Da.3]	Acceleration time No.		◎	◎	◎	◎	◎
[Da.4]	Deceleration time No.		◎	◎	◎	◎	◎
[Da.6]	Positioning address/movement amount		◎	◎	◎	◎	—
[Da.7]	Arc address		—	—	◎	◎	—
[Da.8]	Command speed		◎	◎	◎	◎	◎
[Da.9]	Dwell time/JUMP destination positioning data No.		○	○	○	○	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches		○	○	○	○*2	○
[Da.20]	Axis to be interpolated 1		◎: 2 axes, 3 axes, 4 axes, —: 1 axis				
[Da.21]	Axis to be interpolated 2		◎: 3 axes, 4 axes, —: 1 axis, 2 axes				
[Da.22]	Axis to be interpolated 3		◎: 4 axes, —: 1 axis, 2 axes, 3 axes				
[Da.27]	M code ON signal output timing		○	○	○	○	○
[Da.28]	ABS direction in degrees		○	○	○	○	○
[Da.29]	Interpolation speed designation method		△	△	△	△	△

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

*2 Set an M code for the reference axis and set the number of pitches for the linear interpolation axis.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur at start.)

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning data			Speed-position switching control	Position-speed switching control
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	◎	◎
		Continuous positioning control	◎	×
		Continuous path control	×	×
[Da.2]	Control method		Forward run speed/position Reverse run speed/position *1	Forward run position/speed Reverse run position/speed
[Da.3]	Acceleration time No.		◎	◎
[Da.4]	Deceleration time No.		◎	◎
[Da.6]	Positioning address/movement amount		◎	◎
[Da.7]	Arc address		—	—
[Da.8]	Command speed		◎	◎
[Da.9]	Dwell time/JUMP destination positioning data No.		○	○
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches		○	○
[Da.20]	Axis to be interpolated 1		—	—
[Da.21]	Axis to be interpolated 2		—	—
[Da.22]	Axis to be interpolated 3		—	—
[Da.27]	M code ON signal output timing		○	○
[Da.28]	ABS direction in degrees		○	○
[Da.29]	Interpolation speed designation method		—	—

*1 Two control systems are available: the absolute (ABS) system and incremental (INC) system.

◎: Always set

○: Set as required ("—" when not required)

×: Setting not possible (If set, "Continuous path control not possible" (error code: 1B1EH to 1B20H) will occur at start.)

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Positioning data			Other control				
			NOP instruction	Current value changing	JUMP instruction	LOOP	LEND
[Da.1]	Operation pattern	Independent positioning control (Positioning complete)	—	◎	—	—	—
		Continuous positioning control	—	◎	—	—	—
		Continuous path control	—	×	—	—	—
[Da.2]	Control method		NOP	Current value changing	JUMP instruction	LOOP	LEND
[Da.3]	Acceleration time No.		—	—	—	—	—
[Da.4]	Deceleration time No.		—	—	—	—	—
[Da.6]	Positioning address/movement amount		—	New address	—	—	—
[Da.7]	Arc address		—	—	—	—	—
[Da.8]	Command speed		—	—	—	—	—
[Da.9]	Dwell time/JUMP destination positioning data No.		—	—	JUMP destination positioning data No.	—	—
[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches		—	○	JUMP condition data No.	Number of LOOP to LEND repetitions	—
[Da.20]	Axis to be interpolated 1		—	—	—	—	—
[Da.21]	Axis to be interpolated 2		—	—	—	—	—
[Da.22]	Axis to be interpolated 3		—	—	—	—	—
[Da.27]	M code ON signal output timing		—	○	—	—	—
[Da.28]	ABS direction in degrees		○	○	○	○	○
[Da.29]	Interpolation speed designation method		—	—	—	—	—

Checking the positioning data

[Da.1] to [Da.10], [Da.20] to [Da.22], [Da.27] to [Da.29] are checked at the following timings:

- Startup of a positioning operation

Setting items for block start data

The "block start data" must be set when carrying out "high-level positioning control". The setting items for the "block start data" are shown below.

Up to 50 points of "block start data" can be set for each axis.

○: Set as required ("—" when not required)

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Block start data		Block start (Normal Start)	Condition Start	Wait Start	Simultaneous Start	Repeated start (FOR Loop)	Repeated start (FOR Condition)
[Da.11]	Shape (end/ continue)	○	○	○	○	○	○
[Da.12]	Start data No.	○	○	○	○	○	○
[Da.13]	Special start instruction	—	○	○	○	○	○
[Da.14]	Parameter	—	○	○	○	○	○

Checking the block start data

[Da.11] to [Da.14] are checked with the following timing.

- When "Block start data" starts

Setting items for condition data

When carrying out "high-level positioning control" or using the JUMP instruction in the "major positioning control", the "condition data" must be set as required. The setting items for the "condition data" are shown below.

Up to 10 "condition data" items can be set for each axis.

○: Set as required ("—" when not required)

△: Setting limited

—: Setting not required (When the value is the default value or within the setting range, there is no problem.)

Condition data		Major positioning control		High-level positioning control					
		Other than JUMP instruction	JUMP instruction	Block start (Normal Start)	Condition Start	Wait Start	Simultaneous Start	Repeated start (FOR Loop)	Repeated start (FOR Condition)
[Da.15]	Condition target	—	○	—	○	○	○	—	○
[Da.16]	Condition operator	—	○	—	○	○	○	—	○
[Da.17]	Address	—	△	—	△	△	—	—	△
[Da.18]	Parameter 1	—	○	—	○	○	△	—	○
[Da.19]	Parameter 2	—	△	—	△	△	△	—	△
[Da.23]	Number of simultaneous starting axes	—	—	—	—	—	○	—	—
[Da.24]	Simultaneous starting axis No.1	—	—	—	—	—	○	—	—
[Da.25]	Simultaneous starting axis No.2	—	—	—	—	—	○	—	—
[Da.26]	Simultaneous starting axis No.3	—	—	—	—	—	○	—	—

Checking the condition data

[Da.15] to [Da.19], [Da.23] to [Da.26] are checked with the following timing.

- When "Block start data" starts
- When "JUMP instruction" starts

Types and roles of monitor data

The monitor data area in the buffer memory stores data relating to the operating state of the positioning system, which are monitored as required while the positioning system is operating.

The following data are available for monitoring

Item	Details
System monitoring	Monitoring the specification and operation history of the Motion module (system monitor data [Md.1], [Md.3] to [Md.8], [Md.19], [Md.50], [Md.52], [Md.54], [Md.59], [Md.60], [Md.64], [Md.130] to [Md.135])
Axis operation monitoring	Monitoring the current position and speed, and other data related to the movements of axes (axis monitor data [Md.20] to [Md.33], [Md.35] to [Md.48], [Md.62], [Md.101] to [Md.104], [Md.108] to [Md.117], [Md.119], [Md.120], [Md.122] to [Md.126], [Md.160] to [Md.167], [Md.503], [Md.514], [Md.900])

Monitoring the system

■Monitoring the positioning system operation history

Monitor details			Corresponding item
Monitor whether the system is in the test mode			[Md.1] In test mode flag
History of data that started an operation	Start information		[Md.3] Start information
	Start No.		[Md.4] Start No.
	Start*1	Year: month	[Md.54] Start (Year: month)
		Day: hour	[Md.5] Start (Day: hour)
		Minute: second	[Md.6] Start (Minute: second)
		ms	[Md.60] Start (ms)
	Error upon starting		[Md.7] Error judgment
	Pointer No. next to the pointer No. where the latest history is stored		[Md.8] Start history pointer
Number of write accesses to the flash ROM after the power is switched ON	Number of write accesses to flash ROM		[Md.19] Number of write accesses to flash ROM
Forced stop input signal (EMI) turn ON/OFF	Forced stop input signal (EMI) information		[Md.50] Forced stop input
The detection state of the axis set for driver communication is stored			[Md.52] Communication between amplifiers axes searching flag
Store the module information			[Md.59] Module information
When a network error is detected, the error code corresponding to the error details is stored			[Md.64] Network error number
Monitor the first two digits of the module firmware version Monitor with the string display			[Md.130] F/W version
Monitor the RUN status of digital oscilloscope			[Md.131] Digital oscilloscope running flag
Monitor the current operation cycle			[Md.132] Operation cycle setting
Monitor whether the operation cycle time exceeds operation cycle			[Md.133] Operation cycle over flag
Monitor the time that took for operation every operation cycle			[Md.134] Operation time
Monitor the maximum value of operation time after each module's power supply ON			[Md.135] Maximum operation time

*1 Displays a value set by the clock function of the CPU module.

Monitoring the axis operation state

■Monitoring the position

Monitor details	Corresponding item
Monitor the current machine feed value	[Md.21] Machine feed value
Monitor the command position value	[Md.20] Command position value
Monitor the current target value	[Md.32] Target value

■Monitoring the speed

Monitor details				Corresponding item
Monitor the current speed	During independent axis control		Indicates the speed of each axis	[Md.22] Speed command
	During interpolation control	When "0: Composite speed" is set for "[Pr.20] Interpolation speed designation method"	Indicates the composite speed	
		When "1: Reference axis speed" is set for "[Pr.20] Interpolation speed designation method"	Indicates the reference axis speed	
	Monitor "[Da.8] Command speed" currently being executed			[Md.27] Current speed
	Constantly indicates the speed of each axis			[Md.28] Axis speed command
Monitor the current target speed				[Md.33] Target speed
Monitor the command speed at speed control mode or continuous operation to torque control mode in the speed-torque control				[Md.122] Speed during command

■Monitoring the status of servo amplifier

Monitor details	Corresponding item
Monitor the real current value "command position value - (command pulse - feedback pulse)".	[Md.101] Actual position value
Monitor the pulse droop	[Md.102] Deviation counter value
Monitor the motor speed of servo motor	[Md.103] Motor rotation speed
Monitor the current value of servo motor	[Md.104] Motor current value
Monitor the status (servo status) of servo amplifier.	[Md.108] Servo status1
	[Md.119] Servo status2
	[Md.125] Servo status3
	[Md.126] Servo status4
• Monitor the percentage of regenerative power to permissible regenerative value. • Monitor the content of "[Pr.91] Optional data monitor: Data type setting 1" and "[Pr.591] Optional data monitor: Data type expansion setting 1" at optional data monitor data type setting.	[Md.109] Regenerative load ratio/Optional data monitor output 1
• Monitor the continuous effective load torque. • Monitor the content of "[Pr.92] Optional data monitor: Data type setting 2" and "[Pr.592] Optional data monitor: Data type expansion setting 2" at optional data monitor data type setting.	[Md.110] Effective load torque/Optional data monitor output 2
• Monitor the maximum generated torque. • Monitor the content of "[Pr.93] Optional data monitor: Data type setting 3" and "[Pr.593] Optional data monitor: Data type expansion setting 3" at optional data monitor data type setting.	[Md.111] Peak torque ratio/Optional data monitor output 3
Monitor the content of "[Pr.94] Optional data monitor: Data type setting 4" and "[Pr.594] Optional data monitor: Data type expansion setting 4" at optional data monitor data type setting.	[Md.112] Optional data monitor output 4
Monitor the status of semi closed loop control/fully closed loop control	[Md.113] Semi/Fully closed loop status
Monitor the alarm of servo amplifier	[Md.114] Servo alarm
Monitor the alarm detail number of the servo amplifier.	[Md.115] Servo alarm detail number
Monitor the option information of encoder.	[Md.116] Encoder option information
Monitor CiA402 Statusword of the servo amplifier.	[Md.117]Statusword
Monitor the status of the servo amplifier during the home position return.	[Md.514] Home position return operating status

■Monitoring the state

Monitor details	Corresponding item
Monitor the latest error code that occurred with the axis	[Md.23] Axis error No.
Monitor the latest warning code that occurred with the axis	[Md.24] Axis warning No.
Monitor the valid M codes	[Md.25] Valid M code
Monitor the axis operation state	[Md.26] Axis operation status
Monitor the movement amount after the current position control switching when using "speed-position switching control"	[Md.29] Speed-position switching control positioning movement amount
Monitor the external input/output signal and flag	[Md.30] External input signal
	[Md.31] Status
Monitor the current torque limit value	[Md.35] Torque limit stored value/forward torque limit stored value
	[Md.120] Reverse torque limit stored value
Monitor the "instruction code" of the special start data when using special start	[Md.36] Special start data instruction code setting value
Monitor the "instruction parameter" of the special start data when using special start	[Md.37] Special start data instruction parameter setting value
Monitor the "start data No." of the special start data when using special start	[Md.38] Start positioning data No. setting value
Monitor whether the speed is being limited	[Md.39] In speed limit flag
Monitor whether the speed is being changed	[Md.40] In speed change processing flag
Monitor the remaining number of repetitions (special start)	[Md.41] Special start repetition counter
Monitor the remaining number of repetitions (control system)	[Md.42] Control system repetition counter
Monitor the "start data" point currently being executed	[Md.43] Start data pointer being executed
Monitor the "positioning data No." currently being executed	[Md.44] Positioning data No. being executed
Monitor the block No.	[Md.45] Block No. being executed
Monitor the "positioning data No." executed last	[Md.46] Last executed positioning data No.
Monitor the positioning data currently being executed	[Md.47] Positioning data being executed
Monitor switching from the constant speed status or acceleration status to the deceleration status during position control whose operation pattern is "Positioning complete"	[Md.48] Deceleration start flag
Monitor the carrying over movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value"	[Md.62] Amount of the manual pulser driving carrying over movement
Monitor the command torque at torque control mode or continuous operation to torque control mode in the speed-torque control	[Md.123] Torque during command
Monitor the switching status of control mode	[Md.124] Control mode switching status
Monitor the response code (SDO Abort code) of a device for the transient request.	[Md.160] Optional SDO transfer result 1
	[Md.161] Optional SDO transfer result 2
	[Md.162] Optional SDO transfer result 3
	[Md.163] Optional SDO transfer result 4
Monitor the processing status of the transient request.	[Md.164] Optional SDO transfer status 1
	[Md.165] Optional SDO transfer status 2
	[Md.166] Optional SDO transfer status 3
	[Md.167] Optional SDO transfer status 4
Monitor the controller position value restoration completion status of a connected device.	[Md.190] Controller position value restoration complete status
Monitor the positioning data analysis status	[Md.503] Pre-reading data analysis status
Monitor the status of the external command signals assigned to link devices.	[Md.900] External command signal monitor

Types and roles of control data

Operation of the positioning system is achieved through the execution of necessary controls. (Data required for controls are given through the default values when the power is switched ON, which can be modified as required by the program.)
Items that can be controlled are described below.

Controlling the system data	Setting and resetting "setting data" of the Motion module. (system control data [Cd.1], [Cd.2])
Controlling the operation	Setting operation parameters, changing speed during operation, interrupting or restarting operation, etc. (system control data [Cd.41], [Cd.42], [Cd.44], [Cd.55], [Cd.158], axis control data [Cd.3] to [Cd.40], [Cd.43], [Cd.45], [Cd.46], [Cd.100], [Cd.101], [Cd.108], [Cd.112], [Cd.113], [Cd.133], [Cd.136], [Cd.138] to [Cd.154], [Cd.180] to [Cd.183])

Controlling the system data

■Setting and resetting the setting data

Control details	Corresponding item
Write setting data from buffer memory to flash ROM	[Cd.1] Flash ROM write request
Reset (initialize) parameters	[Cd.2] Parameter initialization request

Controlling the operation

■Controlling the operation

Control details	Corresponding item
Set which positioning to execute (start No.)	[Cd.3] Positioning start No.
Set start point No. for executing block start	[Cd.4] Positioning starting point No.
Clear (reset) the axis error ([Md.23]) and warning ([Md.24])	[Cd.5] Axis error reset
Issue instruction to restart (When axis operation is stopped)	[Cd.6] Restart command
Stop continuous control	[Cd.18] Interrupt request during continuous operation
Set start data No. of own axis at multiple axes simultaneous starting	[Cd.30] Simultaneous starting own axis start data No.
Set start data No.1 for axes that start up simultaneously	[Cd.31] Simultaneous starting axis start data No.1
Set start data No.2 for axes that start up simultaneously	[Cd.32] Simultaneous starting axis start data No.2
Set start data No.3 for axes that start up simultaneously	[Cd.33] Simultaneous starting axis start data No.3
Stop (deceleration stop) the current positioning operation and execute the next positioning operation	[Cd.37] Skip command
Specify write destination for teaching results	[Cd.38] Teaching data selection
Specify data to be taught	[Cd.39] Teaching positioning data No.
Set number of simultaneous starting axes and target axis	[Cd.43] Simultaneous starting axis
Set the status of the external input signal (upper/lower limit switch signal, proximity dog signal, stop signal)	[Cd.44] External input signal operation device
Set the information of the forced stop to the buffer memory	[Cd.158] Forced stop input
Stop axis in control	[Cd.180] Axis stop
Execute start request of JOG operation or inching operation	[Cd.181] Forward run JOG start
	[Cd.182] Reverse run JOG start
Execute pre-reading at positioning start	[Cd.183] Execution prohibition flag

■Controlling operation per step

Control details	Corresponding item
Set unit to carry out step	[Cd.34] Step mode
Stop positioning operation after each operation	[Cd.35] Step valid flag
Continuous operation from stopped step	[Cd.36] Step start information

■Controlling the speed

Control details	Corresponding item
When changing acceleration time during speed change, set new acceleration time	[Cd.10] New acceleration time value
When changing deceleration time during speed change, set new deceleration time	[Cd.11] New deceleration time value
Set acceleration/deceleration time validity during speed change	[Cd.12] Acceleration/deceleration time change value during speed change, enable/disable
Change positioning operation speed between 0 and 300% range	[Cd.13] Positioning operation speed override
Set new speed when changing speed during operation	[Cd.14] New speed value
Issue instruction to change speed in operation to [Cd.14] value. (Only during positioning operation and JOG operation)	[Cd.15] Speed change request
Set inching movement amount	[Cd.16] Inching movement amount
Set JOG speed	[Cd.17] JOG speed

■Making settings related to operation

Control details	Corresponding item
Turn M code ON signal OFF	[Cd.7] M code OFF request
Validate external command signal	[Cd.8] External command valid
Set new value when changing current value	[Cd.9] New position value
Change home position return request flag from "ON to OFF"	[Cd.19] Home position return request flag OFF request
Set scale per pulse of number of input pulses from manual pulse generator	[Cd.20] Manual pulse generator 1 pulse input magnification
Set manual pulse generator operation validity	[Cd.21] Manual pulse generator enable flag
Change "[Md.35] Torque limit stored value/forward torque limit stored value"	[Cd.22] New torque value/forward new torque value
Change movement amount for position control during speed-position switching control (INC mode)	[Cd.23] Speed-position switching control movement amount change register
Validate switching signal set in "[Cd.45] Speed-position switching device selection"	[Cd.24] Speed-position switching enable flag
Change speed for speed control during position-speed switching control	[Cd.25] Position-speed switching control speed change register
Validate switching signal set in "[Cd.45] Speed-position switching device selection"	[Cd.26] Position-speed switching enable flag
Set new positioning address when changing target position during positioning	[Cd.27] Target position change value (New address)
Set new speed when changing target position during positioning	[Cd.28] Target position change value (New speed)
Turn on after setting the target position change value when changing the target position during positioning	[Cd.29] Target position change request flag
Set absolute (ABS) moving direction in degrees	[Cd.40] ABS direction in degrees
Set whether "[Md.48] Deceleration start flag" is valid or invalid	[Cd.41] Deceleration start flag valid
Set the stop command processing for deceleration stop function (deceleration curve re-processing/ deceleration curve continuation)	[Cd.42] Stop command processing for deceleration stop selection
Set the device used for speed-position switching	[Cd.45] Speed-position switching device selection
Switch speed-position control.	[Cd.46] Speed-position switching command
Set a value to be used every time as the input value for the manual pulse generator via CPU	[Cd.55] Input value for manual pulse generator via CPU
Turn the servo OFF for each axis	[Cd.100] Servo OFF command
Set torque limit value	[Cd.101] Torque output setting value
Set whether gain switching is execution or not	[Cd.108] Gain switching command flag
Set "same setting/individual setting" of the forward torque limit value or reverse torque limit value in the torque change function	[Cd.112] Torque change function switching request
Change "[Md.120] Reverse torque limit stored value"	[Cd.113] New reverse torque value
Set the semi closed loop control/fully closed loop control	[Cd.133] Semi/Fully closed loop switching request
Set the PI-PID switching to servo amplifier	[Cd.136] PI-PID switching request

Control details		Corresponding item
Speed-torque control	Switch the control mode	[Cd.138] Control mode switching request
	Set the control mode to switch	[Cd.139] Control mode setting
	Set the command speed during speed control mode	[Cd.140] Command speed at speed control mode
	Set the acceleration time during speed control mode	[Cd.141] Acceleration time at speed control mode
	Set the deceleration time during speed control mode	[Cd.142] Deceleration time at speed control mode
	Set the command torque during torque control mode	[Cd.143] Command torque at torque control mode
	Set the time constant at driving of torque control mode	[Cd.144] Torque time constant at torque control mode (Forward direction)
	Set the time constant at regeneration of torque control mode	[Cd.145] Torque time constant at torque control mode (Negative direction)
	Set the speed limit value during torque control mode	[Cd.146] Speed limit value at torque control mode
	Set the command speed during continuous operation to torque control mode	[Cd.147] Speed limit value at continuous operation to torque control mode
	Set the acceleration time during continuous operation to torque control mode	[Cd.148] Acceleration time at continuous operation to torque control mode
	Set the deceleration time during continuous operation to torque control mode	[Cd.149] Deceleration time at continuous operation to torque control mode
	Set the target torque during continuous operation to torque control mode	[Cd.150] Target torque at continuous operation to torque control mode
	Set the time constant at driving of continuous operation to torque control mode	[Cd.151] Torque time constant at continuous operation to torque control mode (Forward direction)
	Set the time constant at regeneration of continuous operation to torque control mode	[Cd.152] Torque time constant at continuous operation to torque control mode (Negative direction)
	Set the switching conditions for switching to continuous operation to torque control mode.	[Cd.153] Control mode auto-shift selection
	Set the condition value when "[Cd.153] Control mode auto-shift selection" is set	[Cd.154] Control mode auto-shift parameter

12.2 List of Buffer Memory Addresses

The following shows the relation between the buffer memory addresses and the various items.

Do not use the buffer memory address that is not described here since they are for "Maker setting".

References for the list of buffer memory addresses in this section are shown below.

Buffer memory address	Reference
Buffer memory addresses for positioning data	"Help" in "Simple Motion Module Setting Function" of the engineering tool*1
Buffer memory addresses used in synchronous control	Refer to "List of Buffer Memory Addresses (for Synchronous Control)" in the following manual. MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)
Buffer memory addresses used in network	Refer to "Buffer Memory (When Using the Simple Motion Mode)" in the following manual. MELSEC iQ-R Motion Module User's Manual (Network)

*1 Simple Motion Module Setting Function ⇨ "Help" ⇨ "Buffer Memory Address List"

[Basic setting]

■Servo network composition parameters

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Pr.101]	Virtual servo amplifier setting	Power supply ON/the CPU module reset	58022+32n
[Pr.140]	Driver command discard detection setting		58023+32n
[Pr.141]	IP address		58024+32n 58025+32n
[Pr.142]	Multidrop number		58028+32n
[Pr.143]	Driver communication setting		58029+32n

■Common parameters

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Pr.82]	Forced stop valid/invalid selection	PLC READY [Y0] OFF to ON	35
[Pr.152]	Maximum number of control axes	Power supply ON/the CPU module reset	58003
[Pr.156]	Manual pulse generator smoothing time constant	PLC READY [Y0] OFF to ON	58011

■Positioning parameters: Basic parameters 1

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Pr.1]	Unit setting	PLC READY [Y0] OFF to ON	0+150n
[Pr.2]	Number of pulses per rotation (AP)		2+150n 3+150n
[Pr.3]	Movement amount per rotation (AL)		4+150n 5+150n
[Pr.4]	Unit magnification (AM)		1+150n
[Pr.7]	Bias speed at start		6+150n 7+150n

■Positioning parameters: Basic parameters 2

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Pr.8]	Speed limit value	Next start of each speed control	10+150n 11+150n
[Pr.9]	Acceleration time 0		12+150n 13+150n
[Pr.10]	Deceleration time 0		14+150n 15+150n

■Positioning parameters: Detailed parameters 1

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Pr.11]	Backlash compensation amount	PLC READY [Y0] OFF to ON	17+150n
[Pr.12]	Software stroke limit upper limit value		18+150n 19+150n
[Pr.13]	Software stroke limit lower limit value		20+150n 21+150n
[Pr.14]	Software stroke limit selection		22+150n
[Pr.15]	Software stroke limit valid/invalid setting		23+150n
[Pr.16]	Command in-position width		24+150n 25+150n
[Pr.17]	Torque limit setting value		26+150n
[Pr.18]	M code ON signal output timing		27+150n
[Pr.19]	Speed switching mode		28+150n
[Pr.20]	Interpolation speed designation method		29+150n
[Pr.21]	Command position value during speed control		30+150n
[Pr.22]	Input signal logic selection		31+150n
[Pr.81]	Speed-position function selection		34+150n
[Pr.116]	FLS signal selection	Power supply ON/the CPU module reset/PLC READY [Y0] OFF to ON	116+150n
[Pr.117]	RLS signal selection		117+150n
[Pr.118]	DOG signal selection		118+150n
[Pr.119]	STOP signal selection		119+150n

■Positioning parameters: Detailed parameters 2

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Pr.25]	Acceleration time 1	Next start of each speed control	36+150n 37+150n
[Pr.26]	Acceleration time 2		38+150n 39+150n
[Pr.27]	Acceleration time 3		40+150n 41+150n
[Pr.28]	Deceleration time 1		42+150n 43+150n
[Pr.29]	Deceleration time 2		44+150n 45+150n
[Pr.30]	Deceleration time 3		46+150n 47+150n
[Pr.31]	JOG speed limit value		48+150n 49+150n
[Pr.32]	JOG operation acceleration time selection		50+150n
[Pr.33]	JOG operation deceleration time selection		51+150n
[Pr.34]	Acceleration/deceleration process selection		52+150n
[Pr.35]	S-curve ratio		53+150n
[Pr.36]	Rapid stop deceleration time		54+150n 55+150n
[Pr.37]	Stop group 1 rapid stop selection		56+150n
[Pr.38]	Stop group 2 rapid stop selection		57+150n
[Pr.39]	Stop group 3 rapid stop selection		58+150n
[Pr.40]	Positioning complete signal output time		59+150n
[Pr.41]	Allowable circular interpolation error width		60+150n 61+150n
[Pr.42]	External command function selection	When condition is satisfied (DI input)	62+150n
[Pr.83]	Speed control 10 × multiplier setting for degree axis	PLC READY [Y0] OFF to ON	63+150n
[Pr.84]	Restart allowable range when servo OFF to ON	At start	64+150n 65+150n
[Pr.90]	Operation setting for speed-torque control mode	PLC READY [Y0] OFF to ON	68+150n
[Pr.95]	External command signal selection		69+150n
[Pr.112]	Servo OFF command valid/invalid setting	When condition is satisfied (Control mode switching)	112+150n
[Pr.122]	Manual pulse generator speed limit mode	PLC READY [Y0] OFF to ON	121+150n
[Pr.123]	Manual pulse generator speed limit value		122+150n 123+150n
[Pr.127]	Speed limit value input selection at control mode switching		125+150n

■Home position return parameters: Home position return basic parameters

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Pr.43]	Home position return method	PLC READY [Y0] OFF to ON	70+150n
[Pr.44]	Home position return direction		71+150n
[Pr.45]	Home position address		72+150n 73+150n
[Pr.46]	Home position return speed		74+150n 75+150n

■Home position return parameters: Home position return detailed parameters

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Pr.51]	Home position return acceleration time selection	PLC READY [Y0] OFF to ON	82+150n
[Pr.52]	Home position return deceleration time selection		83+150n
[Pr.55]	Operation setting for incompletion of home position return		87+150n

■Extended parameters

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Pr.91]	Optional data monitor: Data type setting 1	Power supply ON/the CPU module reset (Transfer to the servo amplifier is only during communication initialization)	100+150n
[Pr.92]	Optional data monitor: Data type setting 2		101+150n
[Pr.93]	Optional data monitor: Data type setting 3		102+150n
[Pr.94]	Optional data monitor: Data type setting 4		103+150n
[Pr.591]	Optional data monitor: Data type expansion setting 1	Power supply ON	92+150n
[Pr.592]	Optional data monitor: Data type expansion setting 2		93+150n
[Pr.593]	Optional data monitor: Data type expansion setting 3		94+150n
[Pr.594]	Optional data monitor: Data type expansion setting 4		95+150n

[Monitor data]

■System monitor data

p: Pointer No. - 1

Item			Refresh cycle	Buffer memory address[*1]
				Axis 1 to axis 16
[Md.1]	In test mode flag		Immediate	4000
[Md.3]	Start information	Start history[*2]	At start	87010+10p
[Md.4]	Start No.			87011+10p
[Md.54]	Start (Year: month)			87012+10p
[Md.5]	Start (Day: hour)			87013+10p
[Md.6]	Start (Minute: second)			87014+10p
[Md.60]	Start (ms)			87015+10p
[Md.7]	Error judgment			87016+10p
[Md.8]	Start history pointer			87000
[Md.19]	Number of write accesses to flash ROM		Immediate	4224 4225
[Md.50]	Forced stop input		Operation cycle	4231
[Md.52]	Communication between amplifiers axes searching flag		Immediate	4234
[Md.59]	Module information		Power supply ON	31332
[Md.64]	Network error number		Main cycle	31504
[Md.130]	F/W version		Power supply ON	4006 4007
[Md.131]	Digital oscilloscope running flag		Main cycle	4011
[Md.132]	Operation cycle setting		Power supply ON	4238
[Md.133]	Operation cycle over flag		Immediate	4239
[Md.134]	Operation time		Operation cycle	4008
[Md.135]	Maximum operation time		Immediate	4009

*1 This may be different from the buffer memory address of the command axis used in synchronous control. For the specification of the command generation axis, refer to "Command Generation Axis" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

*2 Displays a value set by the clock function of the CPU module.

■Axis monitor data

n: Axis No. - 1

Item			Refresh cycle	Buffer memory address[*1]
				Axis 1 to axis 16
[Md.20]	Command position value		Operation cycle	2400+100n 2401+100n
[Md.21]	Machine feed value			2402+100n 2403+100n
[Md.22]	Speed command			2404+100n 2405+100n
[Md.23]	Axis error No.		Immediate	2406+100n
[Md.24]	Axis warning No.			2407+100n
[Md.25]	Valid M code			2408+100n
[Md.26]	Axis operation status			2409+100n
[Md.27]	Current speed			2410+100n 2411+100n
[Md.28]	Axis speed command		Operation cycle	2412+100n 2413+100n
[Md.29]	Speed-position switching control positioning movement amount		Immediate	2414+100n 2415+100n
[Md.30]	External input signal		Operation cycle	2416+100n
[Md.31]	Status		Immediate	2417+100n
[Md.32]	Target value			2418+100n 2419+100n
[Md.33]	Target speed			2420+100n 2421+100n
[Md.35]	Torque limit stored value/forward torque limit stored value			2426+100n
[Md.36]	Special start data instruction code setting value			2427+100n
[Md.37]	Special start data instruction parameter setting value			2428+100n
[Md.38]	Start positioning data No. setting value			2429+100n
[Md.39]	In speed limit flag			2430+100n
[Md.40]	In speed change processing flag			2431+100n
[Md.41]	Special start repetition counter			2432+100n
[Md.42]	Control system repetition counter			2433+100n
[Md.43]	Start data pointer being executed			2434+100n
[Md.44]	Positioning data No. being executed			2435+100n
[Md.45]	Block No. being executed		At start	2436+100n
[Md.46]	Last executed positioning data No.		Immediate	2437+100n
[Md.47]	Positioning data being executed	Positioning identifier		2438+100n
		M code		2439+100n
		Dwell time		2440+100n
		Positioning option		2441+100n
		Command speed		2442+100n 2443+100n
		Positioning address		2444+100n 2445+100n
		Arc address		2446+100n 2447+100n
		Axis to be interpolated		2496+100n 2497+100n
[Md.48]	Deceleration start flag			2499+100n
[Md.62]	Amount of the manual pulser driving carrying over movement			2422+100n 2423+100n

Item		Refresh cycle	Buffer memory address*1
			Axis 1 to axis 16
[Md.101]	Actual position value	Operation cycle	2450+100n 2451+100n
[Md.102]	Deviation counter value		2452+100n 2453+100n
[Md.103]	Motor rotation speed		2454+100n 2455+100n
[Md.104]	Motor current value		2456+100n
[Md.108]	Servo status1		2477+100n
[Md.109]	Regenerative load ratio/Optional data monitor output 1		2478+100n
[Md.110]	Effective load torque/Optional data monitor output 2		2479+100n
[Md.111]	Peak torque ratio/Optional data monitor output 3		2480+100n
[Md.112]	Optional data monitor output 4		2481+100n
[Md.113]	Semi/Fully closed loop status		2487+100n
[Md.114]	Servo alarm	Immediate	2488+100n
[Md.115]	Servo alarm detail number		2489+100n
[Md.116]	Encoder option information	Servo amplifier power supply ON	2490+100n
[Md.117]	Statusword	Operation cycle	2472+100n
[Md.119]	Servo status2		2476+100n
[Md.120]	Reverse torque limit stored value	Immediate	2491+100n
[Md.122]	Speed during command	Operation cycle (Only at speed control mode/Continuous operation to torque control mode)	2492+100n 2493+100n
[Md.123]	Torque during command	Operation cycle (Only at torque control mode/Continuous operation to torque control mode)	2494+100n
[Md.124]	Control mode switching status	Operation cycle (Only at continuous operation to torque control mode)	2495+100n
[Md.125]	Servo status3	Operation cycle	2458+100n
[Md.126]	Servo status4		2459+100n
[Md.190]	Controller position value restoration complete status	16.0ms	59327+100n
[Md.503]	Pre-reading data analysis status	Operation cycle	59303+100n
[Md.514]	HPR operating status		2457+100n

*1 This may be different from the buffer memory address of the command axis used in synchronous control. For the specification of the command generation axis, refer to "Command Generation Axis" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

[Control data]

■System control data

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Cd.1]	Flash ROM write request	116ms	5900
[Cd.2]	Parameter initialization request		5901
[Cd.41]	Deceleration start flag valid	PLC READY [Y0] OFF to ON	5905
[Cd.42]	Stop command processing for deceleration stop selection	When condition is satisfied (At deceleration stop causes occurrence)	5907
[Cd.44]	External input signal operation device	Operation cycle	5928 (Axis 1 to 4) 5929 (Axis 5 to 8) 5930 (Axis 9 to 12) 5931 (Axis 13 to 16)
[Cd.55]	Input value for manual pulse generator via CPU	8.0ms	5946 5947
[Cd.158]	Forced stop input	Operation cycle	5945

■Axis control data

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Cd.3]	Positioning start No.	At start	4300+100n
[Cd.4]	Positioning starting point No.		4301+100n
[Cd.5]	Axis error reset	16.0ms	4302+100n
[Cd.6]	Restart command		4303+100n
[Cd.7]	M code OFF request	Operation cycle	4304+100n
[Cd.8]	External command valid	At request	4305+100n
[Cd.9]	New position value		4306+100n 4307+100n
[Cd.10]	New acceleration time value		4308+100n 4309+100n
[Cd.11]	New deceleration time value		4310+100n 4311+100n
[Cd.12]	Acceleration/deceleration time change value during speed change, enable/disable		4312+100n
[Cd.13]	Positioning operation speed override	Operation cycle	4313+100n
[Cd.14]	New speed value	At request	4314+100n 4315+100n
[Cd.15]	Speed change request	Operation cycle	4316+100n
[Cd.16]	Inching movement amount	At start	4317+100n
[Cd.17]	JOG speed		4318+100n 4319+100n
[Cd.18]	Interrupt request during continuous operation	Operation cycle	4320+100n
[Cd.19]	Home position return request flag OFF request	16.0ms	4321+100n
[Cd.20]	Manual pulse generator 1 pulse input magnification	Operation cycle (At manual pulse generator enabled)	4322+100n 4323+100n
[Cd.21]	Manual pulse generator enable flag	Operation cycle	4324+100n
[Cd.22]	New torque value/forward new torque value		4325+100n
[Cd.23]	Speed-position switching control movement amount change register	At request	4326+100n 4327+100n
[Cd.24]	Speed-position switching enable flag		4328+100n
[Cd.25]	Position-speed switching control speed change register		4330+100n 4331+100n
[Cd.26]	Position-speed switching enable flag		4332+100n
[Cd.27]	Target position change value (New address)		4334+100n 4335+100n
[Cd.28]	Target position change value (New speed)		4336+100n 4337+100n
[Cd.29]	Target position change request flag	Operation cycle	4338+100n
[Cd.30]	Simultaneous starting own axis start data No.	At start	4340+100n
[Cd.31]	Simultaneous starting axis start data No.1		4341+100n
[Cd.32]	Simultaneous starting axis start data No.2		4342+100n
[Cd.33]	Simultaneous starting axis start data No.3		4343+100n
[Cd.34]	Step mode		4344+100n
[Cd.35]	Step valid flag		4345+100n
[Cd.36]	Step start information	16.0ms	4346+100n
[Cd.37]	Skip command	Operation cycle (During positioning operation)	4347+100n
[Cd.38]	Teaching data selection	At request	4348+100n
[Cd.39]	Teaching positioning data No.	16.0ms	4349+100n
[Cd.40]	ABS direction in degrees	At start	4350+100n
[Cd.43]	Simultaneous starting axis		4368+100n 4369+100n
[Cd.45]	Speed-position switching device selection		4366+100n

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Cd.46]	Speed-position switching command	Operation cycle	4367+100n
[Cd.100]	Servo OFF command		4351+100n
[Cd.101]	Torque output setting value	At start	4352+100n
[Cd.108]	Gain switching command flag	Operation cycle	4359+100n
[Cd.112]	Torque change function switching request		4363+100n
[Cd.113]	New reverse torque value		4364+100n
[Cd.133]	Semi/Fully closed loop switching request	Operation cycle (Fully closed loop control servo amplifier only)	4358+100n
[Cd.136]	PI-PID switching request	Operation cycle	4365+100n
[Cd.138]	Control mode switching request		4374+100n
[Cd.139]	Control mode setting	At request (Mode switching)	4375+100n
[Cd.140]	Command speed at speed control mode	Operation cycle (At speed control mode)	4376+100n 4377+100n
[Cd.141]	Acceleration time at speed control mode	At request (Mode switching)	4378+100n
[Cd.142]	Deceleration time at speed control mode		4379+100n
[Cd.143]	Command torque at torque control mode	Operation cycle (At torque control mode)	4380+100n
[Cd.144]	Torque time constant at torque control mode (Forward direction)	At request (Mode switching)	4381+100n
[Cd.145]	Torque time constant at torque control mode (Negative direction)		4382+100n
[Cd.146]	Speed limit value at torque control mode	Operation cycle (At torque control mode)	4384+100n 4385+100n
[Cd.147]	Speed limit value at continuous operation to torque control mode	Operation cycle (At continuous operation to torque control mode)	4386+100n 4387+100n
[Cd.148]	Acceleration time at continuous operation to torque control mode	At request (Mode switching)	4388+100n
[Cd.149]	Deceleration time at continuous operation to torque control mode		4389+100n
[Cd.150]	Target torque at continuous operation to torque control mode	Operation cycle (At continuous operation to torque control mode)	4390+100n
[Cd.151]	Torque time constant at continuous operation to torque control mode (Forward direction)	At request (Mode switching)	4391+100n
[Cd.152]	Torque time constant at continuous operation to torque control mode (Negative direction)		4392+100n
[Cd.153]	Control mode auto-shift selection		4393+100n
[Cd.154]	Control mode auto-shift parameter		4394+100n 4395+100n
[Cd.180]	Axis stop	Operation cycle	30100+10n
[Cd.181]	Forward run JOG start		30101+10n
[Cd.182]	Reverse run JOG start		30102+10n
[Cd.183]	Execution prohibition flag	At start	30103+10n

[Positioning data]

■Positioning data

n: Axis No. - 1

Memory area	Item			Buffer memory address
				Axis 1 to axis 16
Positioning data No.1	[Da.1]	Operation pattern	Positioning identifier	6000+1000n
	[Da.2]	Control method		
	[Da.3]	Acceleration time No.		
	[Da.4]	Deceleration time No.		
	[Da.6]	Positioning address/movement amount		6006+1000n 6007+1000n
	[Da.7]	Arc address		6008+1000n 6009+1000n
	[Da.8]	Command speed		6004+1000n 6005+1000n
	[Da.9]	Dwell time/JUMP destination positioning data No.		6002+1000n
	[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches		6001+1000n
	[Da.20]	Axis to be interpolated No.1	Axis to be interpolated	71000+1000n 71001+1000n
	[Da.21]	Axis to be interpolated No.2		
	[Da.22]	Axis to be interpolated No.3		
	[Da.27]	M code ON signal output timing	Positioning option	6003+1000n
	[Da.28]	ABS direction in degrees		
	[Da.29]	Interpolation speed designation method		
No.2	[Da.1] Operation pattern [Da.2] Control method [Da.3] Acceleration time No. [Da.4] Deceleration time No. [Da.6] Positioning address/movement amount [Da.7] Arc address [Da.8] Command speed [Da.9] Dwell time/JUMP destination positioning data No. [Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches [Da.20] Axis to be interpolated No.1 [Da.21] Axis to be interpolated No.2 [Da.22] Axis to be interpolated No.3 [Da.27] M code ON signal output timing [Da.28] ABS direction in degrees [Da.29] Interpolation speed designation method			6010+1000n ⋮ 6019+1000n 71010+1000n 71011+1000n
No.3				6020+1000n ⋮ 6029+1000n 71020+1000n 71021+1000n
⋮				⋮
No.100				6990+1000n ⋮ 6999+1000n 71990+1000n 71991+1000n

Memory area	Item			Buffer memory address
				Axis 1 to axis 16
No.101	[Da.1]	Operation pattern	Positioning identifier	200000+5000n
	[Da.2]	Control method		
	[Da.3]	Acceleration time No.		
	[Da.4]	Deceleration time No.		
	[Da.6]	Positioning address/movement amount		200006+5000n 200007+5000n
	[Da.7]	Arc address		200008+5000n 200009+5000n
	[Da.8]	Command speed		200004+5000n 200005+5000n
	[Da.9]	Dwell time/JUMP destination positioning data No.		200002+5000n
	[Da.10]	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches		200001+5000n
	[Da.20]	Axis to be interpolated No.1	Axis to be interpolated	280000+5000n 280001+5000n
	[Da.21]	Axis to be interpolated No.2		
	[Da.22]	Axis to be interpolated No.3		
	[Da.27]	M code ON signal output timing	Positioning option	200003+5000n
	[Da.28]	ABS direction in degrees		
	[Da.29]	Interpolation speed designation method		
No.102	[Da.1] Operation pattern [Da.2] Control method [Da.3] Acceleration time No. [Da.4] Deceleration time No. [Da.6] Positioning address/movement amount [Da.7] Arc address [Da.8] Command speed [Da.9] Dwell time/JUMP destination positioning data No. [Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches [Da.20] Axis to be interpolated No.1 [Da.21] Axis to be interpolated No.2 [Da.22] Axis to be interpolated No.3 [Da.27] M code ON signal output timing [Da.28] ABS direction in degrees [Da.29] Interpolation speed designation method			200010+5000n ⋮ 200019+5000n 280010+5000n 280011+5000n
No.103				200020+5000n ⋮ 200029+5000n 280020+5000n 280021+5000n
⋮				⋮
No.600				204990+5000n ⋮ 204999+5000n 284990+5000n 284991+5000n

[Block start data]

■Positioning data (Block start data)

n: Axis No. - 1

Memory area	Item				Buffer memory address
					Axis 1 to axis 16
Start block 0	Block start data 1st point	[Da.11] [Da.12]	Shape Start data No.		22000+400n
		[Da.13] [Da.14]	Special start instruction Parameter		22050+400n
	2nd point	[Da.11] [Da.12]	Shape Start data No.		22001+400n
		[Da.13] [Da.14]	Special start instruction Parameter		22051+400n
	3rd point	[Da.11] [Da.12]	Shape Start data No.		22002+400n
		[Da.13] [Da.14]	Special start instruction Parameter		22052+400n
	⋮				⋮
	50th point	[Da.11] [Da.12]	Shape Start data No.		22049+400n
		[Da.13] [Da.14]	Special start instruction Parameter		22099+400n
	Condition data No.1	[Da.15]	Condition target		22100+400n
		[Da.16]	Condition operator		
		[Da.17]	Address		22102+400n 22103+400n
		[Da.18]	Parameter 1		22104+400n 22105+400n
		[Da.19]	Parameter 2		22106+400n 22107+400n
		[Da.23]	Number of simultaneous starting axes	Simultaneous starting axis	22108+400n 22109+400n
		[Da.24]	Simultaneous starting axis No.1		
		[Da.25]	Simultaneous starting axis No.2		
		[Da.26]	Simultaneous starting axis No.3		
	Condition data No.2				22110+400n ⋮ 22119+400n
	Condition data No.3				22120+400n ⋮ 22129+400n
	⋮				⋮
	Condition data No.10				22190+400n ⋮ 22199+400n
Start block 1	Block start data				22200+400n ⋮ 22299+400n
	Condition data				22300+400n ⋮ 22399+400n

Memory area	Item				Buffer memory address
					Axis 1 to axis 16
Start block 2	Block start data 1st point	[Da.11] [Da.12]	Shape Start data No.		360000+600n
		[Da.13] [Da.14]	Special start instruction Parameter		360050+600n
	2nd point	[Da.11] [Da.12]	Shape Start data No.		360001+600n
		[Da.13] [Da.14]	Special start instruction Parameter		360051+600n
	3rd point	[Da.11] [Da.12]	Shape Start data No.		360002+600n
		[Da.13] [Da.14]	Special start instruction Parameter		360052+600n
	⋮				⋮
	50th point	[Da.11] [Da.12]	Shape Start data No.		360049+600n
		[Da.13] [Da.14]	Special start instruction Parameter		360099+600n
	Condition data No.1	[Da.15]	Condition target		360100+600n
		[Da.16]	Condition operator		
		[Da.17]	Address		360102+600n 360103+600n
		[Da.18]	Parameter 1		360104+600n 360105+600n
		[Da.19]	Parameter 2		360106+600n 360107+600n
		[Da.23]	Number of simultaneous starting axes	Simultaneous starting axis	360108+600n 360109+600n
		[Da.24]	Simultaneous starting axis No.1		
		[Da.25]	Simultaneous starting axis No.2		
		[Da.26]	Simultaneous starting axis No.3		
	Condition data No.2				360110+600n ⋮ 360119+600n
	Condition data No.3				360120+600n ⋮ 360129+600n
	⋮				⋮
	Condition data No.10				360190+600n ⋮ 360199+600n
Start block 3 and 4	Block start data				360200+600n ⋮ 360599+600n
	Condition data				

Mark detection function

The following shows the relation between the buffer memory addresses for mark detection function and the various items.

■Mark detection parameters

k: Mark detection setting No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Pr.800]	Mark detection signal setting	Power supply ON	54000+20k
[Pr.801]	Mark detection signal compensation time	Power supply ON/PLC READY [Y0] OFF to ON	54001+20k
[Pr.802]	Mark detection data type	Power supply ON	54002+20k
[Pr.803]	Mark detection data axis No.		54003+20k
[Pr.804]	Mark detection data buffer memory No.		54004+20k 54005+20k
[Pr.805]	Latch data range upper limit value	Power supply ON/PLC READY [Y0] OFF to ON/At request (Latch data range change)	54006+20k 54007+20k
[Pr.806]	Latch data range lower limit value		54008+20k 54009+20k
[Pr.807]	Mark detection mode setting	Power supply ON/PLC READY [Y0] OFF to ON	54010+20k
[Pr.808]	Mark detection signal link device type	Power supply ON	54011+20k
[Pr.809]	Mark detection link device start No.	Power supply ON	54012+20k
[Pr.810]	Mark detection link device bit specification	Power supply ON	54013+20k
[Pr.811]	Mark detection signal detection direction setting	Power supply ON	54014+20k

■Mark detection control data

k: Mark detection setting No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Cd.800]	Number of mark detection clear request	Operation cycle	54640+10k
[Cd.801]	Mark detection invalid flag		54641+10k
[Cd.802]	Latch data range change request	Operation cycle/When condition is satisfied (DI input)	54642+10k

■Mark detection monitor data

k: Mark detection setting No. - 1

Item			Refresh cycle	Buffer memory address
				Axis 1 to axis 16
[Md.800]	Number of mark detection		When condition is satisfied (Mark detection)	54960+80k
[Md.801]	Mark detection data storage area (1 to 32)	1		54962+80k 54963+80k
		2		54964+80k 54965+80k
		3		54966+80k 54967+80k
		⋮		⋮
		32		55024+80k 55025+80k

Link device external signal assignment

The following shows the relation between the buffer memory addresses for link device external signal assignment and the various items.

■Link device external signal assignment parameter

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to Axis 16
[Pr.900]	Forced stop signal (EMI): Link device type	At power supply ON/the CPU module reset	440000+320n
[Pr.901]	Forced stop signal (EMI): Link device start No.		440001+320n
[Pr.902]	Forced stop signal (EMI): Link device bit specification		440002+320n
[Pr.903]	Forced stop signal (EMI): Link device logic setting		440003+320n
[Pr.910]	Upper limit signal (FLS): Link device type		440010+320n
[Pr.911]	Upper limit signal (FLS): Link device start No.		440011+320n
[Pr.912]	Upper limit signal (FLS): Link device bit specification		440012+320n
[Pr.913]	Upper limit signal (FLS): Link device logic setting		440013+320n
[Pr.920]	Lower limit signal (RLS): Link device type		440020+320n
[Pr.921]	Lower limit signal (RLS): Link device start No.		440021+320n
[Pr.922]	Lower limit signal (RLS): Link device bit specification		440022+320n
[Pr.923]	Lower limit signal (RLS): Link device logic setting		440023+320n
[Pr.930]	Proximity dog signal (DOG): Link device type		440030+320n
[Pr.931]	Proximity dog signal (DOG): Link device start No.		440031+320n
[Pr.932]	Proximity dog signal (DOG): Link device bit specification		440032+320n
[Pr.933]	Proximity dog signal (DOG): Link device logic setting		440033+320n
[Pr.940]	Stop signal (STOP): Link device type		440040+320n
[Pr.941]	Stop signal (STOP): Link device start No.		440041+320n
[Pr.942]	Stop signal (STOP): Link device bit specification		440042+320n
[Pr.943]	Stop signal (STOP): Link device logic setting		440043+320n
[Pr.950]	External positioning start request: Link device type		440050+320n
[Pr.951]	External positioning start request: Link device start No.		440051+320n
[Pr.952]	External positioning start request: Link device bit specification		440052+320n
[Pr.953]	External positioning start request: Link device logic setting		440053+320n
[Pr.960]	External speed change request: Link device type		440060+320n
[Pr.961]	External speed change request: Link device start No.		440061+320n
[Pr.962]	External speed change request: Link device bit specification		440062+320n
[Pr.963]	External speed change request: Link device logic setting		440063+320n
[Pr.970]	Skip request: Link device type		440070+320n
[Pr.971]	Skip request: Link device start No.		440071+320n
[Pr.972]	Skip request: Link device bit specification		440072+320n
[Pr.973]	Skip request: Link device logic setting		440073+320n
[Pr.980]	Speed-position control switching request: Link device type		440080+320n
[Pr.981]	Speed-position control switching request: Link device start No.		440081+320n
[Pr.982]	Speed-position control switching request: Link device bit specification		440082+320n
[Pr.983]	Speed-position control switching request: Link device logic setting		440083+320n
[Pr.984]	Speed-position control switching request: Acquisition delay compensation time		440084+320n
[Pr.990]	Main shaft clutch control request (ON control mode): Link device type		440090+320n
[Pr.991]	Main shaft clutch control request (ON control mode): Link device start No.		440091+320n
[Pr.992]	Main shaft clutch control request (ON control mode): Link device bit specification		440092+320n
[Pr.993]	Main shaft clutch control request (ON control mode): Link device logic setting		440093+320n

Item		Fetch cycle	Buffer memory address
			Axis 1 to Axis 16
[Pr.994]	Main shaft clutch control request (ON control mode): Acquisition delay compensation time	At power supply ON/the CPU module reset	440094+320n
[Pr.995]	Main shaft clutch control request (OFF control mode): Link device type		440095+320n
[Pr.996]	Main shaft clutch control request (OFF control mode): Link device start No.		440096+320n
[Pr.997]	Main shaft clutch control request (OFF control mode): Link device bit specification		440097+320n
[Pr.998]	Main shaft clutch control request (OFF control mode): Link device logic setting		440098+320n
[Pr.999]	Main shaft clutch control request (OFF control mode): Acquisition delay compensation time		440099+320n
[Pr.1000]	Auxiliary shaft clutch control request (ON control mode): Link device type		440100+320n
[Pr.1001]	Auxiliary shaft clutch control request (ON control mode): Link device start No.		440101+320n
[Pr.1002]	Auxiliary shaft clutch control request (ON control mode): Link device bit specification		440102+320n
[Pr.1003]	Auxiliary shaft clutch control request (ON control mode): Link device logic setting		440103+320n
[Pr.1004]	Auxiliary shaft clutch control request (ON control mode): Acquisition delay compensation time		440104+320n
[Pr.1005]	Auxiliary shaft clutch control request (OFF control mode): Link device type		440105+320n
[Pr.1006]	Auxiliary shaft clutch control request (OFF control mode): Link device start No.		440106+320n
[Pr.1007]	Auxiliary shaft clutch control request (OFF control mode): Link device bit specification		440107+320n
[Pr.1008]	Auxiliary shaft clutch control request (OFF control mode): Link device logic setting		440108+320n
[Pr.1009]	Auxiliary shaft clutch control request (OFF control mode): Acquisition delay compensation time		440109+320n
[Pr.1020]	Block No.7000 start request: Link device type		440120+320n
[Pr.1021]	Block No.7000 start request: Link device start No.		440121+320n
[Pr.1022]	Block No.7000 start request: Link device bit specification		440122+320n
[Pr.1023]	Block No.7000 start request: Link device logic setting		440123+320n
[Pr.1030]	Block No.7001 start request: Link device type		440130+320n
[Pr.1031]	Block No.7001 start request: Link device start No.		440131+320n
[Pr.1032]	Block No.7001 start request: Link device bit specification		440132+320n
[Pr.1033]	Block No.7001 start request: Link device logic setting		440133+320n
[Pr.1040]	Block No.7002 start request: Link device type		440140+320n
[Pr.1041]	Block No.7002 start request: Link device start No.		440141+320n
[Pr.1042]	Block No.7002 start request: Link device bit specification		440142+320n
[Pr.1043]	Block No.7002 start request: Link device logic setting		440143+320n
[Pr.1050]	Block No.7003 start request: Link device type		440150+320n
[Pr.1051]	Block No.7003 start request: Link device start No.		440151+320n
[Pr.1052]	Block No.7003 start request: Link device bit specification		440152+320n
[Pr.1053]	Block No.7003 start request: Link device logic setting		440153+320n
[Pr.1060]	Block No.7004 start request: Link device type		440160+320n
[Pr.1061]	Block No.7004 start request: Link device start No.		440161+320n
[Pr.1062]	Block No.7004 start request: Link device bit specification		440162+320n
[Pr.1063]	Block No.7004 start request: Link device logic setting		440163+320n

■Axis monitor data

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to Axis 16
[Md.900]	Link device external command signal monitor	Operation cycle	59328+100n

Device station operation

The following shows the relation between the buffer memory addresses for device operation and the various items.

■Axis control data (device station operation)

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Cd.160]	Optional SDO transfer request 1	Main cycle	534796+2048n
[Cd.161]	Optional SDO transfer request 2		534797+2048n
[Cd.162]	Optional SDO transfer request 3		534798+2048n
[Cd.163]	Optional SDO transfer request 4		534799+2048n
[Cd.164]	Optional SDO transfer data 1	At request (Command request)	534800+2048n ⋮ 534862+2048n
[Cd.165]	Optional SDO transfer data 2		534864+2048n ⋮ 534926+2048n
[Cd.166]	Optional SDO transfer data 3		534928+2048n ⋮ 534990+2048n
[Cd.167]	Optional SDO transfer data 4		534992+2048n ⋮ 535054+2048n

■Axis monitor data (device station operation)

n: Axis No. - 1

Item		Refresh cycle	Buffer memory address
			Axis 1 to axis 16
[Md.160]	Optional SDO transfer result 1	At request (Command request)	468192+2048n 468193+2048n
[Md.161]	Optional SDO transfer result 2		468194+2048n 468195+2048n
[Md.162]	Optional SDO transfer result 3		468196+2048n 468197+2048n
[Md.163]	Optional SDO transfer result 4		468198+2048n 468199+2048n
[Md.164]	Optional SDO transfer status 1		468200+2048n
[Md.165]	Optional SDO transfer status 2		468201+2048n
[Md.166]	Optional SDO transfer status 3		468202+2048n
[Md.167]	Optional SDO transfer status 4		468203+2048n

Servo object specification area

The following shows the relation between the buffer memory addresses for servo object specification area and the various items.

■Servo object specification area

n: Axis No. - 1

Item		Fetch cycle	Buffer memory address
			Axis 1 to axis 16
[Pr.512]	Optional SDO 1	At request (Servo transient request)	460024+256n 460025+256n
[Pr.513]	Optional SDO 2		460026+256n 460027+256n
[Pr.514]	Optional SDO 3		460028+256n 460029+256n
[Pr.515]	Optional SDO 4		460030+256n 460031+256n

12.3 Basic Setting

The setting items of the setting data are explained in this section.

Servo network composition parameters

n: Axis No. - 1

Item		Setting value, setting range	Default value	Buffer memory address
				Axis 1 to axis 16
[Pr.101]	Virtual servo amplifier setting	0: Use real servo amplifier 1: Use as virtual servo amplifier	0	58022+32n
[Pr.140]	Driver command discard detection setting	0: Detection invalid 1: Detection valid	0	58023+32n
[Pr.141]	IP address	Specify the IP address. Assign 1 [byte] each to octets 1 to 4.	0	58024+32n 58025+32n
[Pr.142]	Multidrop number	0 to 65535	0	58028+32n
[Pr.143]	Driver communication setting	0: Driver communication disabled 1: Driver communication enabled	0	58029+32n

[Pr.101] Virtual servo amplifier setting

Set if use as virtual servo amplifier axis.

0: Use real servo amplifier

1: Use as virtual servo amplifier

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 431 Servo network composition parameters

[Pr.140] Driver command discard detection setting

By setting the driver command discard detection setting, when bit 12 in "[Md.117] Statusword" of the drive unit is turned ON → OFF during the actual servo amplifier operation, "Driver command discard detection" (error code: 1BE6H) can be outputted to stop the command before the motor stops.

0: Detection invalid

1: Detection valid

The content of bit 12 in "[Md.117] Statusword" changes depending on the control mode of the connected drive unit. Refer to the specifications of the drive unit connected for the change conditions of "[Md.117] Statusword", etc.

Driver control mode	Abbreviation for bit 12 of "[Md.117] Statusword"	Details
Cyclic synchronous position mode (csp)	Target position ignored	0: Discarding Target position [Obj. 607Ah]
Cyclic synchronous velocity mode (csv)	Target velocity ignored	0: Discarding Target velocity [Obj. 60FFh]
Cyclic synchronous torque mode (cst)	Target torque ignored	0: Discarding Target torque [Obj. 6071h]
Continuous operation to torque control mode (ct)	Target torque ignored	0: Discarding Target torque [Obj. 6071h]
Other than the above	—	Not checked

■Buffer memory address

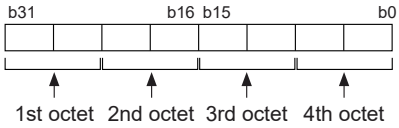
Refer to the following for the buffer memory address in this area.

☞ Page 431 Servo network composition parameters

[Pr.141] IP address

Specify the IP address.

Assign 1 [byte] each to octets 1 to 4.



Ex.

For 192.168.3.1

Setting value: HC0A80301

Point

- When using the amplifier as an actual servo amplifier, always set an IP address. Axis control cannot be performed when it is set to the default value of "0".
- For this parameter, the value set in the flash ROM of the Motion module becomes valid when the power is turned ON or the CPU module is reset. The value is not fetched by turning PLC READY [Y0] ON from OFF. Therefore, write to the flash ROM after setting the value in the buffer memory to change. (The value must be fixed when turning ON the power or resetting the CPU module.)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 431 Servo network composition parameters

[Pr.142] Multidrop number

When one station includes multiple logic axes, such as a multi-axis drive unit, specify the number to distinguish the logic axes.

Specify 0 when using a single axis servo amplifier.

Point

For this parameter, the value set in the flash ROM of the Motion module becomes valid when the power is turned ON or the CPU module is reset. The value is not fetched by turning PLC READY [Y0] ON from OFF. Therefore, write to the flash ROM after setting the value in the buffer memory to change. (The value must be fixed when turning ON the power or resetting the CPU module.)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 431 Servo network composition parameters

[Pr.143] Driver communication setting

Sets whether to enable or disable driver communication.

0: Driver communication disabled

1: Driver communication enabled

Point

For details of the servo amplifier which supports the driver communication, refer to the manual of the servo amplifier.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 431 Servo network composition parameters

Common parameters

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with the engineering tool	Value set with a program		Axis 1 to axis 16
[Pr.82] Forced stop valid/invalid selection	1: Invalid	1	1	35
	2: Valid (Buffer memory)	2		
	3: Valid (Link device)	3		
[Pr.152] Maximum number of control axes	0: No setting	0	0	58003
	1 to maximum number of control axes	1 to maximum number of control axes		
[Pr.156] Manual pulse generator smoothing time constant	0 to 5000 (ms)	0 to 5000	0	58011

[Pr.82] Forced stop valid/invalid selection

Set the forced stop valid/invalid.

All axes of the servo amplifier are made to batch forced stop when the forced stop input signal is turned on after the forced stop valid/invalid is set to "2: Valid (Buffer memory)". "Servo READY signal OFF during operation" (error code: 1A02H) does not occur if the forced input signal is turned on during operation.

Forced stop valid/invalid selection	Setting value
"Invalid" (Forced stop is not used.)	1
"Valid (Buffer memory)" (Forced stop from the buffer memory is used.)	2
"Valid (Link device)" (Forced stop from the buffer memory is used.)	3

Point

- If the setting is other than 1 to 3, "Forced stop valid/invalid setting error" (error code 1DC1H) occurs.
- "[Md.50] Forced stop input" is stored "1" by setting "Forced stop valid/invalid selection" to invalid.
- If "3: Valid (Link device)" is selected, specify the link device to be used for the forced stop signal by using the following parameters.
  - [Pr.900] Forced stop signal (EMI): Link device type
  - [Pr.901] Forced stop signal (EMI): Link device start No.
  - [Pr.902] Forced stop signal (EMI): Link device bit specification
  - [Pr.903] Forced stop signal (EMI): Link device logic setting

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 431 Common parameters

[Pr.152] Maximum number of control axes

Set the maximum number of control axes.

This is used to reduce the operation cycle when the actual number of axes used is lower than the maximum number of control axes of the relevant model.

Maximum number of control axes	Setting value
No setting (Controls with the maximum number of control axes for each module.)	0
Maximum number of control axes (Controls the axes until the set axis No.)*1	1 to 16

*1 Example) When "10" is set, control axes are axis 1 to 10. Axis 11 and later are not controlled.

- When the maximum number of control axes exceeds the maximum number of control axes of the Motion module (such as when setting "5" for the 4-axis module), "Outside maximum number of control axes" (warning code: 0D3AH) occurs and the module is controlled as set with "0: No setting". (The warning occurs in axis 1.)
- When "[Pr.141] IP address" is set with a value other than "0: No setting" or "[Pr.101] Virtual servo amplifier setting" is set with a value other than "0: Use for the actual servo amplifier" in the axis which is out of the maximum number of control axes, "Outside control axis setting" (warning code: 0D3BH) occurs to these axes and the servo amplifier does not switch to RUN time. (The LED display on the servo amplifier remains "B".)

Point

- For this parameter, the value set in the flash ROM of the Motion module becomes valid when the power is turned ON or the CPU module is reset. The value is not fetched by turning PLC READY [Y0] ON from OFF. Therefore, write to the flash ROM after setting the value in the buffer memory to change. (The value must be fixed when turning ON the power or resetting the CPU module.)
- The servo input axis (synchronous control) and virtual servo amplifier of the axes which are out of the maximum number of control axes are out of the target.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 431 Common parameters

[Pr.156] Manual pulse generator smoothing time constant

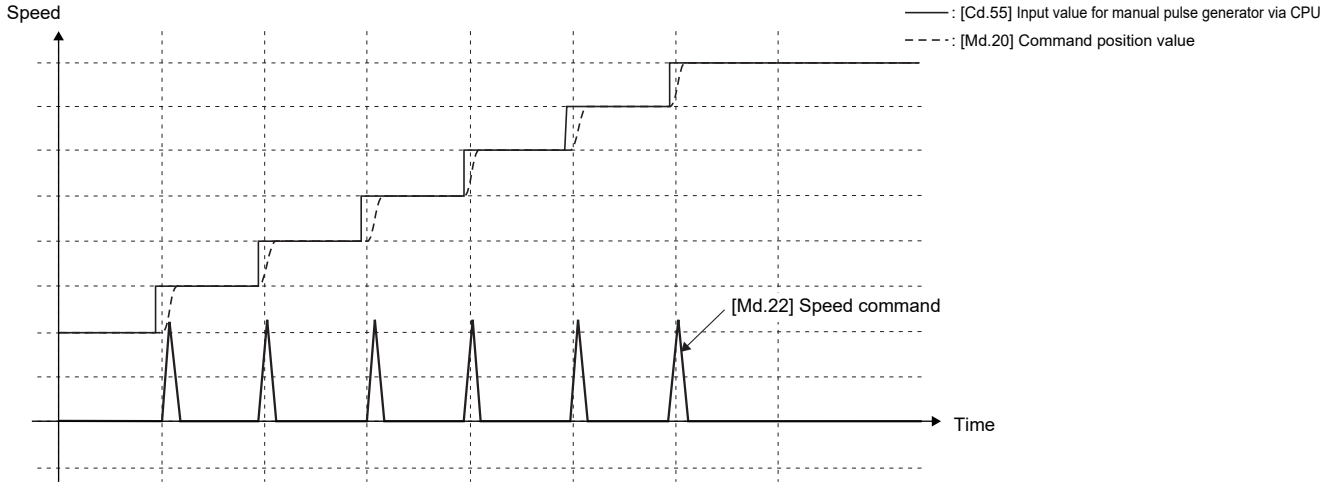
- The smoothing process smooths the speed change in the manual pulse generator operation. Note that the input response is delayed by the time set by the smoothing processing.
- When a value outside the range is set, "Outside manual pulse generator smoothing time constant range error" (error code: 1DC6H) occurs when PLC READY [Y0] turns ON, preventing the READY signal [X0] from turning ON.
- Since the input cycle of "[Cd.55] Input value for manual pulse generator via CPU" has an interval of 8.0ms, the smoothing time constant is rounded down to the nearest multiple of 8. (Example: When a setting value is within the range of 8 to 15ms, the operation is performed with a time constant of 8ms.)
- The smoothing time constant is not reflected at a stop cause occurrence or at a deceleration stop via the "0" setting of "[Cd.21] Manual pulse generator enable flag".

■Basic concept of speed change

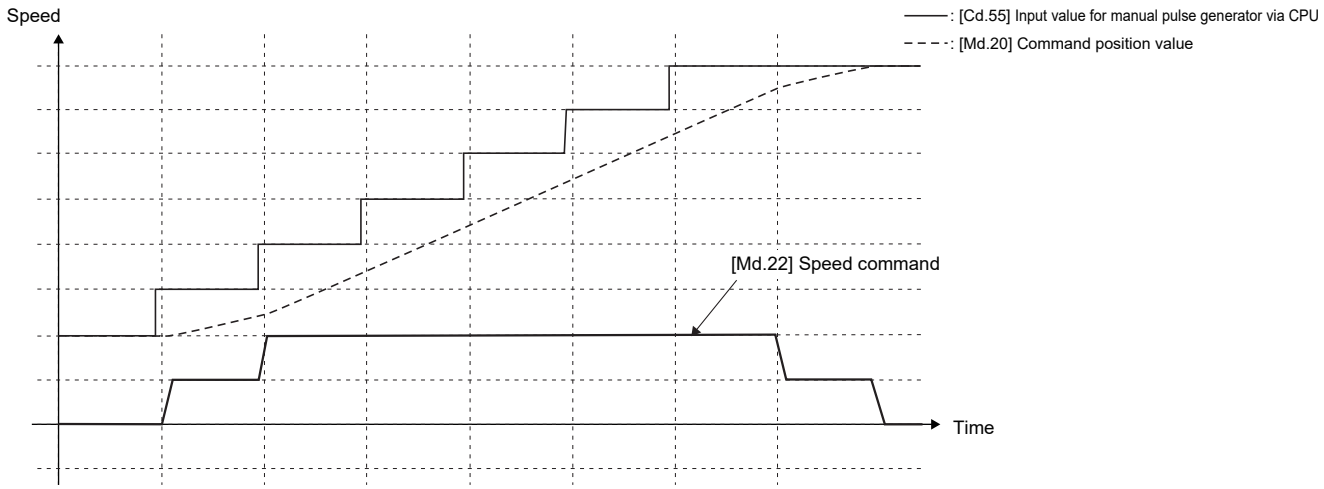
The speed change occurs due to a discrepancy between the scan time of the CPU module and the input cycle in "[Cd.55] Input value for manual pulse generator via CPU". As shown in the figure below, the speed change can be suppressed by setting "[Pr.156] Manual pulse generator smoothing time constant" to a value equal to or more than the maximum scan time.

- When speed change occurs

As shown in the diagram below, speed change occurs when the scan time is larger than the input cycle of "[Cd.55] Input value for manual pulse generator via CPU".



- When speed change is suppressed Example: When a value twice as large as the scan time is set in "[Pr.156] Manual pulse generator smoothing time constant"



■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 431 Common parameters

Basic parameters 1

This section describes the details on the basic parameter 1.

n: Axis No. - 1

Item		Setting value, setting range		Default value	Buffer memory address
		Value set with the engineering tool	Value set with a program		Axis 1 to axis 16
[Pr.1] Unit setting		0: mm	0	3	0+150n
		1: inch	1		
		2: degree	2		
		3: pulse	3		
Movement amount per pulse	[Pr.2] Number of pulses per rotation (AP) (Unit: pulse)	1 to 200000000	1 to 200000000	20000	2+150n 3+150n
	[Pr.3] Movement amount per rotation (AL)	The setting value range differs according to "[Pr.1] Unit setting".		20000	4+150n 5+150n
	[Pr.4] Unit magnification (AM)	1: 1 time	1	1	1+150n
		10: 10 times	10		
		100: 100 times	100		
		1000: 1000 times	1000		
[Pr.7] Bias speed at start		The setting value range differs according to "[Pr.1] Unit setting".		0	6+150n 7+150n

[Pr.1] Unit setting

Set the unit used for defining positioning operations. Choose from the following units depending on the type of the control target: mm, inch, degree, or pulse. Different units can be defined for different axes.

Ex.

Different units (mm, inch, degree, and pulse) are applicable to different systems:

- mm or inch: X-Y table, conveyor (Select inch when the machine has inch specifications.)
- degree: Rotating body (360degrees/rotation)
- pulse: X-Y table, conveyor

Point

- When you change the unit, note that the values of other parameters and data will not be changed automatically. After changing the unit, check if the parameter and data values are within the allowable range.
- Set "2: degree" to exercise speed-position switching control (ABS mode).
- Set "2: degree", when executing unlimited length feed in the absolute system.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 431 Positioning parameters: Basic parameters 1

[Pr.2] to [Pr.4] Electronic gear (Movement amount per pulse)

The mechanical system value used when the Motion module performs positioning control.
The settings are made using [Pr.2] to [Pr.4].
The electronic gear is expressed by the following equation.

$$\text{Electronic gear} = \frac{\text{[Pr.2] Number of pulses per rotation (AP)}}{\text{[Pr.3] Movement amount per rotation (AL)} \times \text{[Pr.4] Unit magnification (AM)}}$$

When positioning has been performed, an error (mechanical system error) may be produced between the specified movement amount and the actual movement amount.
The error can be compensated by adjusting the value set in electronic gear.
☞ Page 230 Electronic gear function

Point

- The result of below calculation (round up after decimal point) is a minimum pulse when the command position value is updated at follow up processing. (The movement amount for droop pulse is reflected as the command position value when the droop pulse becomes more than above calculated value in pulse unit of motor end.)

[Pr.2]Number of pulses per rotation (AP) / ([Pr.3] Movement amount per rotation (AL) × [Pr.4] Unit magnification (AM)) [pulse]
Refer to the following for the follow up processing.
☞ Page 311 Follow-up function

■Buffer memory address

Refer to the following for the buffer memory address in this area.
☞ Page 431 Positioning parameters: Basic parameters 1

[Pr.2] Number of pulses per rotation (AP)

Set the number of pulses required for a complete rotation of the motor shaft.
If you are using the Mitsubishi servo amplifier MR-J5(W)-G/MR-JET-G, set the value considering the electronic gear of the servo amplifier.
Number of pulses per rotation (AP) = Resolution per servo motor rotation × Electronic gear denominator (PA07) / Electronic gear numerator (PA06)

Point

If you are using the MR-J5(W)-G rotary servo motor, the servo motor resolution per rotation is 26 bits (67108864). However, set the number of pulses per rotation (AP) to 22 bits (4194304) since "Electronic gear numerator (PA06) / Electronic gear denominator (PA07)" of the servo amplifier is overwritten with 1/16 from the controller.

■Buffer memory address

Refer to the following for the buffer memory address in this area.
☞ Page 431 Positioning parameters: Basic parameters 1

[Pr.3] Movement amount per rotation (AL), [Pr.4] Unit magnification (AM)

The amount how the workpiece moves with one motor rotation is determined by the mechanical structure.

If the worm gear lead (μm/rev) is PB and the deceleration rate is 1/n, then

Movement amount per rotation (AL) = PB × 1/n

However, the maximum value that can be set for this "movement amount per rotation (AL)" parameter is 20000000.0 μm (20 m). Set the "movement amount per rotation (AL)" as shown below so that the "movement amount per rotation (AL)" does not exceed this maximum value.

Movement amount per rotation (AL)

= PB 20 × 1/n

= Movement amount per rotation (AL) × Unit magnification (AM)*1

*1 The unit magnification (AM) is a value of 1, 10, 100 or 1000. If the "PB × 1/n" value exceeds 20000000.0μm (20m), adjust with the unit magnification so that the "movement amount per rotation (AL)" does not exceed 20000000.0μm (20m).

[Pr.1] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)
0: mm	0.1 to 20000000.0 (μm)	1 to 200000000 (× 10^{-1}μm)
1: inch	0.00001 to 2000.00000 (inch)	1 to 200000000 (× 10^{-5}inch)
2: degree	0.00001 to 2000.00000 (degree)	1 to 200000000 (× 10^{-5}degree)
3: pulse	1 to 200000000 (pulse)	1 to 200000000 (pulse)

Refer to the following for information about electric gear.

☞ Page 230 Electronic gear function

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 431 Positioning parameters: Basic parameters 1

[Pr.7] Bias speed at start

Set the bias speed (minimum speed) upon starting. When using a stepping motor, etc., set it to start the motor smoothly. (If the motor speed at start is low, the stepping motor does not start smoothly.)

The specified "bias speed at start" will be valid during the following operations:

- Positioning operation
- Home position return operation
- JOG operation

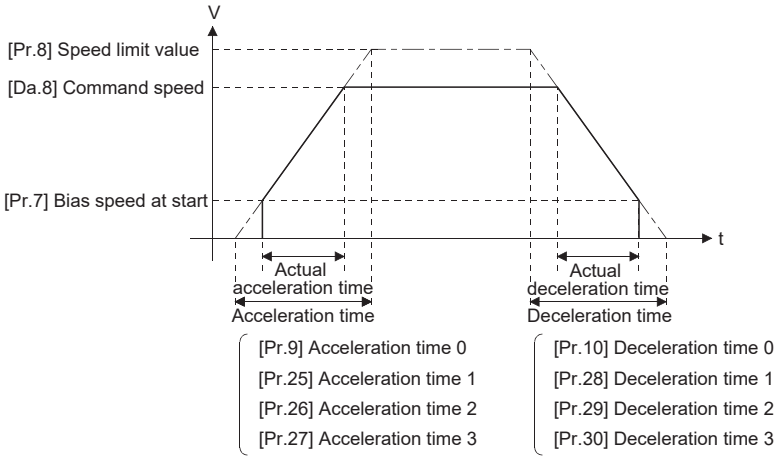
Set the value that the bias speed should not exceed "[Pr.8] Speed limit value".

[Pr.1] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)
0: mm	0.00 to 20000000.00 (mm/min)	0 to 2000000000 (× 10^{-2}mm/min)
1: inch	0.000 to 2000000.000 (inch/min)	0 to 2000000000 (× 10^{-3}inch/min)
2: degree	0.000 to 2000000.000 (degree/min)*1	0 to 2000000000 (× 10^{-3}degree/min)*2
3: pulse	0 to 1000000000 (pulse/s)	0 to 1000000000 (pulse/s)

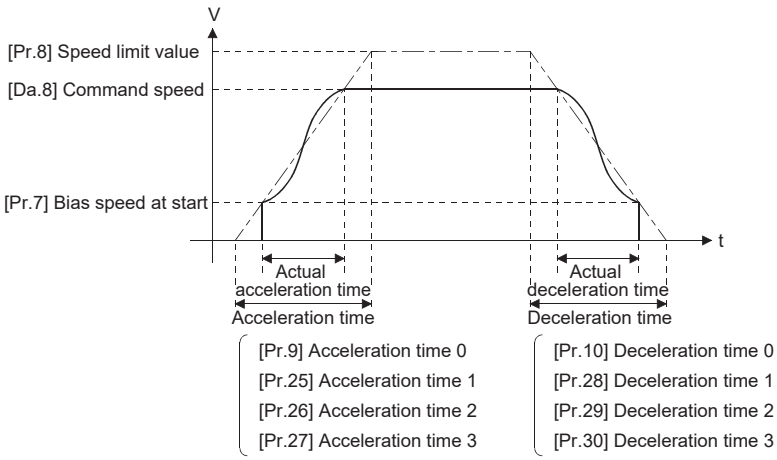
*1 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 0.00 to 20000000.00 (degree/min)

*2 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 0 to 2000000000 (× 10^{-2} degree/min)

Trapezoidal acceleration/deceleration (S-curve ratio is 0%)



S-curve acceleration/deceleration (S-curve ratio is other than 0%)



Point

For the 2-axis or more interpolation control, the bias speed at start is applied by the setting of "[Pr.20] Interpolation speed designation method".

- "0: Composite speed": Bias speed at start set to the reference axis is applied to the composite command speed.
- "1: Reference axis speed": Bias speed at start is applied to the reference axis.

■Precautionary notes

- "[Pr.7] Bias speed at start" is valid regardless of motor type. Set "0" when using the motor other than the stepping motor. Otherwise, it may cause vibration or impact even though an error does not occur.
- Set "[Pr.7] Bias speed at start" according to the specification of stepping motor driver. If the setting is outside the range, it may cause the following troubles by rapid speed change or overload.

  - Stepping motor steps out.
  - An error occurs in the stepping motor driver.

- In synchronous control, when "[Pr.7] Bias speed at start" is set to the servo input axis, the bias speed at start is applied to the servo input axis. Note that the unexpected operation might be generated to the output axis.
- Set "[Pr.7] Bias speed at start" within the following range.

"[Pr.8] Speed limit value" ≥ "[Pr.46] Home position return speed" ≥ "[Pr.7] Bias speed at start"

- If the data ("[Da.8] Command speed" of positioning data, "[Da.8] Command speed" of next point for continuous path control, or "[Cd.14] New speed value" for speed change function) is less than "[Pr.7] Bias speed at start", "Below bias speed" (warning code: 0D08H) will occur and it will operate at "[Pr.7] Bias speed at start".
- When using S-curve acceleration/deceleration processing and bias speed at start together, S-curve acceleration/deceleration processing is carried out based on the acceleration/deceleration time set by user, "[Pr.8] Speed limit value" and "[Pr.35] S-curve ratio" (1 to 100%) in the section of acceleration/deceleration from bias speed at start to command speed.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 431 Positioning parameters: Basic parameters 1

Basic parameters 2

This section describes the details on the basic parameter 2.

n: Axis No. - 1

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with the engineering tool	Value set with a program		Axis 1 to axis 16
[Pr.8] Speed limit value	The setting value range differs according to "[Pr.1] Unit setting".		200000	10+150n 11+150n
[Pr.9] Acceleration time 0	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	12+150n 13+150n
[Pr.10] Deceleration time 0	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	14+150n 15+150n

[Pr.8] Speed limit value

Set the maximum speed during positioning, home position return and speed-torque operations.

[Pr.1] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)
0: mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 ($\times 10^{-2}$mm/min)
1: inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 ($\times 10^{-3}$inch/min)
2: degree	0.001 to 2000000.000 (degree/min)*1	1 to 2000000000 ($\times 10^{-3}$degree/min)*2
3: pulse	1 to 1000000000 (pulse/s)	1 to 1000000000 (pulse/s)

*1 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 0.01 to 20000000.00 (degree/min)

*2 Range of speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is set to valid: 1 to 2000000000 ($\times 10^{-2}$ degree/min)

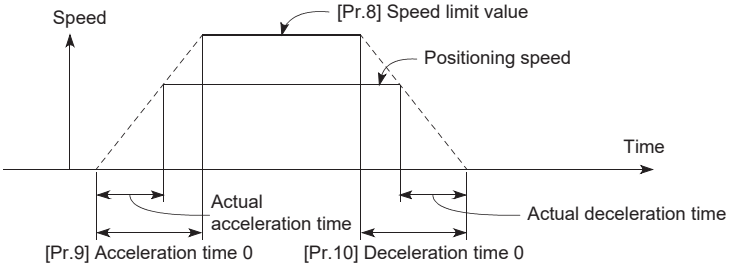
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Basic parameters 2

[Pr.9] Acceleration time 0, [Pr.10] Deceleration time 0

"[Pr.9] Acceleration time 0" specifies the time for the speed to increase from zero to "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control). "[Pr.10] Deceleration time 0" specifies the time for the speed to decrease from "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) to zero.



- If the positioning speed is set lower than the parameter-defined speed limit value, the actual acceleration/deceleration time will be relatively short. Thus, set the maximum positioning speed equal to or only a little lower than the parameter-defined speed limit value.
- These settings are valid for home position return, positioning and JOG operations.
- When the positioning involves interpolation, the acceleration/deceleration time defined for the reference axis is valid.

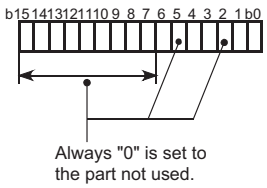
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Basic parameters 2

Detailed parameters 1

n: Axis No. - 1

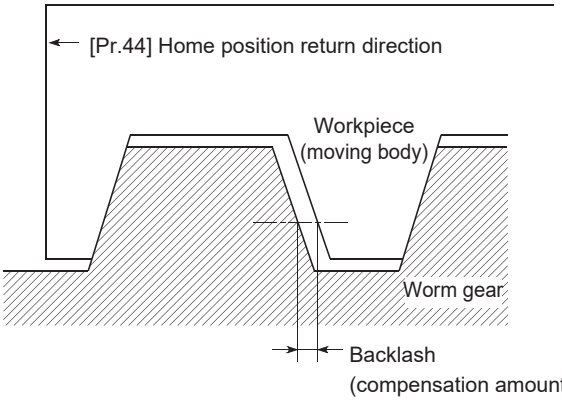
Item	Setting value, setting range				Default value	Buffer memory address
	Value set with the engineering tool			Value set with a program		Axis 1 to axis 16
[Pr.11] Backlash compensation amount	The setting value range differs according to "[Pr.1] Unit setting".				0	17+150n
[Pr.12] Software stroke limit upper limit value					2147483647	18+150n 19+150n
[Pr.13] Software stroke limit lower limit value					-2147483648	20+150n 21+150n
[Pr.14] Software stroke limit selection	0: Apply software stroke limit on command position value			0	0	22+150n
	1: Apply software stroke limit on machine feed value			1		
[Pr.15] Software stroke limit valid/invalid setting	0: Software stroke limit valid during JOG operation, inching operation and manual pulse generator operation			0	0	23+150n
	1: Software stroke limit invalid during JOG operation, inching operation and manual pulse generator operation			1		
[Pr.16] Command in-position width	The setting value range differs according to "[Pr.1] Unit setting".				100	24+150n 25+150n
[Pr.17] Torque limit setting value	0.1 to 1000.0 (%)			1 to 10000 (× 0.1%)	3000	26+150n
[Pr.18] M code ON signal output timing	0: WITH mode			0	0	27+150n
	1: AFTER mode			1		
[Pr.19] Speed switching mode	0: Standard speed switching mode			0	0	28+150n
	1: Front-loading speed switching mode			1		
[Pr.20] Interpolation speed designation method	0: Composite speed			0	0	29+150n
	1: Reference axis speed			1		
[Pr.21] Command position value during speed control	0: Do not update command position value			0	0	30+150n
	1: Update command position value			1		
	2: Clear command position value to zero			2		
[Pr.22] Input signal logic selection	b0	Lower limit	0: Negative logic 1: Positive logic		0	31+150n
	b1	Upper limit				
	b2	Not used				
	b3	Stop signal				
	b4	External command/ switching signal				
	b5	Not used				
	b6	Proximity dog signal				
	b7 to b15	Not used				
[Pr.81] Speed-position function selection	0: Speed-position switching control (INC mode)			0	0	34+150n
	2: Speed-position switching control (ABS mode)			2		

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with the engineering tool	Value set with a program		Axis 1 to axis 16
[Pr.116] FLS signal selection	1 (0001H): Servo amplifier[*1] 2 (0002H): Buffer memory 3 (0003H): Link device	1[*1] 2 3	0001H	116+150n
[Pr.117] RLS signal selection			0001H	117+150n
[Pr.118] DOG signal selection			0001H	118+150n
[Pr.119] STOP signal selection			0002H	119+150n

*1 The setting is not available in "[Pr.119] STOP signal selection".

[Pr.11] Backlash compensation amount

The error that occurs due to backlash when moving the machine via gears can be compensated.
(When the backlash compensation amount is set, commands equivalent to the compensation amount will be output each time the direction changes during positioning.)



- The backlash compensation is valid after machine home position return. Thus, if the backlash compensation amount is set or changed, always carry out machine home position return once.
- "[Pr.2] Number of pulses per rotation(AP)", "[Pr.3] Movement amount per rotation(AL)", "[Pr.4] Unit magnification(AM)" and "[Pr.11] Backlash compensation amount" which satisfies the following (1) can be set up.

$$0 \leq \frac{\text{([Pr.11] Backlash compensation amount)} \times \text{([Pr.2] Number of pulses per rotation (AP))}}{\text{([Pr.3] Movement amount per rotation (AL))} \times \text{([Pr.4] Unit magnification (AM))}} (= A) \leq 4194303 \text{ (pulse): (1)}$$
(round down after decimal point)

"Backlash compensation amount error" (error code: 1BA0H) occurs when the setting is outside the range of calculation result of (1).
A servo alarm (error code: 2031, 2035, etc.) may occur by kinds of servo amplifier (servo motor), load inertia moment and the amount of command per operation cycle (Motion module) even if the setting is within the range of calculation result of (1).
Reduce the setting value of "[Pr.11] Backlash compensation amount" if a servo alarm occurs. Use the value of the following (2) as a measure that a servo alarm does not occur.

$$A \leq \frac{\text{(Maximum motor speed (r/min))} \times \text{(Encoder resolution (pulse/rev))} \times \text{(Operation cycle (ms))}}{60 \text{ (s)} \times 1000 \text{ (ms)}} \text{ (pulse): (2)}$$

The backlash compensation amount is all outputted in one operation cycle.

[Pr.1] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)*1
0: mm	0 to 6553.5 (μm)	0 to 65535 (× 10^{-1}μm)
1: inch	0 to 0.65535 (inch)	0 to 65535 (× 10^{-5}inch)
2: degree	0 to 0.65535 (degree)	0 to 65535 (× 10^{-5}degree)
3: pulse	0 to 65535 (pulse)	0 to 65535 (pulse)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

■Buffer memory address

Refer to the following for the buffer memory address in this area.
☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.12] Software stroke limit upper limit value

Set the upper limit for the machine's movement range during positioning control.

[Pr.1] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)
0: mm	-214748364.8 to 214748364.7 (μm)	-2147483648 to 2147483647 (× 10^{-1}μm)
1: inch	-21474.83648 to 21474.83647 (inch)	-2147483648 to 2147483647 (× 10^{-5}inch)
2: degree	0 to 359.99999 (degree)	0 to 35999999 (× 10^{-5}degree)
3: pulse	-2147483648 to 2147483647 (pulse)	-2147483648 to 2147483647 (pulse)

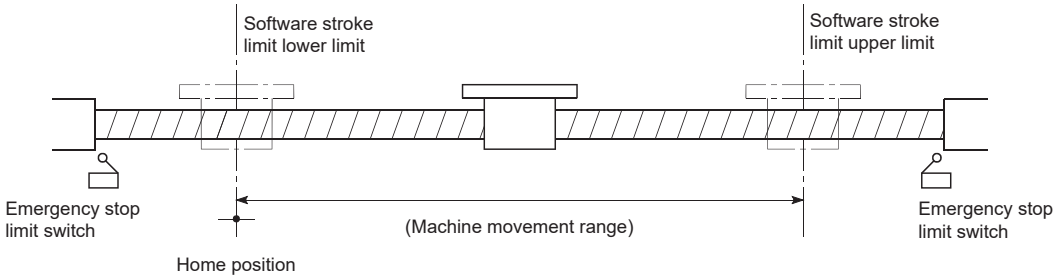
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.13] Software stroke limit lower limit value

Set the lower limit for the machine's movement range during positioning control.



- Generally, the home position is set at the lower limit or upper limit of the stroke limit.
- By setting the upper limit value or lower limit value of the software stroke limit, overrun can be prevented in the software. However, an emergency stop limit switch must be installed nearby outside the range. To invalidate the software stroke limit, set the setting value to "upper limit value = lower limit value". (If it is within the setting range, the setting value can be anything.) When the unit is "degree", the software stroke limit is not checked during the speed control (including the speed control in speed-position and position-speed switching control) or during the manual control.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.14] Software stroke limit selection

Set whether to apply the software stroke limit on the "command position value" or the "machine feed value". The software stroke limit will be validated according to the set value. To invalidate the software stroke limit, set the setting value to "command position value".

When "2: degree" is set in "[Pr.1] Unit setting", set the setting value of software stroke limit to "command position value". "Software stroke limit selection" (error code: 1BA5H) will occur if "machine feed value" is set.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.15] Software stroke limit valid/invalid setting

Set whether to validate the software stroke limit during JOG/Inching operation and manual pulse generator operation.

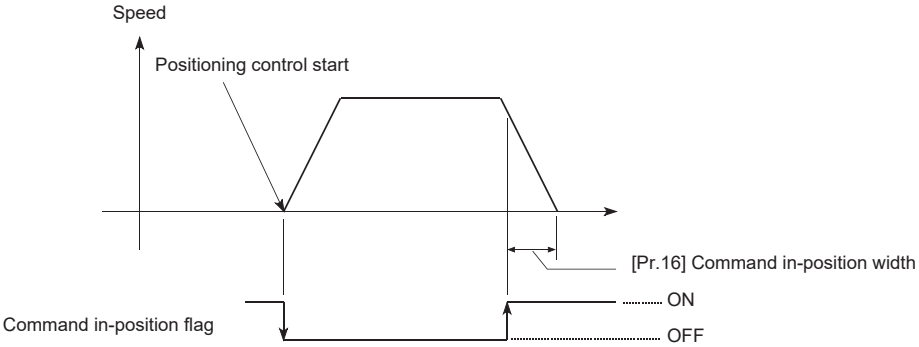
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.16] Command in-position width

Set the remaining distance that turns the command in-position flag ON. When the remaining distance to the stop position during the automatic deceleration of positioning control becomes equal to or less than the value set in the command in-position width, the command in-position flag turns ON.



[Pr.1] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)
0: mm	0.1 to 214748364.7 (μm)	1 to 2147483647 (× 10^{-1}μm)
1: inch	0.00001 to 21474.83647 (inch)	1 to 2147483647 (× 10^{-5}inch)
2: degree	0.00001 to 21474.83647 (degree)	1 to 2147483647 (× 10^{-5}degree)
3: pulse	1 to 2147483647 (pulse)	1 to 2147483647 (pulse)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.17] Torque limit setting value

Set the maximum value of the torque generated by the servo motor as a percentage between 0.1 and 1000.0%.

The torque limit function limits the torque generated by the servo motor within the set range.

If the torque required for control exceeds the torque limit value, it is controlled with the set torque limit value.

☞ Page 241 Torque limit function

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

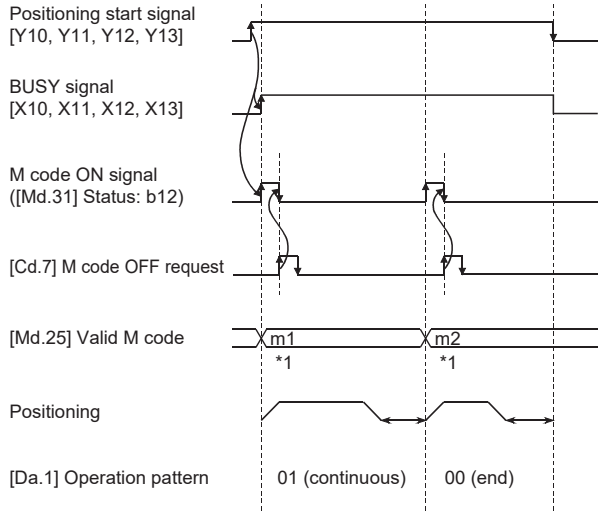
[Pr.18] M code ON signal output timing

This parameter sets the M code ON signal output timing.

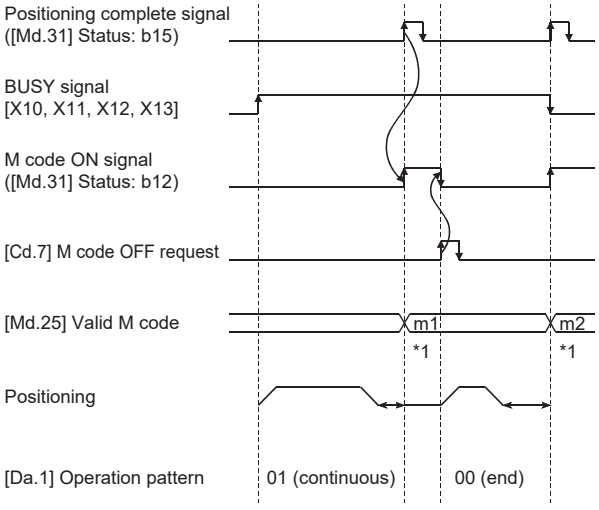
Choose either WITH mode or AFTER mode as the M code ON signal output timing.

■Operation example

WITH mode: An M code is output and the M code ON signal is turned ON when positioning operation starts.



AFTER mode*2: An M code is output and the M code ON signal is turned ON when positioning operation completes.



*1 m1 and m2 indicate set M codes.

*2 If AFTER mode is used with speed control, an M code will not be output and the M code ON signal will not be turned ON.

An M code is a number between 0 and 65535 that can be assigned to each positioning data ([Da.10] M code/Condition data No./Number of LOOP to LEND repetitions).

The program can be coded to read an M code from the buffer memory address specified by "[Md.25] Valid M code" whenever the M code ON signal turns ON so that a command for the sub work (e.g. clamping, drilling, or tool change) associated with the M code can be issued.

- The M code ON signal output timing can be set to each positioning data using the positioning option of the positioning data ([Da.27]).

■Buffer memory address

Refer to the following for the buffer memory address in this area.

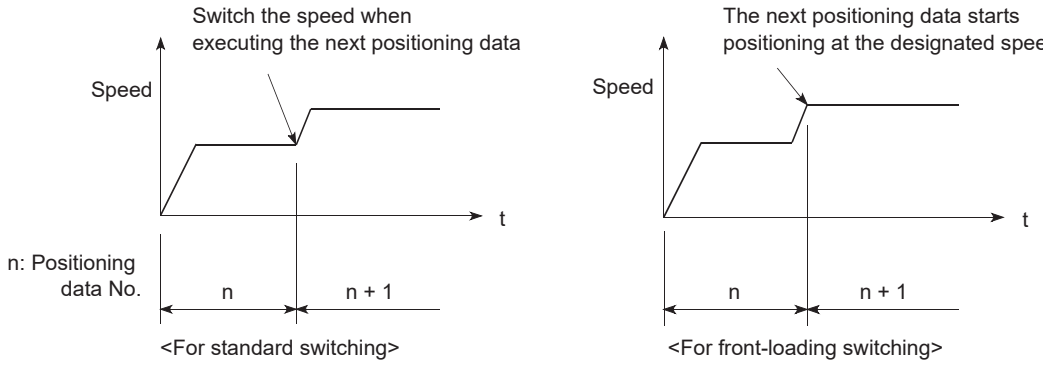
☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.19] Speed switching mode

Set whether to switch the speed switching mode with the standard switching or front-loading switching mode.

- Speed of positioning data No.n > Speed of positioning data No.n + 1 Decelerates at deceleration time No. of Positioning data No.n + 1
- Speed of positioning data No.n < Speed of positioning data No.n + 1 Accelerates at acceleration time No. of Positioning data No.n + 1

Setting value	Details
0: Standard switching	Switch the speed when executing the next positioning data.
1: Front-loading switching	The speed switches at the end of the positioning data currently being executed.



<For standard switching> <For front-loading switching>

■Buffer memory address

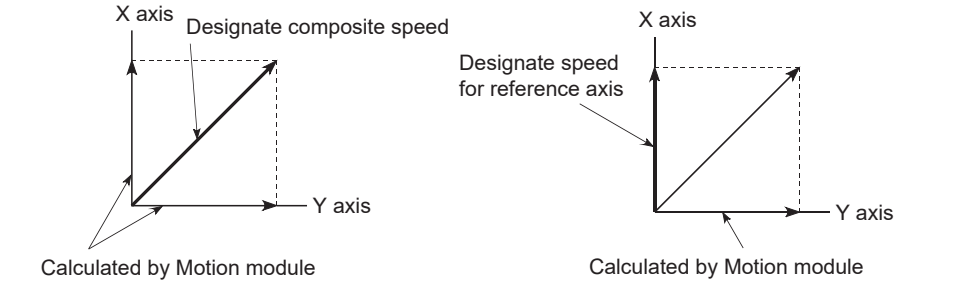
Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.20] Interpolation speed designation method

When carrying out linear interpolation/circular interpolation, set whether to designate the composite speed or reference axis speed.

Setting value	Details
0: Composite speed	The movement speed for the control target is designated, and the speed for each axis is calculated by the Motion module.
1: Reference axis speed	The axis speed set for the reference axis is designated, and the speed for the other axis carrying out interpolation is calculated by the Motion module.



<When composite speed is designated> <When reference axis speed is designated>

Point

When the 4-axis linear interpolation or 2 to 4-axis speed control is performed, specify the reference axis speed.

If "composite speed" is specified for the 4-axis linear interpolation and 2 to 4-axis speed control, "Interpolation mode error" (error code: 1A9AH) will occur when the positioning operation is started.

Specify "composite speed" when performing the 2-axis circular interpolation control and 3-axis helical interpolation control. When "reference axis speed" is specified for the 2-axis circular interpolation control and 3-axis helical interpolation control, "Interpolation mode error" (error code: 1A9BH) will occur when the positioning operation is started.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.21] Command position value during speed control

Specify whether you wish to enable or disable the update of "[Md.20] Command position value" while operations are performed under the speed control (including the speed control in speed-position and position-speed switching control).

Setting value	Details
0: The update of the command position value is disabled	The command position value will not change. (The value at the beginning of the speed control will be kept.)
1: The update of the command position value is enabled	The command position value will be updated. (The command position value will change from the initial.)
2: The command position value is cleared to zero	The command position value will be set initially to zero and change from zero while the speed control is in effect.

Point

- When the speed control is performed over two to four axes, the choice between enabling and disabling the update of "[Md.20] Command position value" depends on how the reference axis is set.
- Set "1" to exercise speed-position switching control (ABS mode).

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.22] Input signal logic selection

Set the input signal logic that matches the signaling specification of the external input signal (upper/lower limit switch, proximity dog) of servo amplifier connected to the Motion module or "[Cd.44] External input signal operation device".

■Negative logic

- The current is not flowed through the input signal contact.

  - FLS, RLS: Limit signal ON
  - DOG, DI, STOP: Invalid

- The current is flowed through the input signal contact.

  - FLS, RLS: Limit signal OFF
  - DOG, DI, STOP: Valid

■Positive logic

Opposite the concept of negative logic.

Point

A mismatch in the signal logic will disable normal operation. Be careful of this when you change from the default value.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.81] Speed-position function selection

Select the mode of speed-position switching control.

0: INC mode

2: ABS mode

Point

If the setting is other than 0 and 2, operation is performed in the INC mode with the setting regarded as 0.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

[Pr.116] to [Pr.119] FLS/RLS/DOG/STOP signal selection

■Input type

Set the input type whose external input signal (upper/lower limit signal (FLS/RLS), proximity dog signal (DOG) or stop signal (STOP)) is used.

1 (0001H): Servo amplifier*1 (Uses the external input signal of the servo amplifier.)

2 (0002H): Buffer memory (Uses the buffer memory of the Motion module.)

3 (0003H): Link device (Uses the link device.)

15 (000FH): Invalid (Does not use the external input signal.)

*1 The setting is not available in "[Pr.119] STOP signal selection". If it is set, "STOP signal selection error" (error code: 1BD3H) occurs and PLC READY [Y0] is not turned ON.

Point

If "3: Link device" is selected, specify the link device to be used for the external input signals (upper/lower limit signal (FLS/RLS), proximity dog signal (DOG), stop signal (STOP)) by using the following parameters.

- [Pr.910], [Pr.920], [Pr.930], [Pr.940] Link device type
- [Pr.911], [Pr.921], [Pr.931], [Pr.941] Link device start No.
- [Pr.912], [Pr.922], [Pr.932], [Pr.942] Link device bit specification
- [Pr.913], [Pr.923], [Pr.933], [Pr.943] Link device logic setting

■Buffer memory address

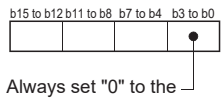
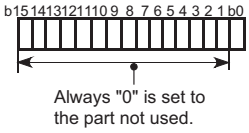
Refer to the following for the buffer memory address in this area.

☞ Page 432 Positioning parameters: Detailed parameters 1

Detailed parameters 2

n: Axis No. - 1

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with the engineering tool	Value set with a program		Axis 1 to axis 16
[Pr.25] Acceleration time 1	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	36+150n 37+150n
[Pr.26] Acceleration time 2				38+150n 39+150n
[Pr.27] Acceleration time 3				40+150n 41+150n
[Pr.28] Deceleration time 1				42+150n 43+150n
[Pr.29] Deceleration time 2				44+150n 45+150n
[Pr.30] Deceleration time 3				46+150n 47+150n
[Pr.31] JOG speed limit value	The setting range differs depending on "[Pr.1] Unit setting".		20000	48+150n 49+150n
[Pr.32] JOG operation acceleration time selection	0: [Pr.9] Acceleration time 0	0	0	50+150n
	1: [Pr.25] Acceleration time 1	1		
	2: [Pr.26] Acceleration time 2	2		
	3: [Pr.27] Acceleration time 3	3		
[Pr.33] JOG operation deceleration time selection	0: [Pr.10] Deceleration time 0	0	0	51+150n
	1: [Pr.28] Deceleration time 1	1		
	2: [Pr.29] Deceleration time 2	2		
	3: [Pr.30] Deceleration time 3	3		
[Pr.34] Acceleration/deceleration process selection	0: Trapezoid acceleration/deceleration process	0	0	52+150n
	1: S-curve acceleration/deceleration process	1		
[Pr.35] S-curve ratio	1 to 100 (%)	1 to 100 (%)	100	53+150n
[Pr.36] Rapid stop deceleration time	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	54+150n 55+150n
[Pr.37] Stop group 1 rapid stop selection	0: Normal deceleration stop	0	0	56+150n
	1: Rapid stop	1		
[Pr.38] Stop group 2 rapid stop selection	0: Normal deceleration stop	0		57+150n
	1: Rapid stop	1		
[Pr.39] Stop group 3 rapid stop selection	0: Normal deceleration stop	0		58+150n
	1: Rapid stop	1		
[Pr.40] Positioning complete signal output time	0 to 65535 (ms)	0 to 65535 (ms) 0 to 32767: Set as a decimal 32768 to 65535: Convert into hexadecimal and set	300	59+150n
[Pr.41] Allowable circular interpolation error width	The setting range differs depending on "[Pr.1] Unit setting".		100	60+150n 61+150n
[Pr.42] External command function selection	0: External positioning start	0	0	62+150n
	1: External speed change request	1		
	2: Speed-position, position-speed switching request	2		
	3: Skip request	3		
	4: High speed input request	4		

Item	Setting value, setting range			Default value	Buffer memory address
	Value set with the engineering tool		Value set with a program		Axis 1 to axis 16
[Pr.83] Speed control 10 × multiplier setting for degree axis	0: Invalid		0	0	63+150n
	1: Valid		1		
[Pr.84] Restart allowable range when servo OFF to ON	0, 1 to 327680 [pulse] 0: restart not allowed			0	64+150n 65+150n
[Pr.90] Operation setting for speed-torque control mode	b0 to b3	Not used		0000H	68+150n
	b4 to b7	Torque initial value selection 0: Command torque 1: Feedback torque			
	b8 to b11	Speed initial value selection 0: Command speed 1: Feedback speed 2: Automatic selection			
	b12 to b15	Condition selection at mode switching 0: Check the switching condition on the Motion module 1: According to the servo amplifier specification			
[Pr.95] External command signal selection	0: Not used		0	0	69+150n
	101 to 116: DI1 to DI16		101 to 116		
	900: Link device		900		
[Pr.112] Servo OFF command valid/ invalid setting	b0	0: Servo OFF command invalid 1: Servo OFF command valid for speed-torque control		0000H	112+150n
	b1 to b15	Not used			
[Pr.122] Manual pulse generator speed limit mode	0: Don't hold speed limit		0	0	121+150n
	1: Don't output over value of speed limit		1		
	2: Output over value of speed limit later		2		
[Pr.123] Manual pulse generator speed limit value	The setting range differs depending on "[Pr.1] Unit setting".			20000	122+150n 123+150n
[Pr.127] Speed limit value input selection at control mode switching	1: Input disable		1	0	125+150n
	Other than 1: Input enable		Other than 1		

[Pr.25] Acceleration time 1 to [Pr.27] Acceleration time 3

These parameters set the time for the speed to increase from zero to "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) during a positioning operation.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.28] Deceleration time 1 to [Pr.30] Deceleration time 3

These parameters set the time for the speed to decrease from "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) to zero during a positioning operation.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.31] JOG speed limit value

Set the maximum speed for JOG operation.

[Pr.1] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)
0: mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 (× 10^{-2}mm/min)
1: inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 (× 10^{-3}inch/min)
2: degree	0.001 to 2000000.000 (degree/min)*1	1 to 2000000000 (× 10^{-3}degree/min)*2
3: pulse	1 to 1000000000 (pulse/s)	1 to 1000000000 (pulse/s)

*1 The range of JOG speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 0.01 to 20000000.00 (degree/min)

*2 The range of JOG speed limit value when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 1 to 2000000000 (× 10^{-2} degree/min)

Point

Set the "JOG speed limit value" to a value equal to "[Pr.8] Speed limit value" or less. If the "speed limit value" is exceeded, "JOG speed limit value error" (error code: 1BB7H) will occur.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.32] JOG operation acceleration time selection

Set which of "acceleration time 0 to 3" to use for the acceleration time during JOG operation.

0: Use value set in "[Pr.9] Acceleration time 0".

1: Use value set in "[Pr.25] Acceleration time 1".

2: Use value set in "[Pr.26] Acceleration time 2".

3: Use value set in "[Pr.27] Acceleration time 3".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.33] JOG operation deceleration time selection

Set which of "deceleration time 0 to 3" to use for the deceleration time during JOG operation.

0: Use value set in "[Pr.10] Deceleration time 0".

1: Use value set in "[Pr.28] Deceleration time 1".

2: Use value set in "[Pr.29] Deceleration time 2".

3: Use value set in "[Pr.30] Deceleration time 3".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

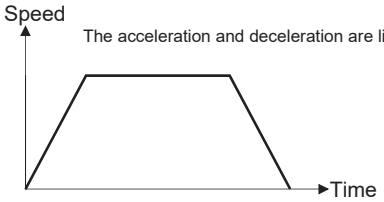
☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.34] Acceleration/deceleration process selection

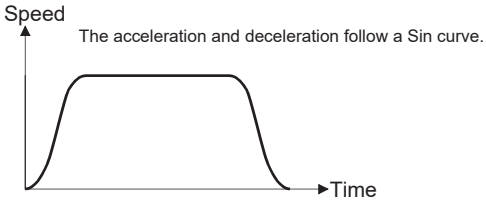
Set whether to use trapezoid acceleration/deceleration or S-curve acceleration/deceleration for the acceleration/deceleration process.

Refer to the following for details.

☞ Page 300 Acceleration/deceleration processing function



<Trapezoid acceleration/deceleration>



<S-curve acceleration/deceleration>

■Buffer memory address

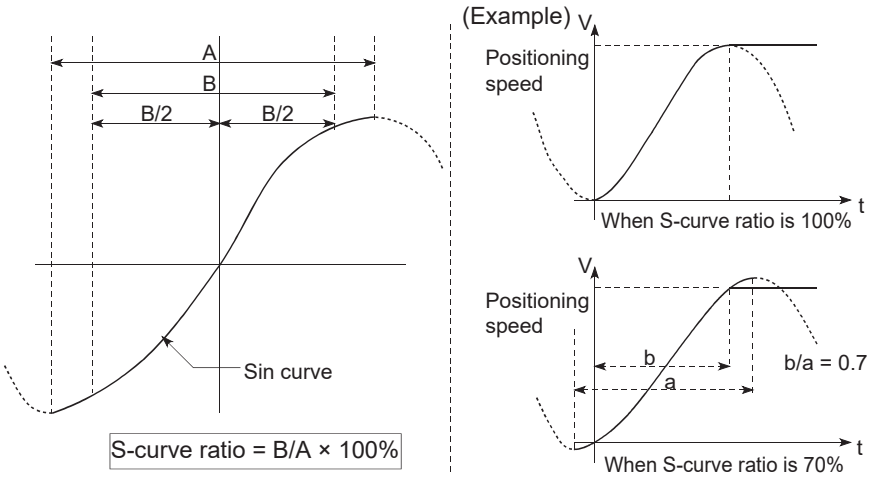
Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.35] S-curve ratio

Set the S-curve ratio (1 to 100%) for carrying out the S-curve acceleration/deceleration process.

The S-curve ratio indicates where to draw the acceleration/deceleration curve using the Sin curve as shown below.



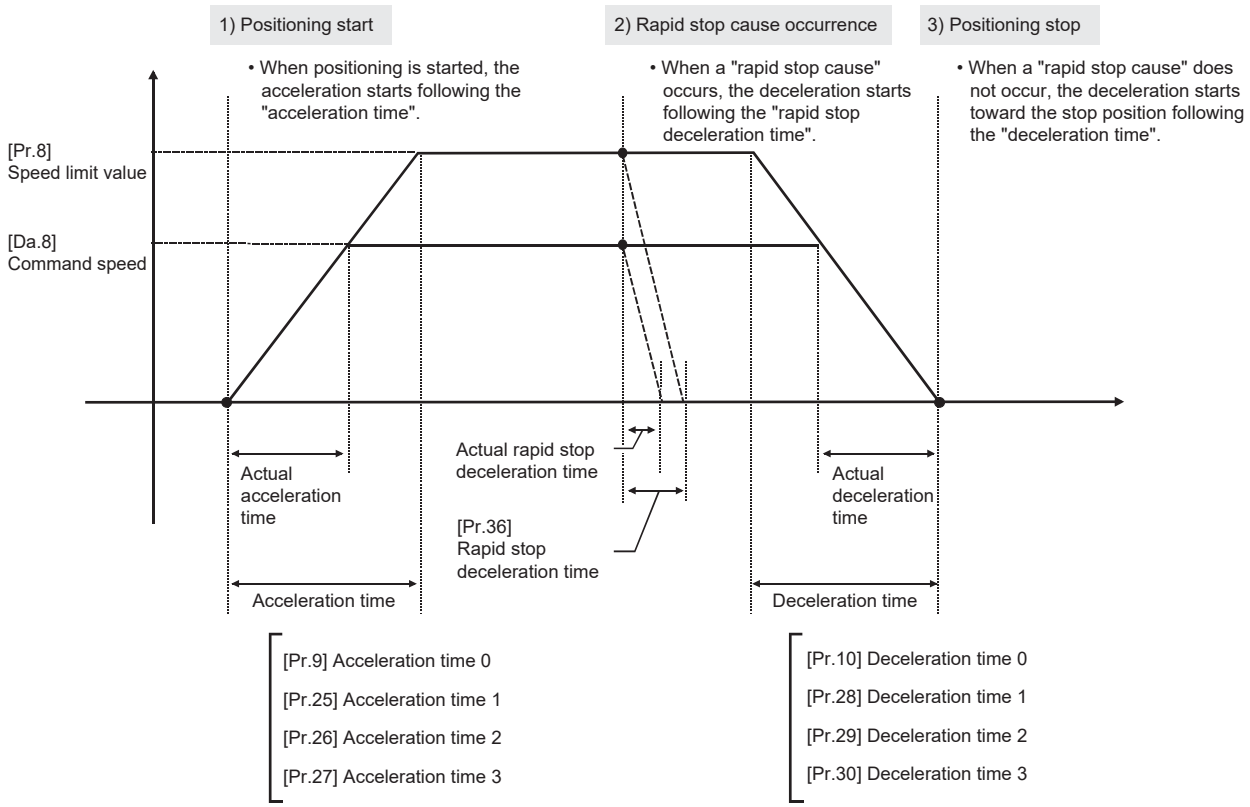
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.36] Rapid stop deceleration time

Set the time to reach speed 0 from "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) during the rapid stop. The illustration below shows the relationships with other parameters.



■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.37] to [Pr.39] Stop group 1/2/3 rapid stop selection

Set the method to stop when the stop causes in the following stop groups occur.

Stop group	Details
Stop group 1	Stop with hardware stroke limit
Stop group 2	Error occurrence of the CPU module, PLC READY [Y0] OFF
Stop group 3	Axis stop signal from the CPU module, Error occurrence (excludes errors in stop groups 1 and 2: includes only the software stroke limit errors during JOG operation, speed control, speed-position switching control, and position-speed switching control)

The methods of stopping include "0: Normal deceleration stop" and "1: Rapid stop".

If "1: Rapid stop" is selected, the axis will rapidly decelerate to a stop when the stop cause occurs.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

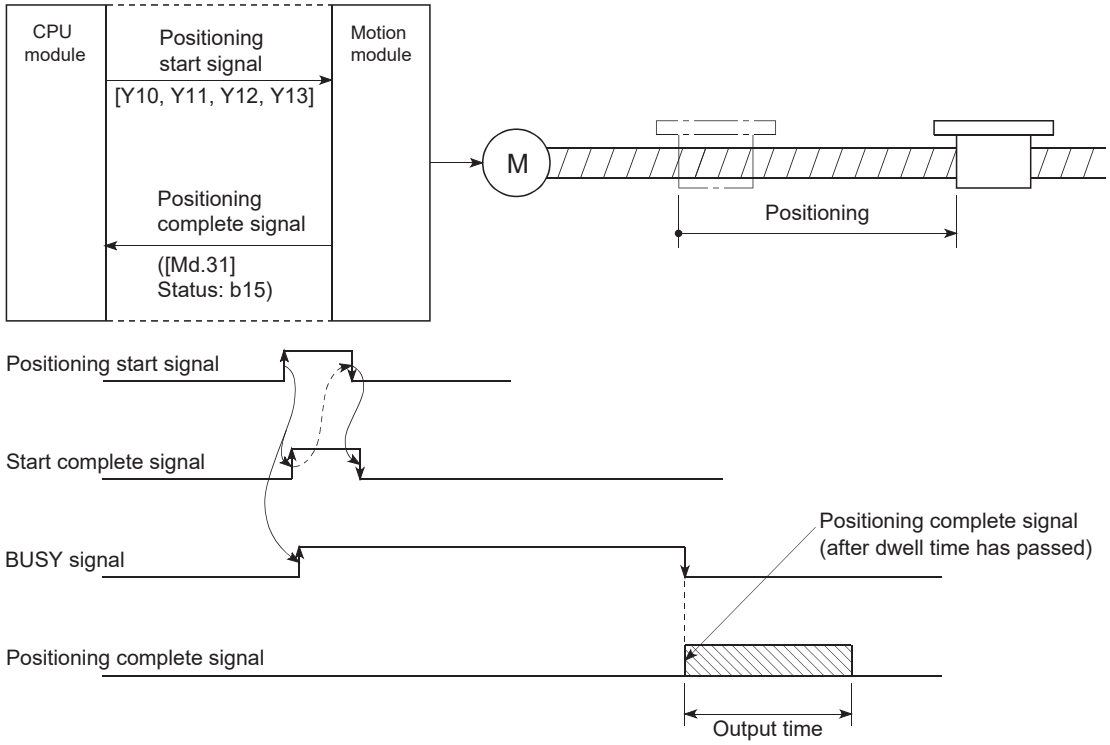
[Pr.40] Positioning complete signal output time

Set the output time of the positioning complete signal output from the Motion module.

The positioning completes when the specified dwell time has passed after the Motion module had terminated the command output.

For the interpolation control, the positioning complete signal of interpolation axis is output at the time set to the reference axis.

■Operation example



■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.41] Allowable circular interpolation error width

The allowable error range of the calculated arc path and end point address is set.*1

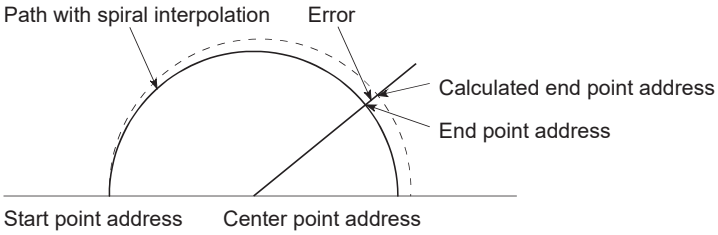
If the error of the calculated arc path and end point address is within the set range, circular interpolation will be carried out to the set end point address while compensating the error with spiral interpolation.

The allowable circular interpolation error width is set in the following axis buffer memory addresses.

Ex.

• If axis 1 is the reference axis, set in the axis 1 buffer memory addresses [60, 61].

• If axis 4 is the reference axis, set in the axis 4 buffer memory addresses [510, 511].



*1 In 2-axis circular interpolation control with center point designation, the arc path calculated with the start point address and center point address and the end point address may deviate.

[Pr.1] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)
0: mm	0 to 10000.0 (μm)	0 to 100000 (× 10^{-1}μm)
1: inch	0 to 1.00000 (inch)	0 to 100000 (× 10^{-5}inch)
2: degree	0 to 1.00000 (degree)	0 to 100000 (× 10^{-5}degree)
3: pulse	0 to 100000 (pulse)	0 to 100000 (pulse)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.42] External command function selection

When "101: DOG signal of axis 1" to "116: DOG signal of axis 16" is selected in "[Pr.95] External command signal selection", select a command with which the external command signal should be associated.

Setting value	Details
0: External positioning start	The external command signal input is used to start a positioning operation.
1: External speed change request	The external command signal input is used to change the speed in the current positioning operation. The new speed should be set in "[Cd.14] New speed value".
2: Speed-position, position-speed switching request	The external command signal input is used to switch from the speed control to the position control while in the speed-position switching control mode, or from the position control to the speed control while in the position-speed switching control mode. To enable the speed-position switching control, set "[Cd.24] Speed-position switching enable flag" to "1". To enable the position-speed switching control, set "[Cd.26] Position-speed switching enable flag" to "1".
3: Skip request	The external command signal input is used skip the current positioning operation.
4: High speed input request	The external command signal input is used to execute the mark detection. And, also set to use the external command signal in the synchronous control.

Point

To enable the external command signal, set "[Cd.8] External command valid" to "1".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.83] Speed control 10 x multiplier setting for degree axis

Set the speed control 10 × multiplier setting for degree axis when you use command speed and speed limit value set by the positioning data and the parameter at "[Pr.1] Unit setting" setup degree by ten times at the speed.

0: Invalid

1: Valid

Normally, the speed specification range is 0.001 to 2000000.000 [degree/min], but it will be decupled and become 0.01 to 20000000.00 [degree/min] by setting "[Pr.83] Speed control 10 × multiplier setting for degree axis" to valid.

Refer to the following for details on the speed control 10 × multiplier setting for degree axis.

☞ Page 305 Speed control 10 x multiplier setting for degree axis function

[Pr.83] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)
0: Invalid	0.001 to 2000000.000 (degree/min)	1 to 2000000000 (× 10^{-3}degree/min)
1: Valid	0.01 to 20000000.00 (degree/min)	1 to 2000000000 (× 10^{-2}degree/min)

Point

"[Pr.83] Speed control 10 × multiplier setting for degree axis" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of PLC READY [Y0].

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.84] Restart allowable range when servo OFF to ON

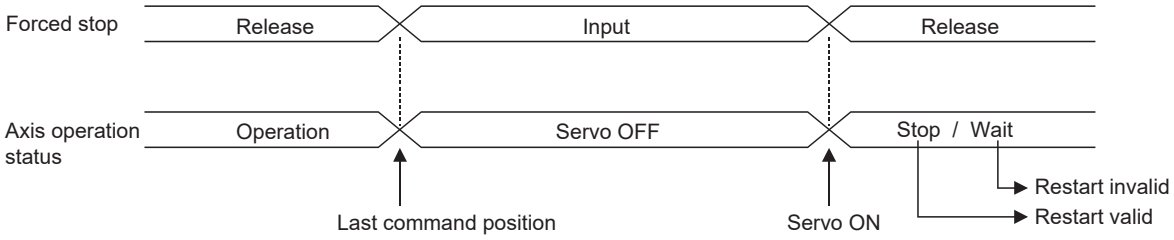
■Restart function at switching servo OFF to ON

The restart function at switching servo OFF to ON performs continuous positioning operation (positioning start, restart) when switching servo OFF to ON while the Motion module is stopped (including forced stop, servo forced stop).

Restart at switching servo OFF to ON can be performed when the difference between the last command position of the Motion module at stop and the current value at switching servo OFF to ON is equal to or less than the value set in the buffer memory for the restart allowable range setting.

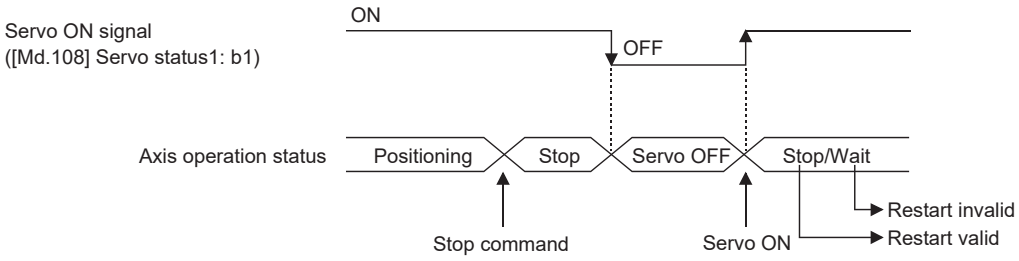
- Servo emergency stop processing

  - When the difference between the last command position of the Motion module at the forced stop input or the servo forced stop input and the current value at the forced stop release or the servo forced stop release is equal to or less than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as stopped and can be restarted.
  - When the difference between the last command position of the Motion module at the forced stop input or the servo forced stop input and the current value at the forced stop release or the servo forced stop release is greater than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as on-standby and cannot be restarted.



• Processing at switching the servo ON signal from OFF to ON

- When the difference between the last command position of the Motion module at switching the servo ON signal from ON to OFF and the current value at switching the servo ON signal from OFF to ON is equal to or less than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as stopped and can be restarted.
- When the difference between the last command position of the Motion module at switching the servo ON signal from ON to OFF and the current value at switching the servo ON signal from OFF to ON is greater than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as on-standby and cannot be restarted.



■Setting method

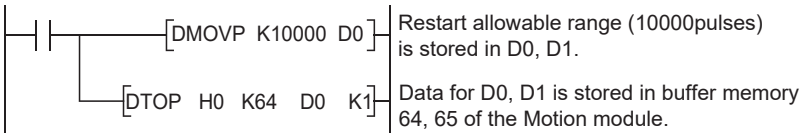
For performing restart at switching servo OFF to ON, set the restart allowable range in the following buffer memory.

n: Axis No. - 1

Item	Setting range	Default value	Buffer memory address
			Axis 1 to axis 16
[Pr.84] Restart allowable range when servo OFF to ON	0, 1 to 327680 [pulse] 0: restart not allowed	0	64+150n 65+150n

• Setting example

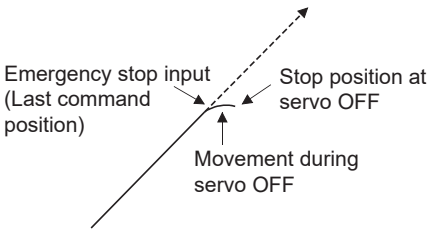
A program to set the restart allowable range for axis 1 to 10000pulses is shown below.



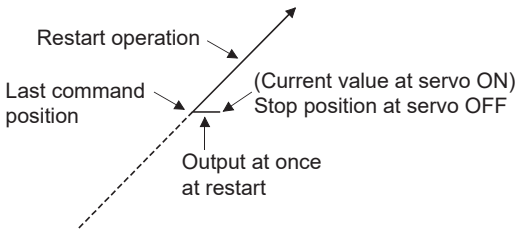
Point

- The difference between the last command position at servo OFF and the current value at servo ON is output at once at the first restart. If the restart allowable range is large at this time, an overload may occur on the servo side. Set a value which does not affect the mechanical system by output once to the restart allowable range when switching servo OFF to ON.
- The restart at switching servo OFF to ON is valid only at switching servo OFF to ON at the first time. At the second time or later, the setting for restart allowable range when switching servo OFF to ON is disregarded.
- Execute servo OFF when the mechanical system is in complete stop state. The restart at switching servo OFF to ON cannot be applied to a system in which the mechanical system is operated by external pressure or other force during servo OFF.
- Restart can be executed only while the axis operation status is "stop". Restart cannot be executed when the axis operation status is other than "stop".
- When PLC READY [Y0] is switched from OFF to ON during servo OFF, restart cannot be executed. If restart is requested, "Restart not possible" (warning code: 0D02H) occurs.
- Do not restart while a stop command is ON. When restart is executed during a stop, "Stop signal ON at start" (error code: 1A08H) occurs and the axis operation status becomes "ERR". Therefore, restart cannot be performed even if the error is reset.
- Restart can also be executed while the positioning start signal is ON. However, do not set the positioning start signal from OFF to ON during a stop. If the positioning start signal is switched from OFF to ON, positioning is performed from the positioning data No. set in "[Cd.3] Positioning start No." or from the positioning data No. of the specified point.
- If positioning is ended with the continuous operation interrupt request, the operation cannot be restarted. If restart is requested, "Restart not possible" (warning code: 0D02H) will occur.

[Operation at emergency stop input]



[Operation at restart]



■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.90] Operation setting for speed-torque control mode

Operation setting of the speed control mode, torque control mode or continuous operation to torque control mode at the speed-torque control is executed.

■Torque initial value selection

Set the torque initial value at switching to torque control mode or to continuous operation to torque control mode.

Setting value	Details
0: Command torque	Command torque value at switching. (following axis control data) Switching to torque control mode: "[Cd.143] Command torque at torque control mode" Switching to continuous operation to torque control mode: "[Cd.150] Target torque at continuous operation to torque control mode"
1: Feedback torque	Motor torque value at switching.

■Speed initial value selection

Set the initial speed at switching from position control mode to speed control mode or the initial speed at switching from position control mode or from speed control mode to continuous operation to torque control mode.

Setting value	Details
0: Command speed	Speed that position command at switching is converted into the motor rotation speed.
1: Feedback speed	Motor rotation speed received from servo amplifier at switching.
2: Automatic selection	The lower speed between speed that position command at switching is converted into the motor rotation speed and motor rotation speed received from servo amplifier at switching. (This setting is valid only when continuous operation to torque control mode is used. At switching from position control mode to speed control mode, operation is the same as "0: Command speed".)

■Condition selection at mode switching

Set the valid/invalid of switching conditions for switching control mode.

0: Check the switching condition on the Motion module

1: According to the servo amplifier specification

Point

- The "Operation setting for speed-torque control mode" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of PLC READY [Y0].
- Set as follows to switch the control mode without waiting for the servo motor to stop. Note that it may cause vibration or impact at control switching.

Set "Condition selection at mode switching (b12 to b15)" to "1: According to the servo amplifier specification".

When using the MR-J5(W)-G, set "ZSP disabled selection at control switching" of the servo parameter "Function selection C-E (PC76)" to "1: Disabled".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.95] External command signal selection

Set the external command signal.

When "101: DOG signal of axis 1" to "116: DOG signal of axis 16" is selected in "[Pr.95] External command signal selection", the DOG signal of the servo amplifier is used regardless of the setting value of "[Pr.118] DOG signal selection".

Setting value	Details
0: Not used	External command signal is not used.
101: DOG signal of Axis 1	DOG signal of Axis 1 is used as external command signal.
⋮	⋮
116: DOG signal of Axis 16	DOG signal of Axis 16 is used as external command signal.
900: Link device	The link device is used as external command signal.

The logic selection of the DOG signal assigned as the external command signal follows the setting of "[Pr.22] Input signal logic selection" "b4: External command/switching signal".

Point

- The "External command signal selection" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of PLC READY [Y0].
- Same external command signal can be used in the multiple axes.
- If "900: Link device" is specified, specify the link device to be used with the parameter corresponding to the intended external command signal from among the following parameters.
  · [Pr.950], [Pr.960], [Pr.970], [Pr.980], [Pr.990], [Pr.995], [Pr.1000], [Pr.1005], [Pr.1020], [Pr.1030], [Pr.1040], [Pr.1050], [Pr.1060] Link device type
  · [Pr.951], [Pr.961], [Pr.971], [Pr.981], [Pr.991], [Pr.996], [Pr.1001], [Pr.1006], [Pr.1021], [Pr.1031], [Pr.1041], [Pr.1051], [Pr.1061] Link device type start No.
  · [Pr.952], [Pr.962], [Pr.972], [Pr.982], [Pr.992], [Pr.997], [Pr.1002], [Pr.1007], [Pr.1022], [Pr.1032], [Pr.1042], [Pr.1052], [Pr.1062] Link device bit specification
  · [Pr.953], [Pr.963], [Pr.973], [Pr.983], [Pr.993], [Pr.998], [Pr.1003], [Pr.1008], [Pr.1023], [Pr.1033], [Pr.1043], [Pr.1053], [Pr.1063] Link device logic setting

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.112] Servo OFF command valid/invalid setting

Set whether to accept all axis servo ON [Y1] of "[Cd.100] Servo OFF command" during speed control mode, torque control mode, or continuous operation to torque control mode for each axis. The setting value is applied at control mode switching. Only the setting in bit0 is valid.

0: Servo OFF command invalid

1: Servo OFF command valid during speed-torque control

Point

If any bit other than bit0 is set to "1", the setting is ignored and the operation is performed in the same way as when bit0 is set to "0: Servo OFF command invalid".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.122] Manual pulse generator speed limit mode

Set how to output when the output by manual pulse generator operation exceeds "[Pr.123] Manual pulse generator speed limit value".

0: Don't hold speed limit

1: Don't output over value of speed limit

2: Output over value of speed limit later

Point

The "Manual pulse generator speed limit mode" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of PLC READY [Y0].

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.123] Manual pulse generator speed limit value

Set the maximum speed during manual pulse generator operation.

Point

- The "Manual pulse generator speed limit value" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of PLC READY [Y0].
- Set the "Manual pulse generator speed limit value" to a value less than "[Pr.8] Speed limit value". If the "speed limit value" is exceeded, "Manual pulse generator speed limit value error" (error code: 1BBAH) will occur.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

[Pr.127] Speed limit value input selection at control mode switching

Set whether to input the value of "[Pr.8] Speed limit value" at speed-torque control mode switching.

Point

The "Speed limit value input selection at control mode switching" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of PLC READY [Y0].

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Positioning parameters: Detailed parameters 2

Home position return basic parameters

n: Axis No. - 1

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with the engineering tool	Value set with a program		Axis 1 to axis 16
[Pr.43] Home position return method	8: Driver home position return method	8	8	70+150n
[Pr.44] Home position return direction	0: Positive direction (address increment direction)	0	0	71+150n
	1: Negative direction (address decrement direction)	1		
[Pr.45] Home position address	The setting value range differs depending on "[Pr.1] Unit setting".		0	72+150n 73+150n
[Pr.46] Home position return speed			1	74+150n 75+150n

[Pr.43] Home position return method

Set the "home position return method" for carrying out machine home position return.

Setting value	Details	Reference
8: Driver home position return method	Carry out the home position return operation on the driver side. The home position return operation and parameters depend on the specifications of the driver.	☞ Page 38 Driver home position return method

When setting the home position return method that cannot be executed, "Home position return method invalid" (error code: 1A79H) occurs and the home position return is not executed.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

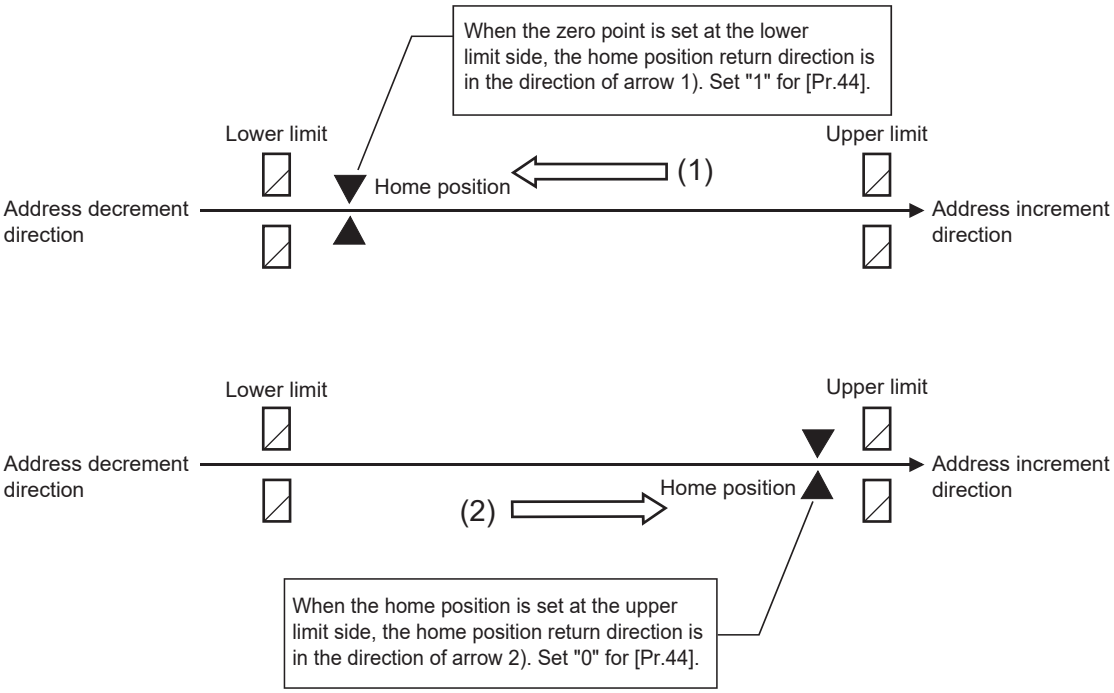
☞ Page 433 Home position return parameters: Home position return basic parameters

[Pr.44] Home position return direction

Set the direction to start movement when starting machine home position return.

Setting value	Details
0: Positive direction (address increment direction)	Moves in the direction that the address increments. (Arrow 2))
1: Negative direction (address decrement direction)	Moves in the direction that the address decrements. (Arrow 1))

Normally, the home position is set near the lower limit or the upper limit, so "[Pr.44] Home position return direction" is set as shown below.



■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Home position return parameters: Home position return basic parameters

[Pr.45] Home position address

Set the address used as the reference point for positioning control (ABS system).

(When the machine home position return is completed, the stop position address is changed to the address set in "[Pr.45] Home position address". At the same time, "[Pr.45] Home position address" is stored in "[Md.20] Command position value" and "[Md.21] Machine feed value".)

[Pr.1] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)
0: mm	-214748364.8 to 214748364.7 (μm)	-2147483648 to 2147483647 ($\times 10^{-1}$ μm)
1: inch	-21474.83648 to 21474.83647 (inch)	-2147483648 to 2147483647 ($\times 10^{-5}$ inch)
2: degree	0 to 359.99999 (degree)	0 to 35999999 ($\times 10^{-5}$ degree)
3: pulse	-2147483648 to 2147483647 (pulse)	-2147483648 to 2147483647 (pulse)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Home position return parameters: Home position return basic parameters

[Pr.46] Home position return speed

Set the speed for home position return.

Performs high-speed home position return with the home position return speed.

[Pr.1] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)
0: mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 (× 10^{-2}mm/min)
1: inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 (× 10^{-3}inch/min)
2: degree	0.001 to 2000000.000 (degree/min)*1	1 to 2000000000 (× 10^{-3}degree/min)*2
3: pulse	1 to 1000000000 (pulse/s)	1 to 1000000000 (pulse/s)

*1 The range of home position return speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 0.01 to 20000000.00 (degree/min)

*2 The range of home position return speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 1 to 2000000000 (× 10^{-2}degree/min)

Point

Set the "home position return speed" to less than "[Pr.8] Speed limit value". If the "speed limit value" is exceeded, "Outside speed limit value range" (error code: 1B69H) will occur, and home position return will not be executed.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 433 Home position return parameters: Home position return basic parameters

Home position return detailed parameters

n: Axis No. - 1

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with the engineering tool	Value set with a program		Axis 1 to axis 16
[Pr.51] Home position return acceleration time selection	0: [Pr.9] Acceleration time 0	0	0	82+150n
	1: [Pr.25] Acceleration time 1	1		
	2: [Pr.26] Acceleration time 2	2		
	3: [Pr.27] Acceleration time 3	3		
[Pr.52] Home position return deceleration time selection	0: [Pr.10] Deceleration time 0	0	0	83+150n
	1: [Pr.28] Deceleration time 1	1		
	2: [Pr.29] Deceleration time 2	2		
	3: [Pr.30] Deceleration time 3	3		
[Pr.55] Operation setting for incompletion of home position return	0: Positioning control is not executed	0	0	87+150n
	1: Positioning control is executed	1		

[Pr.51] Home position return acceleration time selection

Set which of "acceleration time 0 to 3" to use for the acceleration time during home position return.

0: Use the value set in "[Pr.9] Acceleration time 0".

1: Use the value set in "[Pr.25] Acceleration time 1".

2: Use the value set in "[Pr.26] Acceleration time 2".

3: Use the value set in "[Pr.27] Acceleration time 3".

Only valid at high-speed home position return.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 Home position return parameters: Home position return detailed parameters

[Pr.52] Home position return deceleration time selection

Set which of "deceleration time 0 to 3" to use for the deceleration time during home position return.

0: Use the value set in "[Pr.10] Deceleration time 0".

1: Use the value set in "[Pr.28] Deceleration time 1".

2: Use the value set in "[Pr.29] Deceleration time 2".

3: Use the value set in "[Pr.30] Deceleration time 3".

Only valid at high-speed home position return.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 Home position return parameters: Home position return detailed parameters

[Pr.55] Operation setting for incompletion of home position return

Set whether the positioning control is executed or not (When the home position return request flag is ON.).

0: Positioning control is not executed

1: Positioning control is executed

- When the home position return request flag is ON, selecting "0: Positioning control is not executed" will result in "Start at home position return incomplete" (error code: 1AA6H), and positioning control will not be performed. At this time, operation with the manual control (JOG operation, inching operation, manual pulse generator operation) is available. The positioning control can be executed even if the home position return request flag is ON when selecting "1: Positioning control is executed".
- The following shows whether the positioning control is possible to start/restart or not when selecting "0: Positioning control is not executed".

Start possible	Machine home position return, JOG operation, inching operation, manual pulse generator operation, and current value changing using current value changing start No. (9003)
Start/restart impossible control	When the following cases at block start, condition start, wait start, repeated start, multiple axes simultaneous start and pre-reading start 1-axis linear control, 2/3/4-axis linear interpolation control, 1/2/3/4-axis fixed-feed control, 2-axis circular interpolation control (with sub point designation/center point designation), 3-axis helical interpolation control (with sub point designation/center point designation), 1/2/3/4-axis speed control, speed-position switching control (INC mode/ ABS mode), position-speed switching control, and current value changing using current value changing (No.1 to 600)

- When the home position request is ON, starting the fast home position return will result in "Home position return request ON" (error code: 1A45H) despite the setting value of "Operation setting for incompletion of home position return", and the fast home position return will not be executed.

⚠CAUTION

- Do not execute the positioning control in home position return request signal ON for the axis which uses in the positioning control. Failure to observe this could lead to an accident such as a collision.

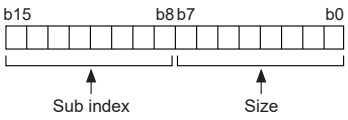
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 Home position return parameters: Home position return detailed parameters

Extended parameters

n: Axis No. - 1

Item	Setting value, setting range		Default value	Buffer memory address
	Value set with the engineering tool	Value set with a program		Axis 1 to axis 16
[Pr.91] Optional data monitor: Data type setting 1	Set the index of the CiA402 object of the device.	Example) When monitoring the effective load ratio, set "2B09H".	0	100+150n
[Pr.92] Optional data monitor: Data type setting 2			0	101+150n
[Pr.93] Optional data monitor: Data type setting 3			0	102+150n
[Pr.94] Optional data monitor: Data type setting 4			0	103+150n
[Pr.591] Optional data monitor: Data type expansion setting 1	Set the sub-index and size of the CiA402 object of the device. Specify the size in bit lengths. 	Example) When monitoring the effective load ratio (sub-index: 00h, size 1 [Word]), set "0010H".	0	92+150n
[Pr.592] Optional data monitor: Data type expansion setting 2			0	93+150n
[Pr.593] Optional data monitor: Data type expansion setting 3			0	94+150n
[Pr.594] Optional data monitor: Data type expansion setting 4			0	95+150n

*1 Used point: 2 words

*2 The name differs depending on the connected device.

[Pr.91] to [Pr.94] Optional data monitor: Data type setting

Set the index of the CiA402 object of the device.

Point

- Registered monitor addresses for the optional data monitor are imported after the power is turned ON or the CPU module is reset.
- Set data types that use 2 points in either "[Pr.91] Optional data monitor: Data type setting 1" and "[Pr.591] Optional data monitor: Data type expansion setting 1" or "[Pr.93] Optional data monitor: Data type setting 3" and "[Pr.593] Optional data monitor: Data type expansion setting 3". The setting values of both "[Pr.92] Optional data monitor: Data type setting 2" and "[Pr.592] Optional data monitor: Data type expansion setting 2" and [Pr.94] Optional data monitor: Data type setting 4" and "[Pr.594] Optional data monitor: Data type expansion setting 4" are ignored.
- When a value other than 08H, 10H, 20H, or 40H is set as the size in "[Pr.591] Optional data monitor: Data type expansion setting 1" to "[Pr.594] Optional data monitor: Data type expansion setting 4", the value is treated as being 20H.
- When a CiA402 object that cannot be monitored is set, "PDO mapping setting error" (error code: 1C48H) occurs and communication with that axis is not performed.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 Extended parameters

[Pr.591] to [Pr.594] Optional data monitor: Data type expansion setting

Set the data type monitored in the optional data monitor function. For details of the data, refer to the manual of the servo amplifier.

Set the sub-index and size of the CiA402 object of the device.

For MR-J5(W)-G: 📖MR-J5-G/MR-J5W-G User's Manual (Object Dictionary)

Specify the size in bit lengths.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 Extended parameters

Servo object specification area

[Pr.512] to [Pr.515] Optional SDO 1 to 4

Used in the servo transient transmission function. Refer to the following for details.

☞ Page 382 Servo Transient Transmission Function

■Buffer memory address

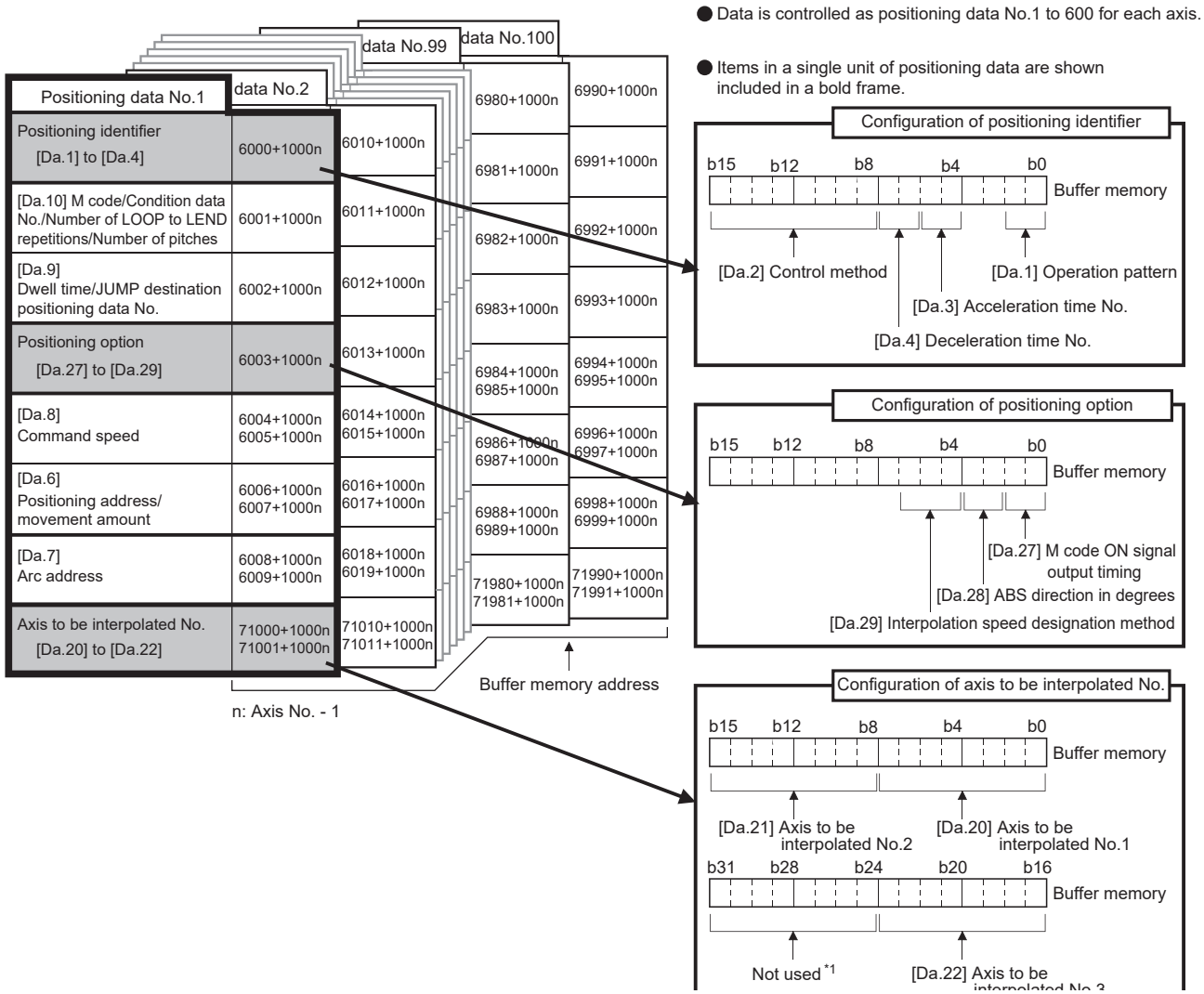
Refer to the following for the buffer memory address in this area.

☞ Page 447 Servo object specification area

12.4 Positioning data

Before explaining the positioning data setting items [Da.1] to [Da.10], [Da.20] to [Da.22], [Da.27] to [Da.29], the configuration of the positioning data is shown below.

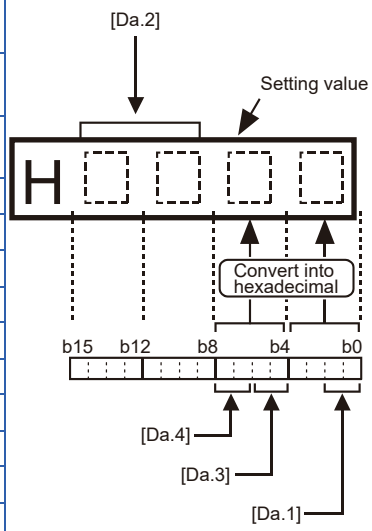
The positioning data stored in the buffer memory of the Motion module is the following configuration.

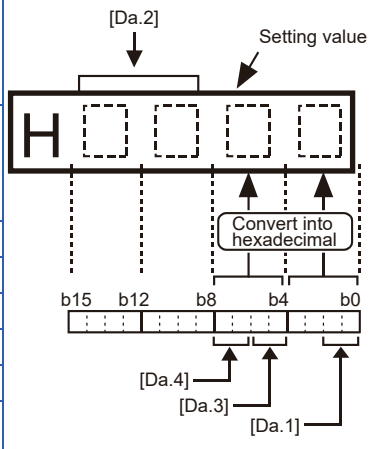


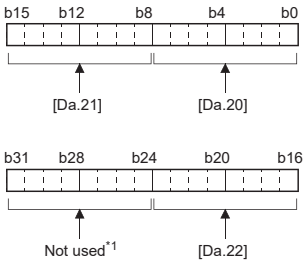
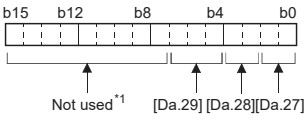
*1 Always "0" is set to the part not used.

The following explains the positioning data setting items [Da.1] to [Da.10], [Da.20] to [Da.22] and [Da.27] to [Da.29]. (The buffer memory addresses shown are those of the "positioning data No.1".)

n: Axis No. - 1

Item		Setting value			Default value	Buffer memory address
		Value set with the engineering tool	Value set with a program			Axis 1 to axis 16
Positioning identifier	[Da.1] Operation pattern	00: Positioning complete	00		0000H	6000+1000n
	[Da.2] Control method	01: Continuous positioning control	01			
		11: Continuous path control	11			
		01H: ABS Linear 1	01H			
		02H: INC Linear 1	02H			
		03H: Feed 1	03H			
		04H: FWD V1	04H			
		05H: RVS V1	05H			
		06H: FWD V/P	06H			
		07H: RVS V/P	07H			
		08H: FWD P/V	08H			
		09H: RVS P/V	09H			
		0AH: ABS Linear 2	0AH			
		0BH: INC Linear 2	0BH			
		0CH: Feed 2	0CH			
		0DH: ABS ArcMP	0DH			
		0EH: INC ArcMP	0EH			
		0FH: ABS ArcRGT	0FH			
		10H: ABS ArcLFT	10H			
		11H: INC ArcRGT	11H			
		12H: INC ArcLFT	12H			
		13H: FWD V2	13H			
		14H: RVS V2	14H			
		15H: ABS Linear 3	15H			
		16H: INC Linear 3	16H			
		17H: Feed 3	17H			
		18H: FWD V3	18H			
		19H: RVS V3	19H			
		1AH: ABS Linear 4	1AH			
		1BH: INC Linear 4	1BH			
		1CH: Feed 4	1CH			
		1DH: FWD V4	1DH			
		1EH: RVS V4	1EH			
		20H: Helical interpolation control with sub point specified (ABS)	20H			
		21H: Helical interpolation control with sub point specified (INC)	21H			
		22H: Helical interpolation control with center point specified (ABS, CW)	22H			
		23H: Helical interpolation control with center point specified (ABS, CCW)	23H			

Item		Setting value			Default value	Buffer memory address
		Value set with the engineering tool	Value set with a program			Axis 1 to axis 16
Positioning identifier	[Da.2] Control method	24H: Helical interpolation control with center point specified (INC, CW)	24H		0000H	6000+1000n
		25H: Helical interpolation control with center point specified (INC, CCW)	25H			
		80h: NOP	80H			
		81H: Address CHG	81H			
		82H: JUMP	82H			
		83H: LOOP	83H			
		84h: LEND	84H			
	[Da.3] Acceleration time No.	0: [Pr.9] Acceleration time 0	00			
		1: [Pr.25] Acceleration time 1	01			
		2: [Pr.26] Acceleration time 2	10			
		3: [Pr.27] Acceleration time 3	11			
	[Da.4] Deceleration time No.	0: [Pr.10] Deceleration time 0	00			
		1: [Pr.28] Deceleration time 1	01			
		2: [Pr.29] Deceleration time 2	10			
		3: [Pr.30] Deceleration time 3	11			
[Da.6] Positioning address/movement amount		The setting value range differs according to "[Da.2] Control method".			0	6006+1000n 6007+1000n
[Da.7] Arc address					0	6008+1000n 6009+1000n
[Da.8] Command speed		The setting value range differs depending on "[Pr.1] Unit setting".			0	6004+1000n 6005+1000n
		-1: Current speed (Speed 1006005+1000n set for previous positioning data No.)	-1			

Item		Setting value			Default value	Buffer memory address
		Value set with the engineering tool	Value set with a program			Axis 1 to axis 16
[Da.9] Dwell time/ JUMP destination positioning data No.	Dwell time	The setting value range differs according to "[Da.2] Control method".			0	6002+1000n
	JUMP destination positioning data No.					
[Da.10] M code/ Condition data No./Number of LOOP to LEND repetitions/ Number of pitches	M code				0	6001+1000n
	Condition data					
	Number of LOOP to LEND repetitions					
Axis to be interpolated	[Da.20] Axis to be interpolated No.1 [Da.21] Axis to be interpolated No.2 [Da.22] Axis to be interpolated No.3	0: Axis 1 selected 1: Axis 2 selected 2: Axis 3 selected 3: Axis 4 selected 4: Axis 5 selected 5: Axis 6 selected 6: Axis 7 selected 7: Axis 8 selected 8: Axis 9 selected 9: Axis 10 selected A: Axis 11 selected B: Axis 12 selected C: Axis 13 selected D: Axis 14 selected E: Axis 15 selected F: Axis 16 selected	0H 1H 2H 3H 4H 5H 6H 7H 8H 9H AH BH CH DH EH FH	 *1: Always "0" is set to the part not used.	0000H	71000+1000n 71001+1000n
Positioning option	[Da.27] M code ON signal output timing	0: Uses the setting value of "[Pr.18] M code ON signal output timing". 1: WITH mode 2: AFTER mode	0 1 2	 *1: Always "0" is set to the part not used.	0000H	6003+1000n
	[Da.28] ABS direction in degrees	0: Uses the setting value of "[Cd.40] ABS direction in degrees". 1: ABS circular right 2: ABS circular left 3: Takes a shortcut. (Specified direction ignored.)	0 1 2 3			
	[Da.29] Interpolation speed designation method	0: Uses the setting value of "[Pr.20] Interpolation speed designation method". 1: Composite speed 2: Reference axis speed	0 1 2			

[Da.1] Operation pattern

The operation pattern designates whether positioning of a certain data No. is to be ended with just that data, or whether the positioning for the next data No. is to be carried out in succession.

Operation pattern	Setting value	Details
Positioning complete	00	Set to execute positioning to the designated address, and then complete positioning.
Continuous positioning control	01	Positioning is carried out successively in order of data Nos. with one start signal. The operation halts at each position indicated by a positioning data.
Continuous path control	11	Positioning is carried out successively in order of data Nos. with one start signal. The operation does not stop at each positioning data.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

[Da.2] Control method

Set the "control method" for carrying out positioning control.

Point

- When "JUMP instruction" is set for the control method, "[Da.9] Dwell time/JUMP destination positioning data No." and "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" setting details will differ.
- In case you selected "LOOP" as the control method, "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" should be set differently from other cases.
- Refer to the following for details on the control methods.

☞ Page 43 MAJOR POSITIONING CONTROL

- If "degree" is set for "[Pr.1] Unit setting", 2-axis circular interpolation control and 3-axis helical interpolation control cannot be carried out. ("Circular interpolation not possible" (error code: 1A9FH) will occur when executed.)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

[Da.3] Acceleration time No.

Set which of "acceleration time 0 to 3" to use for the acceleration time during positioning.

0: Use the value set in "[Pr.9] Acceleration time 0".

1: Use the value set in "[Pr.25] Acceleration time 1".

2: Use the value set in "[Pr.26] Acceleration time 2".

3: Use the value set in "[Pr.27] Acceleration time 3".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

[Da.4] Deceleration time No.

Set which of "deceleration time 0 to 3" to use for the deceleration time during positioning.

0: Use the value set in "[Pr.10] Deceleration time 0".

1: Use the value set in "[Pr.28] Deceleration time 1".

2: Use the value set in "[Pr.29] Deceleration time 2".

3: Use the value set in "[Pr.30] Deceleration time 3".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

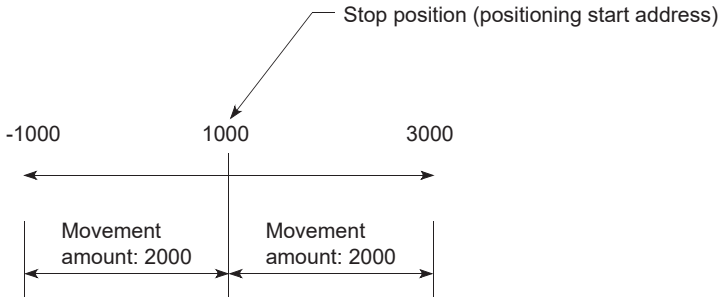
[Da.6] Positioning address/movement amount

Set the address to be used as the target value for positioning control.

The setting value range differs according to "[Da.2] Control method".

■Absolute (ABS) system, current value changing

- The setting value (positioning address) for the ABS system and current value changing is set with an absolute address (address from home position).

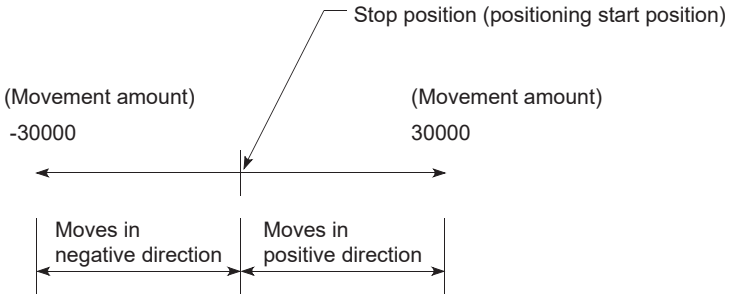


■Incremental (INC) system, fixed-feed 1, fixed-feed 2, fixed-feed 3, fixed-feed 4

- The setting value (movement amount) for the INC system is set as a movement amount with sign.

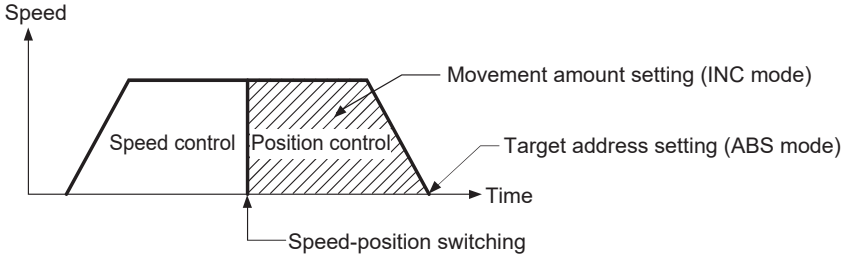
When movement amount is positive: Moves in the positive direction (address increment direction)

When movement amount is negative: Moves in the negative direction (address decrement direction)



■Speed-position switching control

- INC mode: Set the amount of movement after the switching from speed control to position control.
- ABS mode: Set the absolute address which will be the target value after speed control is switched to position control. (The unit is "degree" only)



■Position-speed switching control

• Set the amount of movement before the switching from position control to speed control.

●When "[Pr.1] Unit setting" is "mm"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

[Da.2] setting value	Value set with the engineering tool (μm)	Value set with a program*1 (× 10^{-1}μm)
ABS Linear 1: 01H ABS Linear 2: 0AH ABS Linear 3: 15H ABS Linear 4: 1AH Current value changing: 81H	• Set the address -214748364.8 to 214748364.7	• Set the address -2147483648 to 2147483647
INC Linear 1: 02H INC Linear 2: 0BH INC Linear 3: 16H INC Linear 4: 1BH Fixed-feed 1: 03H Fixed-feed 2: 0CH Fixed-feed 3: 17H Fixed-feed 4: 1CH	• Set the movement amount -214748364.8 to 214748364.7	• Set the movement amount -2147483648 to 2147483647
Forward run speed/position: 06H Reverse run speed/position: 07H Forward run position/speed: 08H Reverse run position/speed: 09H	• Set the movement amount 0 to 214748364.7	• Set the movement amount 0 to 2147483647
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -214748364.8 to 214748364.7	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -214748364.8 to 214748364.7	• Set the movement amount -2147483648 to 2147483647
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -214748364.8 to 214748364.7	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -214748364.8 to 214748364.7	• Set the movement amount -2147483648 to 2147483647

*1 Set an integer because the program cannot handle fractions.
(The value will be converted properly within the system.)

●When "[Pr.1] Unit setting" is "degree"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

[Da.2] setting value	Value set with the engineering tool (degree)	Value set with a program[*1] (× 10^{-5}degree)
ABS Linear 1: 01H ABS Linear 2: 0AH ABS Linear 3: 15H ABS Linear 4: 1AH Current value changing: 81H	• Set the address 0 to 359.99999	• Set the address 0 to 35999999
INC Linear 1: 02H INC Linear 2: 0BH INC Linear 3: 16H INC Linear 4: 1BH Fixed-feed 1: 03H Fixed-feed 2: 0CH Fixed-feed 3: 17H Fixed-feed 4: 1CH	• Set the movement amount -21474.83648 to 21474.83647	• Set the movement amount -2147483648 to 2147483647[*2]
Forward run speed/position: 06H Reverse run speed/position: 07H	In INC mode • Set the movement amount 0 to 21474.83647 In ABS mode • Set the address 0 to 359.99999	In INC mode • Set the movement amount 0 to 2147483647 In ABS mode • Set the address 0 to 35999999
Forward run position/speed: 08H Reverse run position/speed: 09H	• Set the movement amount 0 to 21474.83647	• Set the movement amount 0 to 2147483647
ABS helical sub: 20H[*3] ABS helical right: 22H[*3] ABS helical left: 23H[*3]	• Set the address 0 to 359.99999	• Set the address 0 to 35999999
INC helical sub: 21H[*3] INC helical right: 24H[*3] INC helical left: 25H[*3]	• Set the movement amount -21474.83648 to 21474.83647	• Set the movement amount -2147483648 to 2147483647[*2]

*1 Set an integer because the program cannot handle fractions.
(The value will be converted properly within the system.)

*2 When the software stroke limit is valid, -35999999 to 35999999 is set.

*3 The axis where "degree" can be set in the 3-axis helical interpolation control is only the linear interpolation axis.

●When "[Pr.1] Unit setting" is "pulse"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

[Da.2] setting value	Value set with the engineering tool (pulse)	Value set with a program (pulse)
ABS Linear 1: 01H ABS Linear 2: 0AH ABS Linear 3: 15H ABS Linear 4: 1AH Current value changing: 81H	• Set the address -2147483648 to 2147483647	• Set the address -2147483648 to 2147483647
INC Linear 1: 02H INC Linear 2: 0BH INC Linear 3: 16H INC Linear 4: 1BH Fixed-feed 1: 03H Fixed-feed 2: 0CH Fixed-feed 3: 17H Fixed-feed 4: 1CH	• Set the movement amount -2147483648 to 2147483647	• Set the movement amount -2147483648 to 2147483647
Forward run speed/position: 06H Reverse run speed/position: 07H Forward run position/speed: 08H Reverse run position/speed: 09H	• Set the movement amount 0 to 2147483647	• Set the movement amount 0 to 2147483647
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -2147483648 to 2147483647	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -2147483648 to 2147483647	• Set the movement amount -2147483648 to 2147483647
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -2147483648 to 2147483647	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -2147483648 to 2147483647	• Set the movement amount -2147483648 to 2147483647

●When "[Pr.1] Unit setting" is "inch"

The table below lists the control methods that require the setting of the positioning address or movement amount and the associated setting ranges.

(With any control method excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

[Da.2] setting value	Value set with the engineering tool (inch)	Value set with a program*1 (× 10^{-5}inch)
ABS Linear 1: 01H ABS Linear 2: 0AH ABS Linear 3: 15H ABS Linear 4: 1AH Current value changing: 81H	• Set the address -21474.83648 to 21474.83647	• Set the address -2147483648 to 2147483647
INC Linear 1: 02H INC Linear 2: 0BH INC Linear 3: 16H INC Linear 4: 1BH Fixed-feed 1: 03H Fixed-feed 2: 0CH Fixed-feed 3: 17H Fixed-feed 4: 1CH	• Set the movement amount -21474.83648 to 21474.83647	• Set the movement amount -2147483648 to 2147483647
Forward run speed/position: 06H Reverse run speed/position: 07H Forward run position/speed: 08H Reverse run position/speed: 09H	• Set the movement amount 0 to 21474.83647	• Set the movement amount 0 to 2147483647
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -21474.83648 to 21474.83647	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -21474.83648 to 21474.83647	• Set the movement amount -2147483648 to 2147483647
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -21474.83648 to 21474.83647	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -21474.83648 to 21474.83647	• Set the movement amount -2147483648 to 2147483647

*1 Set an integer because the program cannot handle fractions.
(The value will be converted properly within the system.)

■Buffer memory address

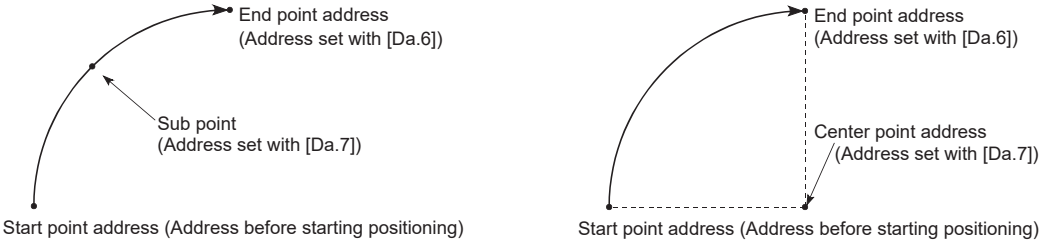
Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

[Da.7] Arc address

The arc address is data required only when carrying out 2-axis circular interpolation control or 3-axis helical interpolation control.

- When carrying out circular interpolation with sub point designation, set the sub point (passing point) address as the arc address.
- When carrying out circular interpolation with center point designation, set the center point address of the arc as the arc address.



<(1) Circular interpolation with sub point designation> <(2) Circular interpolation with center point designation>

When not carrying out 2-axis circular interpolation control or 3-axis helical interpolation control, the value set in "[Da.7] Arc address" will be invalid.

■When "[Pr.1] Unit setting" is "mm"

The table below lists the control methods that require the setting of the arc address and shows the setting range.
(With any control method excluded from the table below, the arc address does not need to be set.)

[Da.2] setting value	Value set with the engineering tool (μm)	Value set with a program[*1] (× 10^{-1}μm)
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -214748364.8 to 214748364.7[*2]	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -214748364.8 to 214748364.7[*2]	• Set the movement amount -2147483648 to 2147483647[*1]
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -214748364.8 to 214748364.7	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -214748364.8 to 214748364.7[*2]	• Set the movement amount -2147483648 to 2147483647

*1 Set an integer because the program cannot handle fractions.
(The value will be converted properly within the system.)

*2 Note that the maximum radius that 2-axis circular interpolation control is possible is 536870912 (× 10^{-1}μm), although the setting value can be input within the range shown in the above table, as an arc address.

■When "[Pr.1] Unit setting" is "degree"

No control method requires the setting of the arc address by "degree".

■When "[Pr.1] Unit setting" is "pulse"

The table below lists the control methods that require the setting of the arc address and shows the setting range.
(With any control method excluded from the table below, the arc address does not need to be set.)

[Da.2] setting value	Value set with the engineering tool (pulse)	Value set with a program (pulse)
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -2147483648 to 2147483647*1	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -2147483648 to 2147483647*1	• Set the movement amount -2147483648 to 2147483647*1
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -2147483648 to 2147483647	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -2147483648 to 2147483647*1	• Set the movement amount -2147483648 to 2147483647*1

*1 Note that the maximum radius that 2-axis circular interpolation control is possible is 536870912 (pulse), although the setting value can be input within the range shown in the above table, as an arc address.

■When "[Pr.1] Unit setting" is "inch"

The table below lists the control methods that require the setting of the arc address and shows the setting range.
(With any control method excluded from the table below, the arc address does not need to be set.)

[Da.2] setting value	Value set with the engineering tool (inch)	Value set with a program*1 (× 10^{-5}inch)
ABS circular sub: 0DH ABS circular right: 0FH ABS circular left: 10H	• Set the address -21474.83648 to 21474.83647*2	• Set the address -2147483648 to 2147483647
INC circular sub: 0EH INC circular right: 11H INC circular left: 12H	• Set the movement amount -21474.83648 to 21474.83647*2	• Set the movement amount -2147483648 to 2147483647*2
ABS helical sub: 20H ABS helical right: 22H ABS helical left: 23H	• Set the address -21474.83648 to 21474.83647	• Set the address -2147483648 to 2147483647
INC helical sub: 21H INC helical right: 24H INC helical left: 25H	• Set the movement amount -21474.83648 to 21474.83647*2	• Set the movement amount -2147483648 to 2147483647*2

*1 Set an integer because the program cannot handle fractions.
(The value will be converted properly within the system.)

*2 Note that the maximum radius that 2-axis circular interpolation control is possible is 536870912 (× 10^{-5}inch), although the setting value can be input within the range shown in the above table, as an arc address.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

[Da.8] Command speed

Set the command speed for positioning.

- If the set command speed exceeds "[Pr.8] Speed limit value", positioning will be carried out at the speed limit value.
- If "-1" is set for the command speed, the current speed (speed set for previous positioning data No.) will be used for positioning control. Use the current speed for uniform speed control, etc. If "-1" is set for continuing positioning data, and the speed is changed, the following speed will also change.

Note that when starting positioning, if the "-1" speed is set for the positioning data that carries out positioning control first, "No command speed" (error code: 1B12H) will occur, and the positioning will not start.

Refer to the following for details on the errors.

☞ Page 662 List of Error Codes

[Pr.1] setting value	Value set with the engineering tool (unit)	Value set with a program (unit)
0: mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 (× 10^{-2}mm/min)
1: inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 (× 10^{-3}inch/min)
2: degree	0.001 to 2000000.000 (degree/min)*1	1 to 2000000000 (× 10^{-3}degree/min)*2
3: pulse	1 to 1000000000 (pulse/s)	1 to 1000000000 (pulse/s)

*1 The range of command speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 0.01 to 20000000.00 (degree/min)

*2 The range of command speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid: 1 to 2000000000 (× 10^{-2} degree/min)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

[Da.9] Dwell time/JUMP destination positioning data No.

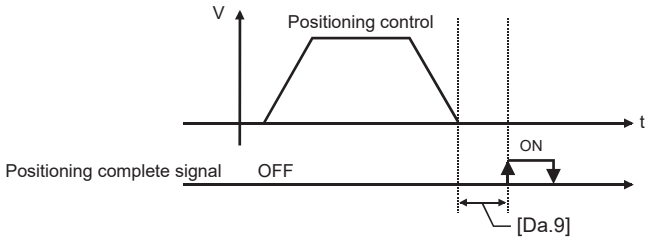
Set the "dwell time" or "positioning data No." corresponding to "[Da.2] Control method".

- When a method other than "JUMP instruction" is set for "[Da.2] Control method": Set the "dwell time".
- When "JUMP instruction" is set for "[Da.2] Control method": Set the "positioning data No." for the JUMP destination.

When the "dwell time" is set, the setting details of the "dwell time" will be as follows according to "[Da.1] Operation pattern".

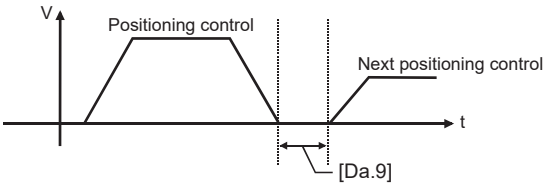
■When "[Da.1] Operation pattern" in "00: Positioning complete"

- Set the time from when the positioning ends to when the "positioning complete signal" turns ON as the "dwell time".



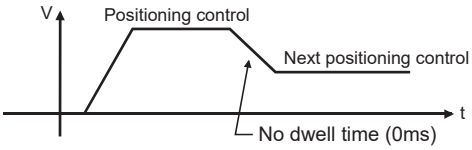
■When "[Da.1] Operation pattern" is "01: Continuous positioning control"

- Set the time from when positioning control ends to when the next positioning control starts as the "dwell time".



■When "[Da.1] Operation pattern" is "11: Continuous path control"

- The setting value is irrelevant to the control. (The "dwell time" is 0ms.)



[Da.2] setting value	Setting item	Value set with the engineering tool	Value set with a program*1
JUMP instruction: 82H	Positioning data No.	1 to 600	1 to 600
Other than JUMP instruction	Dwell time	0 to 65535 (ms)	0 to 65535 (ms)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches

Set an "M code", a "condition data No.", the "Number of LOOP to LEND repetitions" or the "Number of pitches" depending on how "[Da.2] Control method" is set.*1

*1 The condition data specifies the condition for the JUMP instruction to be executed. (A JUMP will take place when the condition is satisfied.)

■If a method other than "JUMP instruction", "LOOP", and "3-axis helical interpolation control" is selected as "[Da.2] Control method"

Set an "M code".

If no "M code" needs to be output, set "0" (default value).

■If "JUMP instruction" or "LOOP" is selected as "[Da.2] Control method"

Set the "condition data No." for JUMP.

- 0: Unconditional JUMP to the positioning data specified by "[Da.9] Dwell time/JUMP destination positioning data No.".
- 1 to 10: JUMP performed according to the condition data No. specified (a number between 1 and 10). Make sure that you specify the number of LOOP to LEND repetitions by a number other than "0". "Control method LOOP setting error" (error code: 1B33H) will occur if "0" is set.

■If "3-axis helical interpolation control" is selected as "[Da.2] Control method"

Set the number of pitches for the linear interpolation axis. The rotation speed of the circular interpolation is set with the number of pitch.

[Da.2] setting value	Setting item	Value set with the engineering tool	Value set with a program*1
JUMP instruction: 82H	Condition data No.	0 to 10	0 to 10
Helical interpolation: 20H to 25H	Number of pitches	0 to 999	0 to 999
LOOP: 83H	Repetition count	1 to 65535	1 to 65535
Other than the above	M code	0 to 65535	0 to 65535

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

[Da.20] Axis to be interpolated No.1 to [Da.22] Axis to be interpolated No.3

Set the axis to be interpolated to execute the 2 to 4-axis interpolation operation. Set the circular interpolation axis and the linear interpolation axis to execute the 3-axis helical interpolation control.

2-axis interpolation	Set the target axis No. in "[Da.20] Axis to be interpolated No.1".
3-axis interpolation	Set the target axis No. in "[Da.20] Axis to be interpolated No.1" and "[Da.21] Axis to be interpolated No.2".
4-axis interpolation	Set the target axis No. in "[Da.20] Axis to be interpolated No.1" to "[Da.22] Axis to be interpolated No.3".
3-axis helical interpolation	Set the circular interpolation axis in "[Da.20] Axis to be interpolated No.1" and the linear interpolation axis No. in "[Da.21] Axis to be interpolated No.2".

Set the axis set as axis to be interpolated.*1

Setting value	Axis to be interpolated	Setting value	Axis to be interpolated
0	Axis 1	8	Axis 9
1	Axis 2	9	Axis 10
2	Axis 3	A	Axis 11
3	Axis 4	B	Axis 12
4	Axis 5	C	Axis 13
5	Axis 6	D	Axis 14
6	Axis 7	E	Axis 15
7	Axis 8	F	Axis 16

*1 The setting value, whose axis No. exceeds the number of controlled axes, cannot be used.

Point

- Do not specify the own axis No. or the value outside the range. Otherwise, "Illegal interpolation description command" (error code: 1B22H) will occur during the program execution.
- When the same axis No. or axis No. of own axis is set to multiple axis to be interpolated No., "Illegal interpolation description command" (error code: 1B22H) will occur during the program execution.)
- Do not specify the axis to be interpolated No.2 and axis to be interpolated No.3 for 2-axis interpolation, and do not specify the axis to be interpolated No.3 for 3-axis interpolation. The setting value is ignored.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

[Da.27] M code ON signal output timing

Set the M code ON signal output timing to each positioning data.

Refer to the following for setting details.

☞ Page 464 [Pr.18] M code ON signal output timing

0: Uses the setting value of "[Pr.18] M code ON signal output timing".

1: WITH mode

2: AFTER mode

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

[Da.28] ABS direction in degrees

Set "[Cd.40] ABS direction in degrees" to each positioning data.

Refer to the following for setting details.

☞ Page 465 [Pr.20] Interpolation speed designation method

0: Uses the setting value of "[Cd.40] ABS direction in degrees".

1: ABS circular right

2: ABS circular left

3: Takes a shortcut. (Specified direction ignored.)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

[Da.29] Interpolation speed designation method

Set the interpolation speed designation method to each positioning data.

Refer to the following for setting details.

☞ Page 465 [Pr.20] Interpolation speed designation method

0: Uses the setting value of "[Pr.20] Interpolation speed designation method".

1: Composite speed

2: Reference axis speed

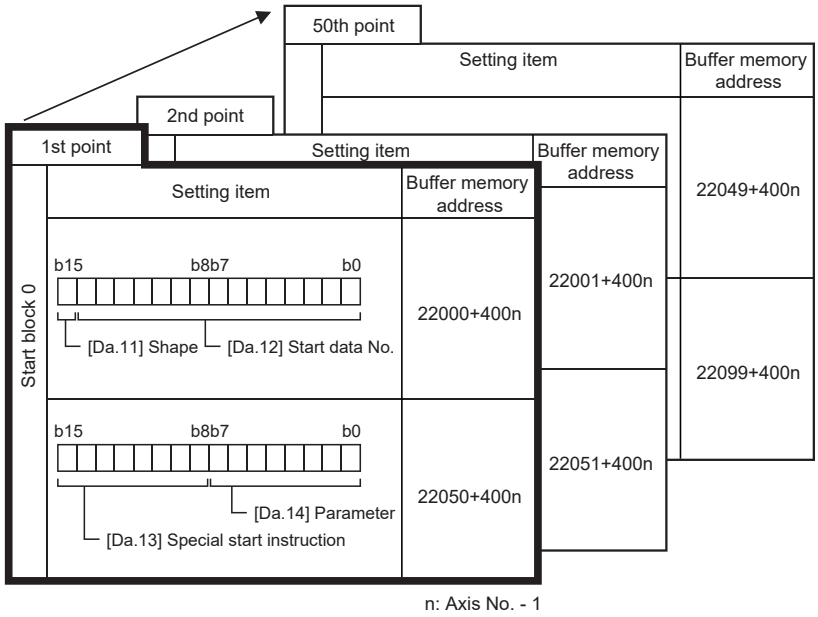
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 439 Positioning data

12.5 Block Start Data

Before explaining the block start data setting items [Da.11] to [Da.14], the configuration of the block start data is shown below.
The block start data stored in the buffer memory of the Motion module is the following configuration.



- Up to 50 block start data points can be set (stored) for each axis in the buffer memory addresses shown on the left.
- Items in a single unit of block start data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).

n: Axis No. - 1

The following explains the block start data setting items [Da.11] to [Da.14]. (The buffer memory addresses shown are those of the "1st point block start data (block No.7000)".)

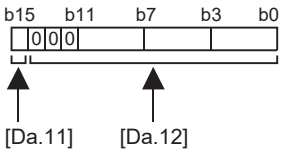
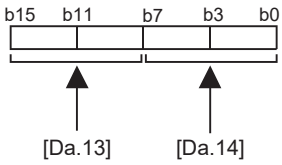
Point

- To perform a high-level positioning control using block start data, set a number between 7000 and 7004 to "[Cd.3] Positioning start No." and use "[Cd.4] Positioning starting point No." to specify a point No. between 1 and 50, a position counted from the beginning of the block.
- The number between 7000 and 7004 specified here is called the "block No.".
- With the Motion module, up to 50 "block start data" points and up to 10 "condition data" items can be assigned to each "block No.".

Block No.*1	Axis	Block Start Data	Condition	Buffer memory	Engineering tool
7000	Axis 1	Start block 0	Condition data (1 to 10)	Supports the settings	Supports the settings
	⋮		⋮		
	Maximum control axis No.		Condition data (1 to 10)		
7001	Axis 1	Start block 1	Condition data (1 to 10)		
	⋮		⋮		
	Maximum control axis No.		Condition data (1 to 10)		
7002	Axis 1	Start block 2	Condition data (1 to 10)		
	⋮		⋮		
	Maximum control axis No.		Condition data (1 to 10)		
7003	Axis 1	Start block 3	Condition data (1 to 10)		
	⋮		⋮		
	Maximum control axis No.		Condition data (1 to 10)		
7004	Axis 1	Start block 4	Condition data (1 to 10)		
	⋮		⋮		
	Maximum control axis No.		Condition data (1 to 10)		

*1 Setting cannot be made when the "Pre-reading start function" is used. If you set any of Nos. 7000 to 7004 and perform the Pre-reading start function, "Outside start No. range" (error code: 1AA3H)" will occur.
Refer to the following for details.
☞ Page 273 Pre-reading start function

n: Axis No. - 1

Item	Setting value			Default value	Buffer memory address
	Value set with the engineering tool	Value set with a program			Axis 1 to axis 16
[Da.11] Shape	0: End	0		0000H	22000+400n
	1: Continue	1			
[Da.12] Start data No.	Positioning data No: 1 to 600 (01H to 258H)	01H to 258H			
[Da.13] Special start instruction	0: Block start (Normal Start)	00H		0000H	22050+400n
	1: Condition Start	01H			
	2: Wait Start	02H			
	3: Simultaneous Start	03H			
	4: FOR Loop	04H			
	5: FOR Condition	05H			
	6: NEXT Start	06H			
[Da.14] Parameter	Condition data No.: 1 to 10 (01H to 0AH) Number of repetitions: 0 to 255 (00H to FFH)	00H to FFH			

[Da.11] Shape

Set whether to carry out only the local "block start data" and then end control, or to execute the "block start data" set in the next point.

Setting value	Setting details
0: End	Execute the designated point's "block start data", and then complete the control.
1: Continue	Execute the designated point's "block start data", and after completing control, execute the next point's "block start data".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 441 Positioning data (Block start data)

[Da.12] Start data No.

Set the "positioning data No." designated with the "block start data".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 441 Positioning data (Block start data)

[Da.13] Special start instruction

Set the "special start instruction" for using "high-level positioning control". (Set how to start the positioning data set in "[Da.12] Start data No.".)

Setting value	Setting details
00H: Block start (Normal Start)	Execute the random block positioning data in the set order with one start.
01H: Condition Start	Carry out the condition judgment set in "condition data" for the designated positioning data, and when the conditions are established, execute the "block start data". If not established, ignore that "block start data", and then execute the next point's "block start data".
02H: Wait Start	Carry out the condition judgment set in "condition data" for the designated positioning data, and when the conditions are established, execute the "block start data". If not established, stop the control (wait) until the conditions are established.
03H: Simultaneous Start	Simultaneously execute (output command at same timing) the positioning data with the No. designated for the axis designated in the "condition data". Up to four axes can start simultaneously.
04H: Repeated start (FOR Loop)	Repeat the program from the block start data with the "FOR Loop" to the block start data with "NEXT" for the designated number of times.
05H: Repeated start (FOR Condition)	Repeat the program from the block start data with the "FOR Condition" to the block start data with "NEXT" until the conditions set in the "condition data" are established.
06H: NEXT Start	Set the end of the repetition when "04H: Repetition start (FOR Loop)" or "05H: Repetition start (FOR Condition)" is set.

Refer to the following for details on the control.

☞ Page 141 HIGH-LEVEL POSITIONING CONTROL

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 441 Positioning data (Block start data)

[Da.14] Parameter

Set the value as required for "[Da.13] Special start instruction".

[Da.13] Special start instruction	Setting value	Setting details
Block start (Normal Start)	—	Not used. (There is no need to set.)
Condition Start	1 to 10	Set the condition data No. (Data No. of "condition data" is set up for the condition judgment.) (Refer to ☞ Page 509 Condition Data.)
Wait Start		
Simultaneous Start		
Repeated start (FOR Loop)	0 to 255	Set the number of repetitions.
Repeated start (FOR Condition)	1 to 10	Set the condition data No. (Data No. of "condition data" is set up for the condition judgment.)

■Buffer memory address

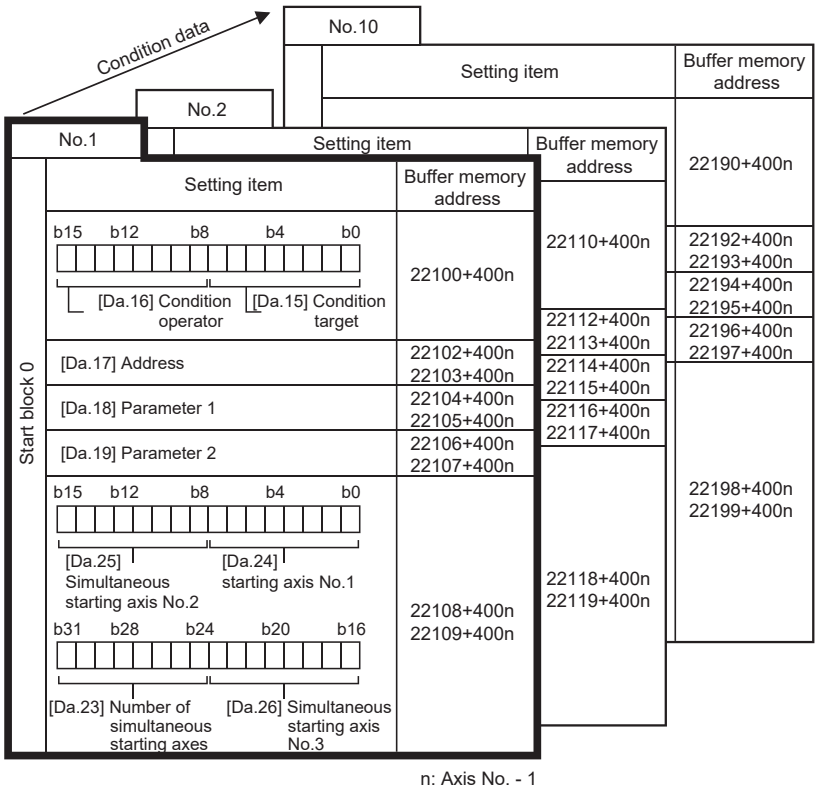
Refer to the following for the buffer memory address in this area.

☞ Page 441 Positioning data (Block start data)

12.6 Condition Data

Before explaining the condition data setting items [Da.15] to [Da.19] and [Da.23] to [Da.26], the configuration of the condition data is shown below.

The condition data stored in the positioning data of the Motion module is the following configuration.



n: Axis No. - 1

- Up to 10 condition data points can be set (stored) for each block No. in the buffer memory addresses shown on the left.
- Items in a single unit of condition data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).

The following explains the condition data setting items [Da.15] to [Da.19] and [Da.23] to [Da.26]. (The buffer memory addresses shown are those of the "condition data No.1 (block No.7000)".)

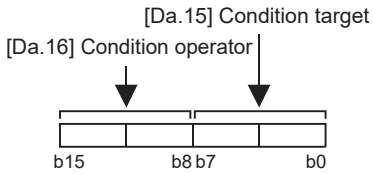
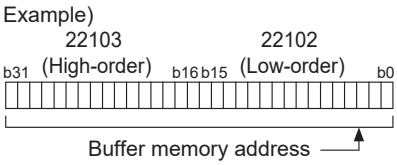
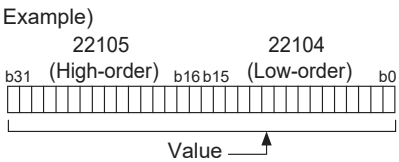
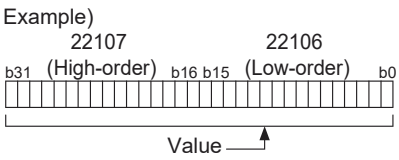
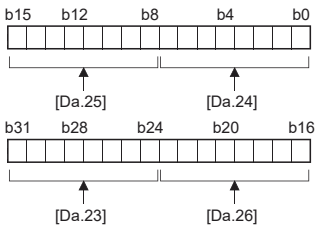
Point

- To perform a high-level positioning control using block start data, set a number between 7000 and 7004 to "[Cd.3] Positioning start No." and use "[Cd.4] Positioning starting point No." to specify a point No. between 1 and 50, a position counted from the beginning of the block.
- The number between 7000 and 7004 specified here is called the "block No.".
- With the Motion module, up to 50 "block start data" points and up to 10 "condition data" items can be assigned to each "block No.".

Block No.*1	Axis	Block start data	Condition	Buffer memory	Engineering tool
7000	Axis 1	Start block 0	Condition data (1 to 10)	Supports the settings	Supports the settings
	⋮		⋮		
	Maximum control axis No.		Condition data (1 to 10)		
7001	Axis 1	Start block 1	Condition data (1 to 10)		
	⋮		⋮		
	Maximum control axis No.		Condition data (1 to 10)		
7002	Axis 1	Start block 2	Condition data (1 to 10)		
	⋮		⋮		
	Maximum control axis No.		Condition data (1 to 10)		
7003	Axis 1	Start block 3	Condition data (1 to 10)		
	⋮		⋮		
	Maximum control axis No.		Condition data (1 to 10)		
7004	Axis 1	Start block 4	Condition data (1 to 10)		
	⋮		⋮		
	Maximum control axis No.		Condition data (1 to 10)		

*1 Setting cannot be made when the "Pre-reading start function" is used. If you set any of Nos. 7000 to 7004 and perform the Pre-reading start function, "Outside start No. range" (error code: 1AA3H)" will occur.
Refer to the following for details.
☞ Page 273 Pre-reading start function

n: Axis No. - 1

Item		Setting value			Default value	Buffer memory address
		Value set with the engineering tool	Value set with a program			Axis 1 to axis 16
Condition identifier	[Da.15] Condition target	01: Device X	01H		0000H	22100+400n
		02: Device Y	02H			
		03: Buffer memory (1-word)	03H			
		04: Buffer memory (2-word)	04H			
		05: Positioning data No.	05H			
	[Da.16] Condition operator	01: ** = P1	01H			
		02: **≠P1	02H			
		03: ** ≤ P1	03H			
		04: ** ≥ P1	04H			
		05: P1 ≤ ** ≤ P2	05H			
		06: ** ≤ P1, P2 ≤ **	06H			
		07: DEV = ON	07H			
		08: DEV = OFF	08H			
[Da.17] Address		Buffer memory address			0000H	22102+400n 22103+400n
[Da.18] Parameter 1		Value			0000H	22104+400n 22105+400n
[Da.19] Parameter 2		Value			0000H	22106+400n 22107+400n
Simultaneous starting axis	[Da.23] Number of simultaneous starting axes	2: 2 axes	2H		0000H	22108+400n 22109+400n
		3: 3 axes	3H			
		4: 4 axes	4H			
	[Da.24] Simultaneous starting axis No.1	0: Axis 1 selected	0H			
		1: Axis 2 selected	1H			
		2: Axis 3 selected	2H			
		3: Axis 4 selected	3H			
		4: Axis 5 selected	4H			
	[Da.25] Simultaneous starting axis No.2	5: Axis 6 selected	5H			
		6: Axis 7 selected	6H			
		7: Axis 8 selected	7H			
		8: Axis 9 selected	8H			
		9: Axis 10 selected	9H			
		A: Axis 11 selected	AH			
	[Da.26] Simultaneous starting axis No.3	B: Axis 12 selected	BH			
		C: Axis 13 selected	CH			
		D: Axis 14 selected	DH			
		E: Axis 15 selected	EH			
		F: Axis 16 selected	FH			

[Da.15] Condition target

Set the condition target as required for each control.

Setting value	Setting details
01H: Device X	Set the state (ON/OFF) of an I/O signal as a condition.
02H: Device Y	
03H: Buffer memory (1-word)	Set the value stored in the buffer memory as a condition. 03H: The target buffer memory is "1-word (16 bits)" 04H: The target buffer memory is "2-word (32 bits)"
04H: Buffer memory (2-word)	
05H: Positioning data No.	Select only for "simultaneous start".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 441 Positioning data (Block start data)

[Da.16] Condition operator

Set the condition operator as required for "[Da.15] Condition target".

[Da.15] Condition target	Setting value	Setting details
01H: Device X 02H: Device Y	07H: DEV = ON	When the state (ON/OFF) of an I/O signal is set as a condition, select ON or OFF as the trigger.
	08H: DEV = OFF	
03H: Buffer memory (1-word) 04H: Buffer memory (2-word)	01H: ** = P1	Select how to use the value (**) in the buffer memory as a part of the condition.
	02H: ** ≠ P1	
	03H: ** ≤ P1	
	04H: ** ≥ P1	
	05H: P1 ≤ ** ≤ P2	
	06H: ** ≤ P1, P2 ≤ **	

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 441 Positioning data (Block start data)

[Da.17] Address

Set the address as required for "[Da.15] Condition target".

[Da.15] Condition target	Setting value	Setting details
01H: Device X	—	Not used. (There is no need to set.)
02H: Device Y		
03H: Buffer memory (1-word)	Value (Buffer memory address)*1	Set the target "buffer memory address". (For 2-word, set the low-order buffer memory address.)
04H: Buffer memory (2-word)		
05H: Positioning data No.	—	Not used. (There is no need to set.)

*1 The setting range of the buffer memory address for the buffer memory specification is as follows.

[Da.15] Condition target	Buffer memory address range
03H: Buffer memory (1-word)	0 to 16777215
04H: Buffer memory (2-word)	0 to 16777214

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 441 Positioning data (Block start data)

[Da.18] Parameter 1

Set the parameters as required for "[Da.16] Condition operator" and "[Da.23] Number of simultaneous starting axes".

[Da.16] Condition operator	[Da.23] Number of simultaneous starting axes	Setting value	Setting details
01H: ** = P1	—	Value	The value of P1 should be equal to or smaller than the value of P2. (P1 ≤ P2) If P1 is greater than P2 (P1 > P2), "Condition data error" (error code: 1B00H to 1B05H) will occur.
02H: ** ≠ P1			
03H: ** ≤ P1			
04H: ** ≥ P1			
05H: P1 ≤ ** ≤ P2			
06H: ** ≤ P1, P2 ≤ **			
07H: DEV = ON		Value (bit No.)	Set the device bit No. X: 0H, 1H, 10H to 1FH*1 Y: 0H, 1H, 10H to 1FH*1 RWr (1-bit), RWw (1-bit): 0 to F
08H: DEV = OFF			
—	2 to 4	Value (positioning data No.)	Set the positioning data No. for starting axis set in "[Da.24] Simultaneous starting axis No.1" and/or "[Da.25] Simultaneous starting axis No.2". Low-order 16-bit: Simultaneous starting axis No.1 positioning data No.1 to 600 (01H to 258H) High-order 16-bit: Simultaneous starting axis No.2 positioning data No.1 to 600 (01H to 258H)

*1 The setting value, whose axis No. exceeds the number of controlled axes, cannot be used.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 441 Positioning data (Block start data)

[Da.19] Parameter 2

Set the parameters as required for "[Da.16] Condition operator" and "[Da.23] Number of simultaneous starting axes".

[Da.16] Condition operator	[Da.23] Number of simultaneous starting axes	Setting value	Setting details
01H: ** = P1	—	—	Not used. (There is no need to set.)
02H: ** ≠ P1			
03H: ** ≤ P1			
04H: ** ≥ P1			
05H: P1 ≤ ** ≤ P2		Value	The value of P2 should be equal to or greater than the value of P1. (P1 ≤ P2) If P1 is greater than P2 (P1 > P2), "Condition data error" (error code: 1B00H to 1B05H) will occur.
06H: ** ≤ P1, P2 ≤ **			
07H: DEV = ON		—	Not used. (There is no need to set.)
08H: DEV = OFF			
—	2 to 3		
	4	Value (positioning data No.)	Set the positioning data No. for starting axis set in "[Da.26] Simultaneous starting axis No.3". Low-order 16-bit: Simultaneous starting axis No.3 positioning data No.1 to 600 (01H to 258H) High-order 16-bit: Not used (Set "0")

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 441 Positioning data (Block start data)

[Da.23] Number of simultaneous starting axes

Set the number of simultaneous starting axes to execute the simultaneous start.

Number of axes	Details
2	Simultaneous start by 2 axes of the starting axis and axis set in "[Da.24] Simultaneous starting axis No.1".
3	Simultaneous start by 3 axes of the starting axis and axis set in "[Da.24] Simultaneous starting axis No.1" and "[Da.25] Simultaneous starting axis No.2".
4	Simultaneous start by 4 axes of the starting axis and axis set in "[Da.24] Simultaneous starting axis No.1" to "[Da.26] Simultaneous starting axis No.3".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 441 Positioning data (Block start data)

[Da.24] Simultaneous starting axis No.1 to [Da.26] Simultaneous starting axis No.3

Set the simultaneous starting axis to execute the 2 to 4-axis simultaneous start.

Simultaneous starting axis	Details
2-axis interpolation	Set the target axis No. in "[Da.24] Simultaneous starting axis No.1".
3-axis interpolation	Set the target axis No. in "[Da.24] Simultaneous starting axis No.1" and "[Da.25] Simultaneous starting axis No.2".
4-axis interpolation	Set the target axis No. in "[Da.24] Simultaneous starting axis No.1" to "[Da.26] Simultaneous starting axis No.3".

Set the axis set as simultaneous starting axis.*1

Setting value	Simultaneous starting axis	Setting value	Simultaneous starting axis
0	Axis 1	8	Axis 9
1	Axis 2	9	Axis 10
2	Axis 3	A	Axis 11
3	Axis 4	B	Axis 12
4	Axis 5	C	Axis 13
5	Axis 6	D	Axis 14
6	Axis 7	E	Axis 15
7	Axis 8	F	Axis 16

*1 The setting value, whose axis No. exceeds the number of controlled axes, cannot be used.

Point

- Do not specify the own axis No. or the value outside the range. Otherwise, "Condition data error" (error code: 1B00H to 1B05H) will occur during the program execution.
- When the same axis No. is set to multiple simultaneous starting axis Nos. or the value outside the range is set to the number of simultaneous starting axes, "Condition data error" (error code: 1B00H to 1B05H) will occur during the program execution.
- Do not specify the simultaneous starting axis No.2 and simultaneous starting axis No.3 for 2-axis simultaneously start, and not specify the simultaneous starting axis No.3 for 3-axis simultaneously start. The setting value is ignored.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 441 Positioning data (Block start data)

12.7 Monitor Data

The setting items of the monitor data are explained in this section.

System monitor data

Unless noted in particular, the monitor value is saved as binary data.

[Md.1] In test mode flag

Whether the mode is the test mode from the engineering tool or not is stored.

- When not in test mode: OFF
- When in test mode: ON

Stored value	In test mode flag
0	When not in test mode
1	When in test mode

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

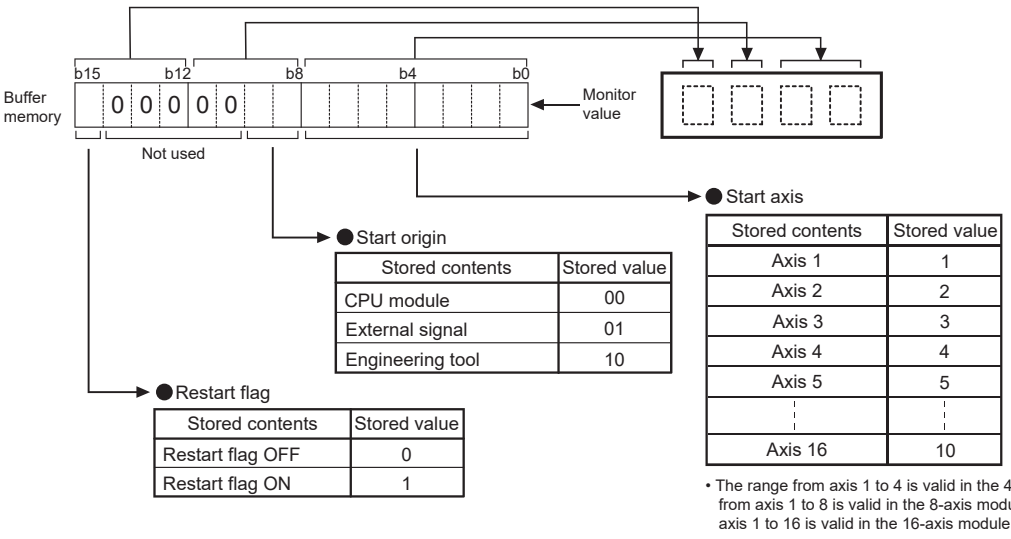
☞ Page 434 System monitor data

[Md.3] Start information

This area stores the start information (restart flag, start origin, and start axis):

- Restart flag: Indicates whether the operation has or has not been halted and restarted.
- Start origin: Indicates the source of the start signal.
- Start axis: Indicates the started axis.

The information shown in the diagram below is stored.



Stored contents	Stored value
CPU module	00
External signal	01
Engineering tool	10

Stored contents	Stored value
Restart flag OFF	0
Restart flag ON	1

Stored contents	Stored value
Axis 1	1
Axis 2	2
Axis 3	3
Axis 4	4
Axis 5	5
⋮	⋮
Axis 16	10

• The range from axis 1 to 4 is valid in the 4-axis module, from axis 1 to 8 is valid in the 8-axis module, and from axis 1 to 16 is valid in the 16-axis module.

Refresh cycle: At start

Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.4] Start No.

The start No. is stored.

Stored value[*1]	Start No.
001 to 600(0001H to 0258H) 7000(1B58H) 7001(1B59H) 7002(1B5AH) 7003(1B5BH) 7004(1B5CH)	Positioning operation
9010(2332H)	JOG operation
9011(2333H)	Manual pulse generator operation
9001(2329H)	Machine home position return
9002(232AH)	Fast home position return
9003(232BH)	Current value changing
9004(232CH)	Simultaneous start
9020(233CH)	Synchronous control operation
9030(2346H)	Position control mode → speed control mode switching
9031(2347H)	Position control mode → torque control mode switching
9032(2348H)	Speed control mode → torque control mode switching
9033(2349H)	Torque control mode → speed control mode switching
9034(234AH)	Speed control mode → position control mode switching
9035(234BH)	Torque control mode → position control mode switching
9036(234CH)	Outside the range of control mode setting
9037(234DH)	Position control mode → continuous operation to torque control mode switching
9038(234EH)	Continuous operation to torque control mode → position control mode switching
9039(234FH)	Speed control mode → continuous operation to torque control mode switching
9040(2350H)	Continuous operation to torque control mode → speed control mode switching
9041(2351H)	Torque control mode → continuous operation to torque control mode switching
9042(2352H)	Continuous operation to torque control mode → torque control mode switching

Refresh cycle: At start

*1 At start from the test mode, the stored value differs depending on the number of operation axes. Refer to the following for details.
☞ Page 385 Test mode
1 axis: 1
2 to 4 axes: Simultaneous starting of multiple axes (9004)

Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

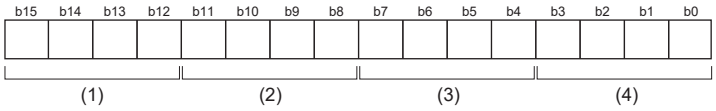
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.54] Start (Year: month)

The starting time (Year: month) is stored.

Buffer memory configuration	Stored contents		Storage value
	(1)	Year (tens place)	0 to 9
	(2)	Year (ones place)	0 to 9
	(3)	Month (tens place)	0, 1
	(4)	Month (ones place)	0 to 9

Refresh cycle: At start

Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

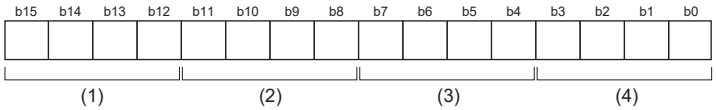
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.5] Start (Day: hour)

The starting time (Day: hour) is stored.

Buffer memory configuration	Stored contents		Storage value
	(1)	Day (tens place)	0 to 3
	(2)	Day (ones place)	0 to 9
	(3)	Hour (tens place)	0 to 2
	(4)	Hour (ones place)	0 to 9

Refresh cycle: At start

Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

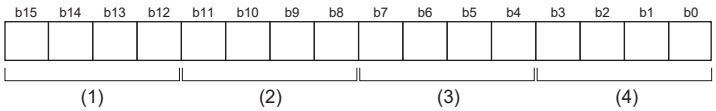
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.6] Start (Minute: second)

The starting time (Minute: second) is stored.

Buffer memory configuration	Stored contents		Storage value
	(1)	Minute (tens place)	0 to 5
	(2)	Minute (ones place)	0 to 9
	(3)	Second (tens place)	0 to 5
	(4)	Second (ones place)	0 to 9

Refresh cycle: At start

Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

■Buffer memory address

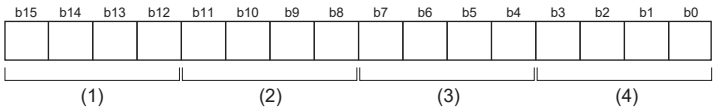
Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.60] Start (ms)

The starting time (ms) is stored.

000 (ms) to 999 (ms)

Buffer memory configuration	Stored contents		Storage value
	(1)	0	0
	(2)	ms (hundreds place)	0 to 9
	(3)	ms (tens place)	0 to 9
	(4)	ms (ones place)	0 to 9

Refresh cycle: At start

Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.7] Error judgment

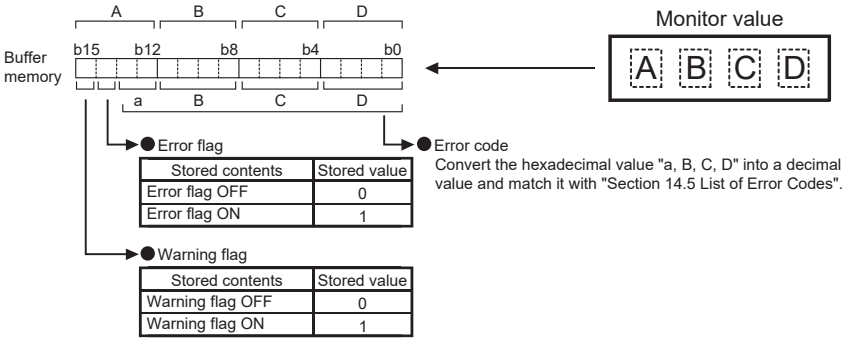
This area stores the following results of the error judgment performed upon starting:

- Warning flag

BUSY start
Control mode switching during BUSY
Control mode switching during zero speed OFF
Outside control mode range
Control mode switching

- Error flag
- Error code

The results of the error judgment shown in the diagram below are stored.



Refresh cycle: At start

Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.8] Start history pointer

Indicates a pointer No. that is next to the pointer No. assigned to the latest of the existing starting history records.
The storage value (Pointer No.) is 0 to 63.
Refresh cycle: At start

Point

If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

■Buffer memory address

Refer to the following for the buffer memory address in this area.
☞ Page 434 System monitor data

[Md.19] Number of write accesses to flash ROM

Stores the number of write accesses to the flash ROM after the power is switched ON.
The storage value is 0 to 25.The count is cleared to "0" when the number of write accesses reaches 26 and an error reset operation is performed.
Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.
☞ Page 434 System monitor data

[Md.50] Forced stop input

This area stores the states (ON/OFF) of forced stop input.

Storage value	Forced stop input
0	Forced stop input ON (Forced stop)
1	Forced stop input OFF (Forced stop release)

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.
☞ Page 434 System monitor data

[Md.52] Communication between amplifiers axes searching flag

The detection state of the axis set for driver communication is stored.

Storage value	Communication between amplifiers axes searching flag
0	Completed searching driver communication setting axes
1	Searching all driver communication setting axes

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.
☞ Page 434 System monitor data

[Md.59] Module information

Stores the module information.

Storage value	Module information
6948H	RD78G4
6949H	RD78G8
694AH	RD78G16

Refresh cycle: At power supply ON

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.64] Network error number

When a network error is detected, the error code corresponding to the error details is stored.

- This area always stores the latest error code. (Whenever the network error occurs, a new error code replaces the stored error code.)
- The error No. is cleared when "[Md.23] Axis error No." of all axes are cleared. (Set to "0".)
- The error No. is cleared when the [Clear Error] button of GX Works3 is clicked. (Set to "0".)

Refresh cycle: Main cycle

Point

- When an error code of a moderate error is stored, no error code of a minor error is stored.
- When an error code of a major error is stored, no error code of a minor/moderate error is stored.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.130] F/W version

The first two digits of the module firmware version is stored.

- Monitoring is carried out with the string display.

Refresh cycle: At power supply ON

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.131] Digital oscilloscope running flag

Stores the RUN status of digital oscilloscope.

Storage value	Digital oscilloscope RUN status
0	Stop
1	Run
-1	Stop by error

Refresh cycle: Main cycle

Point

- When an error occurs in setting data of digital oscilloscope at power supply ON, "-1: Stop by error" is stored. Write the setting again using an engineering tool.
- When the offline digital oscilloscope function is validated, "1: Run" is stored from the start of the unit. If an engineering tool is not compatible with the offline digital oscilloscope function, the operation to set "0: Stop" cannot be executed. Therefore, update to the latest engineering tool.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.132] Operation cycle setting

Stores the current operation cycle.

Storage value	Operation cycle
1004H	0.250ms
1005H	0.500ms
1006H	1.000ms
1007H	2.000ms
1008H	4.000ms

Refresh cycle: At power supply ON

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.133] Operation cycle over flag

This flag turns ON when the operation cycle time exceeds operation cycle.

Storage value	Operation cycle over flag
0	OFF
1	ON (Operation cycle over occurred.)

Refresh cycle: Immediate

Point

Latch status of operation cycle over is indicated. When this flag turns ON, correct the positioning detail or change the operation cycle longer than current setting.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.134] Operation time

The time (unit: μs) taken for the operation is stored in each operation cycle.

Refresh cycle: Operation cycle

Point

When digital oscilloscope is executed in the following conditions, operation cycle will increase about 30μs.

- Probe data: 16CH
- Bit data: 16CH
- Trigger data: 8CH
- Sampling cycle: Same as operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

[Md.135] Maximum operation time

The maximum value (unit: μs) of the operation time after each module power supply ON is stored.

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 434 System monitor data

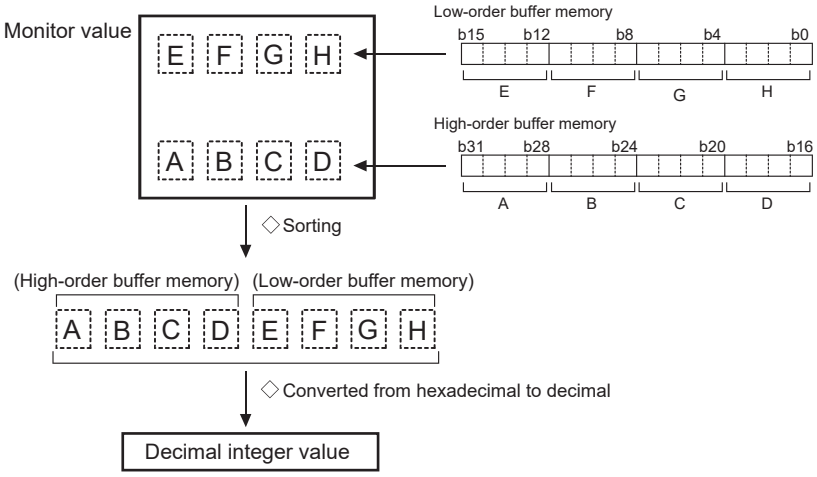
[Md.20] Command position value

The address of the current command is stored. (Different from the actual motor position during operation)

The current position address is stored.

If "degree" is selected as the unit, the addresses will have a ring structure for values between 0 and 359.99999°.

As shown in the diagram below, the hexadecimal monitor value is changed to a decimal integer value. The decimal integer value can be converted into other units by multiplying said value by the following conversion values.



Unit	Conversion value
μm	× 10^{-1}
inch	× 10^{-5}
degree	× 10^{-5}
pulse	× 10^{0}

- The home position address is stored when the machine home position return is completed.
- When the current value is changed with the current value changing function, the changed value is stored.

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.21] Machine feed value

The address of the current position according to the machine coordinates is stored. (Different from the actual motor position during operation)

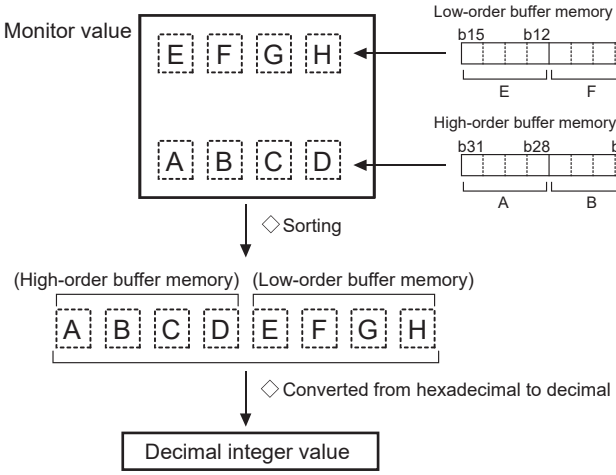
Note that the current value changing function will not change the machine feed value.

Under the speed control mode, the machine feed value is constantly updated always, irrespective of the parameter setting.

The value will not be cleared to "0" at the beginning of fixed-feed control.

Even if "degree" is selected as the unit, the addresses will become a cumulative value. (They will not have a ring structure for values between 0 and 359.99999°). However, the machine feed value is restored with cumulating the machine feed value before the power supply OFF (the rounded value within the range of 0 to 359.99999°) to the movement amount during the power supply OFF at the communication start with servo amplifier after the power supply ON or CPU module reset.

As shown in the diagram below, the hexadecimal monitor value is changed to a decimal integer value. The decimal integer value can be converted into other units by multiplying said value by the following conversion values.



Unit	Conversion value
μm	$\times 10^{-1}$
inch	$\times 10^{-5}$
degree	$\times 10^{-5}$
pulse	$\times 10^{0}$

• Machine coordinates: Characteristic coordinates determined with machine

Refresh cycle: Operation cycle

■Buffer memory address

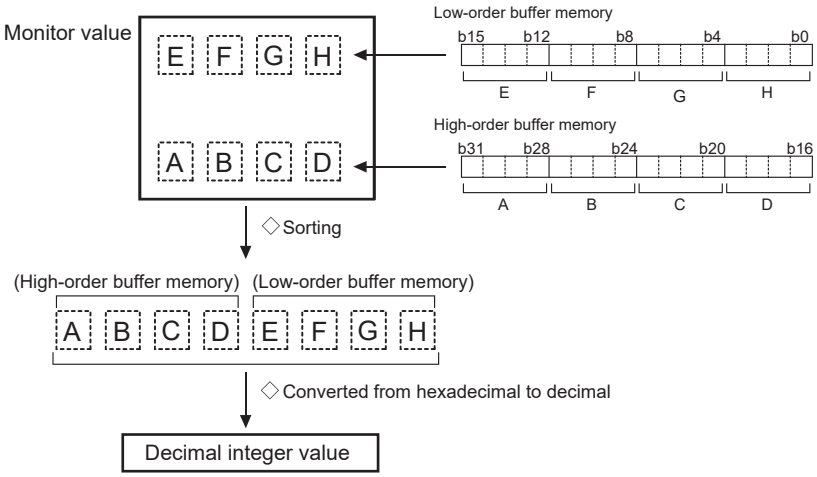
Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.22] Speed command

The command output speed of the operating workpiece is stored. (May be different from the actual motor speed during operation)

As shown in the diagram below, the hexadecimal monitor value is changed to a decimal integer value. The decimal integer value can be converted into other units by multiplying said value by the following conversion values.



Unit	Conversion value
mm/min	$\times 10^{-2}$
inch/min	$\times 10^{-3}$
degree/min	$\times 10^{-3*1}$
pulse/s	$\times 10^{0}$

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, becomes "$\times 10^{-2}$".

- During interpolation operation, the speed is stored in the following manner.

Reference axis	Composite speed or reference axis speed (Set with [Pr.20])
Interpolation axis	0

Refresh cycle: Operation cycle

Point

In case of the single axis operation, "[Md.22] Speed command" and "[Md.28] Axis speed command" are identical.

In the composite mode of the interpolation operation, "[Md.22] Speed command" is a speed in a composite direction and "[Md.28] Axis speed command" is that in each axial direction.

The absolute value is displayed in "[Md.22] Speed command". The operation direction can be checked in "[Md.20] Command position value".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.23] Axis error No.

When an axis error is detected, the error code corresponding to the error details is stored.

- The latest error code is always stored. (When a new axis error occurs, the error code is overwritten.)
- When "1" is set in "[Cd.5] Axis error reset", the axis error No. is cleared (set to "0").
- Monitoring is carried out with a hexadecimal.

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.24] Axis warning No.

Whenever an axis warning is reported, a related warning code is stored.

- This area always stores the latest warning code. (Whenever an axis warning is reported, a new warning code replaces the stored warning code.)
- When "1" is set in "[Cd.5] Axis error reset", the axis warning No. is cleared (set to "0").
- Monitoring is carried out with a hexadecimal.

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.25] Valid M code

This area stores an M code that is currently active (i.e. set to the positioning data relating to the current operation).

"0" is stored at PLC READY [Y0] OFF.

The value stored is 0 to 65535.

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.26] Axis operation status

This area stores the axis operation status.

Storage value	Axis operation status
-2	Step standby
-1	Error
0	Standby
1	Stopped
2	Interpolation
3	JOG operation
4	Manual pulse generator operation
5	Analyzing
6	Special start standby
7	Home position return
8	Position control
9	Speed control
10	Speed control in speed-position switching control
11	Position control in speed-position switching control
12	Position control in position-speed switching control
13	Speed control in position-speed switching control
15	Synchronous control
16	Test mode JOG operation
20	Servo amplifier has not been connected/servo amplifier power OFF
21	Servo OFF
30	Control mode switch
31	Speed control
32	Torque control
33	Continuous operation to torque control

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.27] Current speed

"[Da.8] Command speed" used by the positioning data currently being executed is stored.

- If "[Da.8] Command speed" is set to "-1", this area stores the command speed set by the positioning data used one step earlier.
- If "[Da.8] Command speed" is set to a value other than "-1", this area stores the command speed set by the current positioning data.
- When speed change function is executed, this area stores "[Cd.14] New speed value". (For details of change speed function, refer to ☞ Page 256 Speed change function)

The storage value converted into other units can be checked by multiplying said value by the following conversion values.

Unit	Conversion value
mm/min	$\times 10^{-2}$
inch/min	$\times 10^{-3}$
degree/min	$\times 10^{-3*1}$
pulse/s	$\times 10^{0}$

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, becomes "$\times 10^{-2}$".

Refresh cycle: Immediate

■Buffer memory address

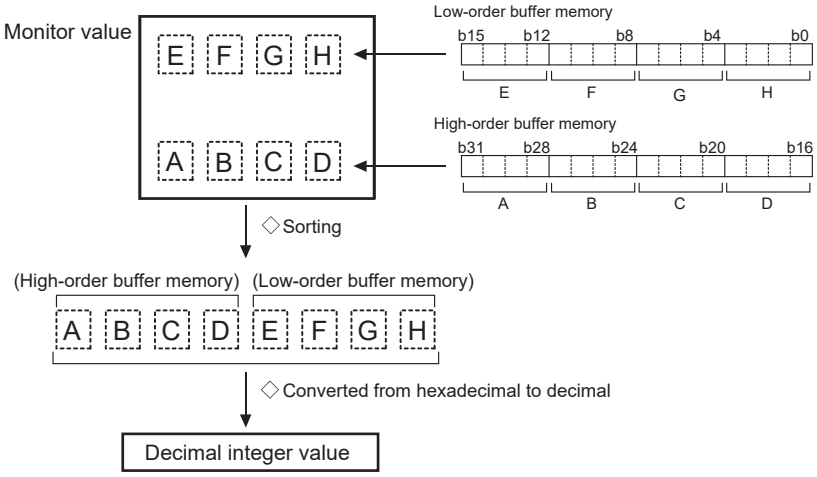
Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.28] Axis speed command

The speed which is actually output as a command at that time in each axis is stored. (May be different from the actual motor speed) "0" is stored when the axis is at a stop. (☞ Page 525 [Md.22] Speed command)

As shown in the diagram below, the hexadecimal monitor value is changed to a decimal integer value. The decimal integer value can be converted into other units by multiplying said value by the following conversion values.



Unit	Conversion value
mm/min	× 10^{-2}
inch/min	× 10^{-3}
degree/min	× 10^{-3*1}
pulse/s	× 10^{0}

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, becomes "× 10^{-2}".

Refresh cycle: Operation cycle

Point

The absolute value is displayed in "[Md.28] Axis speed command". The operation direction can be checked in "[Md.20] Command position value".

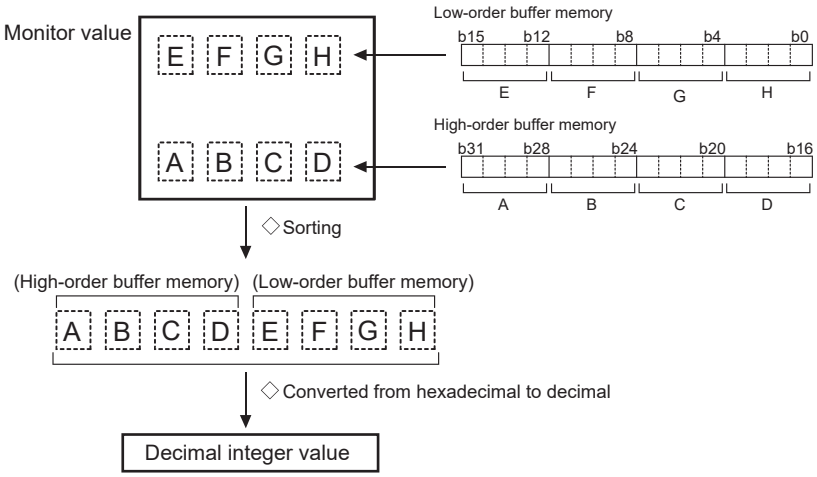
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.29] Speed-position switching control positioning movement amount

The movement amount for the position control to end after changing to position control with the speed-position switching control is stored. When the control method is "Reverse run: position/speed", the negative value is stored.
As shown in the diagram below, the hexadecimal monitor value is changed to a decimal integer value. The decimal integer value can be converted into other units by multiplying said value by the following conversion values.



Unit	Conversion value
μm	$\times 10^{-1}$
inch	$\times 10^{-5}$
degree	$\times 10^{-5}$
pulse	$\times 10^{0}$

Refresh cycle: Immediate

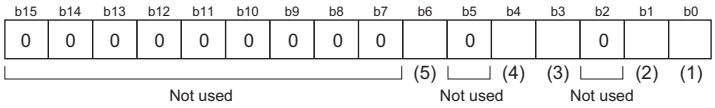
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.30] External input signal

The signal state of the external input signal is stored.

Buffer memory configuration	Stored items		Signal state
	(1)	Lower limit signal	0: Limit signal ON 1: Limit signal OFF
	(2)	Upper limit signal	
	(3)	Stop signal	0: Stop signal is OFF 1: Stop signal is ON
	(4)	External command signal/switching signal	0: External command signal/switching signal is OFF 1: External command signal/switching signal is ON
	(5)	Proximity dog signal	0: Proximity dog signal is OFF 1: Proximity dog signal is ON

The signal state is stored according to the logic set by the following parameters.

- [Pr.22] Input signal logic selection
- [Pr.913] Upper limit signal (FLS): Link device logic setting
- [Pr.923] Lower limit signal (RLS): Link device logic setting
- [Pr.933] Proximity dog signal (DOG): Link device logic setting
- [Pr.943] Stop signal (STOP): Link device logic setting

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

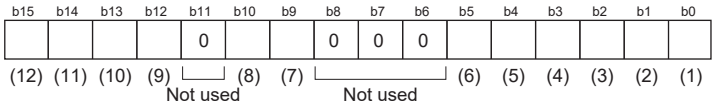
☞ Page 435 Axis monitor data

[Md.31] Status

This area stores the states (ON/OFF) of various flags.

Information on the following flags is stored.

Flag	Details
In speed control flag	This signal that comes ON under the speed control can be used to judge whether the operation is performed under the speed control or position control. The signal goes OFF when the power is switched ON, under the position control, and during JOG operation or manual pulse generator operation. During the speed-position or position-speed switching control, this signal comes ON only when the speed control is in effect. During the speed-position switching control, this signal goes OFF when the speed-position switching signal executes a switching over from speed control to position control. During the position-speed switching control, this signal comes ON when the position-speed switching signal executes a switching over from position control to speed control.
Speed-position switching latch flag	This signal is used during the speed-position switching control for interlocking the movement amount change function. During the speed-position switching control, this signal comes ON when position control takes over. This signal goes OFF when the next positioning data is processed, and during JOG operation or manual pulse generator operation.
Command in-position flag	This signal is ON when the remaining distance is equal to or less than the command in-position range (set by a detailed parameter). This signal remains OFF with data that specify the continuous path control (P11) as the operation pattern. The state of this signal is monitored every operation cycle except when the monitoring is canceled under the speed control or while the speed control is in effect during the speed-position or position-speed switching control. While operations are performed with interpolation, this signal comes ON only in respect of the starting axis. (This signal goes OFF in respect of all axes upon starting.)
Home position return request flag	This signal comes ON when a home position return is required and goes OFF at completion of a home position return. For details of home position return request flag, refer to ☞ Page 34 Outline of Home Position Return Control.
Home position return complete flag	This signal comes ON when a machine home position return operation completes normally. This signal goes OFF when the operation start.
Position-speed switching latch flag	This signal is used during the speed-position switching control for interlocking the movement amount change function. During the speed-position switching control, this signal comes ON when position control takes over. This signal goes OFF when the next positioning data is processed, and during JOG operation or manual pulse generator operation.
Axis warning detection flag	This signal comes ON when an axis warning is reported and goes OFF when the axis error reset signal comes ON.
Speed change 0 flag	This signal comes ON when the speed is "0" by the speed change or override. Otherwise, it goes OFF.
M code ON	In the WITH mode, this signal turns ON when the positioning data operation is started. In the AFTER mode, this signal turns ON when the positioning data operation is completed. This signal turns OFF with "[Cd.7] M code OFF request". When M code is not designated (when "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" is "0"), this signal will remain OFF. With using continuous path control for the positioning operation, the positioning will continue even when this signal does not turn OFF. However, "M code ON signal ON" (warning code: 0D52H) will occur. When PLC READY [Y0] turns OFF, the M code ON signal will also turn OFF. If operation is started while the M code is ON, "M code ON signal start" (error code: 1AA0H) will occur.
Error detection	This signal turns ON when an error (☞ Page 662 List of Error Codes), and turns OFF when the error is reset on "[Cd.5] Axis error reset".
Start complete	This signal turns ON when the positioning start signal turns ON and the Motion module starts the positioning process. (The start complete signal also turns ON during home position return control.)
Positioning complete	This signal turns ON for the time set in "[Pr.40] Positioning complete signal output time" from the instant when the positioning control for each positioning data No. is completed. For the interpolation control, the positioning complete signal of interpolation axis turns ON during the time set to the reference axis. (It does not turn ON when "[Pr.40] Positioning complete signal output time" is "0".) If positioning (including home position return), JOG/Inching operation, or manual pulse generator operation is started while this signal is ON, the signal will turn OFF. This signal will not turn ON when speed control or positioning is canceled midway.

Buffer memory configuration	Stored items		Storage value
	(1)	In speed control flag	0: OFF 1: ON
	(2)	Speed-position switching latch flag	
	(3)	Command in-position flag	
	(4)	Home position return request flag	
	(5)	Home position return complete flag	
	(6)	Position-speed switching latch flag	
	(7)	Axis warning detection	
	(8)	Speed change 0 flag	
	(9)	M code ON	
	(10)	Error detection	
	(11)	Start complete	
	(12)	Positioning complete	

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.32] Target value

This area stores the target value ([Da.6] Positioning address/movement amount) for a positioning operation.

- At the beginning of positioning control and current value changing: Stores the value of "[Da.6] Positioning address/movement amount".
- At the home position shift operation of home position return control: Stores the value of home position shift amount.
- At other times: Stores "0".

The storage value converted into other units can be checked by multiplying said value by the following conversion values.

Unit	Conversion value
μm	$\times 10^{-1}$
inch	$\times 10^{-5}$
degree	$\times 10^{-5}$
pulse	$\times 10^{0}$

Refresh cycle: Immediate

■Buffer memory address

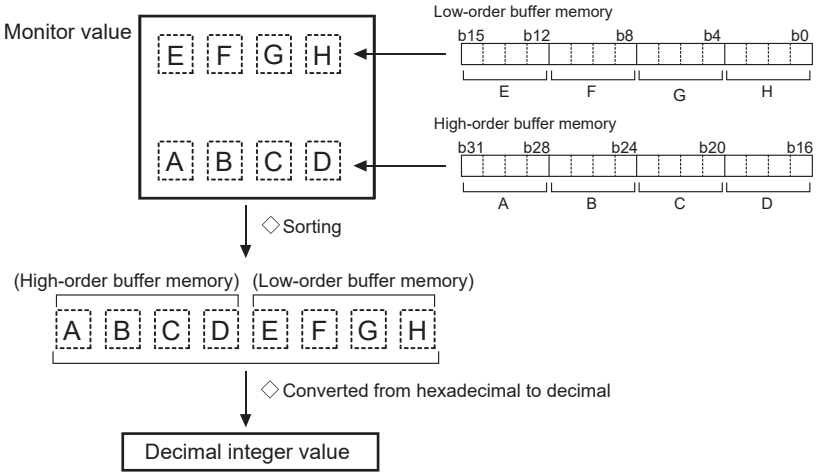
Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.33] Target speed

- During operation with positioning data: The actual target speed, considering the override and speed limit value, etc., is stored. "0" is stored when positioning is completed.
- During interpolation of position control: The composite speed or reference axis speed is stored in the reference axis address, and "0" is stored in the interpolation axis address.
- During interpolation of speed control: The target speeds of each axis are stored in the monitor of the reference axis and interpolation axis.
- During JOG operation: The actual target speed, considering the JOG speed limit value for the JOG speed, is stored.
- During manual pulse generator operation: "0" is stored.

As shown in the diagram below, the hexadecimal monitor value is changed to a decimal integer value. The decimal integer value can be converted into other units by multiplying said value by the following conversion values.



Unit	Conversion value
mm/min	$\times 10^{-2}$
inch/min	$\times 10^{-3}$
degree/min	$\times 10^{-3*1}$
pulse/s	$\times 10^{0}$

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, becomes "$\times 10^{-2}$".

Refresh cycle: Immediate

Point

The target speed is when an override is made to the command speed.
When the speed limit value is overridden, the target speed is restricted to the speed limit value. The target speed changes every time data is switched, but does not change in an acceleration/deceleration state inside each piece of data (changes with the speed change because the target speed changes.)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.35] Torque limit stored value/forward torque limit stored value

"[Pr.17] Torque limit setting value", "[Cd.101] Torque output setting value", or "[Cd.22] New torque value/forward new torque value" is stored.

- The value stored is 1 to 10000 (× 0.1%).
- During positioning start, JOG operation start, manual pulse generator operation: "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" is stored.
- When a value is set in "[Cd.22] New torque value/forward new torque value" during operation: "[Cd.22] New torque value/forward new torque value" is stored.

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.36] Special start data instruction code setting value

The "instruction code" used with special start and indicated by the start data pointer currently being executed is stored.

Storage value	Special start data instruction code setting value
0	Block start
1	Condition Start
2	Wait Start
3	Simultaneous Start
4	FOR Loop
5	FOR Condition
6	NEXT

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.37] Special start data instruction parameter setting value

The "instruction parameter" used with special start and indicated by the start data pointer currently being executed is stored.
The stored value differs according to the value set for "[Md.36] Special start data instruction code setting value".

Setting value of "[Md.36] Special start data instruction code setting value"	Storage value	Stored contents
Block start, NEXT	None	None
Condition Start, Wait Start, Simultaneous Start, FOR Condition	1 to 10	Condition data No.
FOR Loop	0 to 255	Repetition count

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.38] Start positioning data No. setting value

The "positioning data No." indicated by the start data pointer currently being executed is stored.
The value stored is 1 to 600, and 9001 to 9003.

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.39] In speed limit flag

Stores whether the in speed limit is in progress or not.

Storage value	In speed limit flag
0	Not in speed limit (OFF)
1	In speed limit (ON)

- If the speed exceeds "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) due to a speed change or override, the speed limit functions, and the in speed limit flag turns ON.
- When the speed drops to less than "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control), or when the axis stops, the in speed limit flag turns OFF.

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.40] In speed change processing flag

Stores whether the in speed change is in progress or not.

Storage value	Speed change flag
0	Not in speed change (OFF)
1	In speed change (ON)

- The speed change process flag turns ON when the speed is changed during positioning control.
- After the speed change process is completed or when deceleration starts with the stop signal during the speed change process, the in speed change process flag turns OFF.

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.41] Special start repetition counter

- This area stores the remaining number of repetitions during "repetitions" specific to special starting.
- The value stored is 0 to 255.
- The count is decremented by one (-1) at the loop end.
- The control comes out of the loop when the count reaches "0".
- This area stores "0" within an infinite loop.

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.42] Control system repetition counter

- This area stores the remaining number of repetitions during "repetitions" specific to control system.
- The value stored is 0000H to FFFFH.
- The count is decremented by one (-1) at the loop start.
- The loop is terminated with the positioning data of the control method "LEND", after the counter becomes "0".

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.43] Start data pointer being executed

- This area stores a point No. (1 to 50) attached to the start data currently being executed.
- This area stores "0" after completion of a positioning operation.

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.44] Positioning data No. being executed

- This area stores a positioning data No. attached to the positioning data currently being executed.
- The value stored is 1 to 600, and 9001 to 9003.
- This area stores "0" when the JOG/inching operation is executed.
- This area stores "1" during the JOG operation or the positioning operation from the test mode. For details, refer to the following. ☞ Page 385 Test mode

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.45] Block No. being executed

- When the operation is controlled by "block start data", this area stores a block No. (7000 to 7004) attached to the block currently being executed.
- At other times, this area stores "0".

Refresh cycle: At start

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.46] Last executed positioning data No.

- This area stores the positioning data No. attached to the positioning data that was executed last time.
- The value stored is 1 to 600, and 9001 to 9003.
- The value is retained until a new positioning operation is executed.
- This area stores "0" when the JOG/inching operation is executed.
- This area stores "1" when the JOG operation or the positioning operation from the test mode is executed. For details, refer to the following. ☞ Page 385 Test mode

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.47] Positioning data being executed

- The details of the positioning data currently being executed (positioning data No. given by "[Md.44] Positioning data No. being executed") are stored in the buffer memory addresses.

n: Axis No. - 1

Buffer memory address	Stored items	Reference
6000+1000n	Positioning identifier	Page 493 [Da.1] Operation pattern to Page 494 [Da.4] Deceleration time No.
6006+1000n 6007+1000n	Positioning address/movement amount	Page 494 [Da.6] Positioning address/movement amount
6008+1000n 6009+1000n	Arc address	Page 499 [Da.7] Arc address
6004+1000n 6005+1000n	Command speed	Page 501 [Da.8] Command speed
6002+1000n	Dwell time/JUMP destination positioning data No.	Page 502 [Da.9] Dwell time/JUMP destination positioning data No.
6001+1000n	M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches	Page 503 [Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches
71000+1000n 71001+1000n	Axis to be interpolated	Page 504 [Da.20] Axis to be interpolated No.1 to [Da.22] Axis to be interpolated No.3
6003+1000n	Positioning option	Page 504 [Da.27] M code ON signal output timing to Page 505 [Da.29] Interpolation speed designation method

- "04h" or "05h" is stored in the control method of the positioning identifier during the JOG operation from the test mode. For details, refer to the following. ☞ Page 385 Test mode

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.48] Deceleration start flag

- "1" is stored when the constant speed status or acceleration status switches to the deceleration status during position control whose operation pattern is "Positioning complete".
- "0" is stored at the next operation start or manual pulse generator operation enable.

Refresh cycle: Immediate

Point

This parameter is possible to monitor when "[Cd.41] Deceleration start flag valid" is valid.

■Buffer memory address

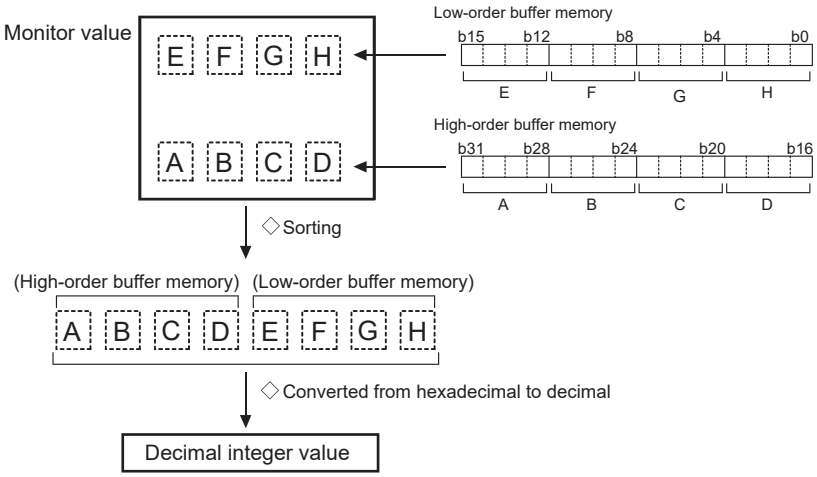
Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.62] Amount of the manual pulser driving carrying over movement

When "2: Output over value of speed limit later" is set in "[Pr.122] Manual pulse generator speed limit mode", this area stores the carrying over movement amount which exceeds "[Pr.123] Manual pulse generator speed limit value".

As shown in the diagram below, the hexadecimal monitor value is changed to a decimal integer value. The decimal integer value can be converted into other units by multiplying said value by the following conversion values.



Unit	Conversion value
μm	$\times 10^{-1}$
inch	$\times 10^{-5}$
degree	$\times 10^{-5}$
pulse	$\times 10^{0}$

Refresh cycle: Immediate

■Buffer memory address

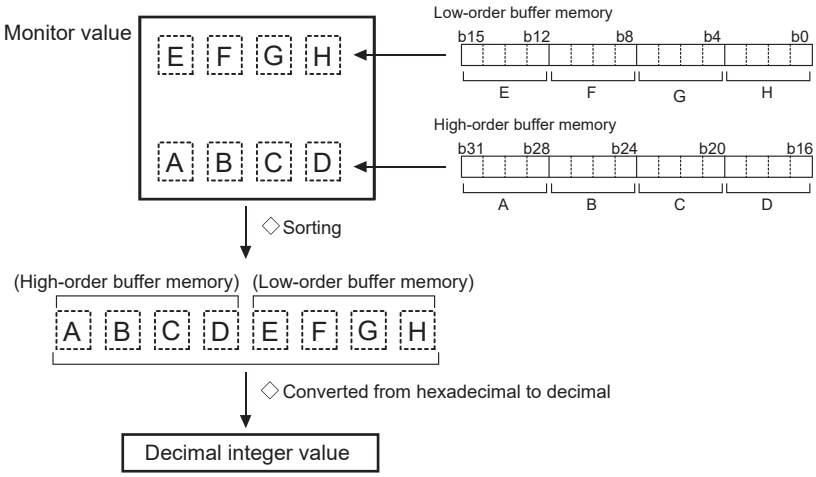
Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.101] Actual position value

This area stores the current value "command position value - (command pulse - feedback pulse)". (Depends on the setting unit)

As shown in the diagram below, the hexadecimal monitor value is changed to a decimal integer value. The decimal integer value can be converted into other units by multiplying said value by the following conversion values.



Unit	Conversion value
μm	$\times 10^{-1}$
inch	$\times 10^{-5}$
degree	$\times 10^{-5}$
pulse	$\times 10^{0}$

Ex.

mm

(Buffer memory details × 0.1) μm

Refresh cycle: Operation cycle

■Buffer memory address

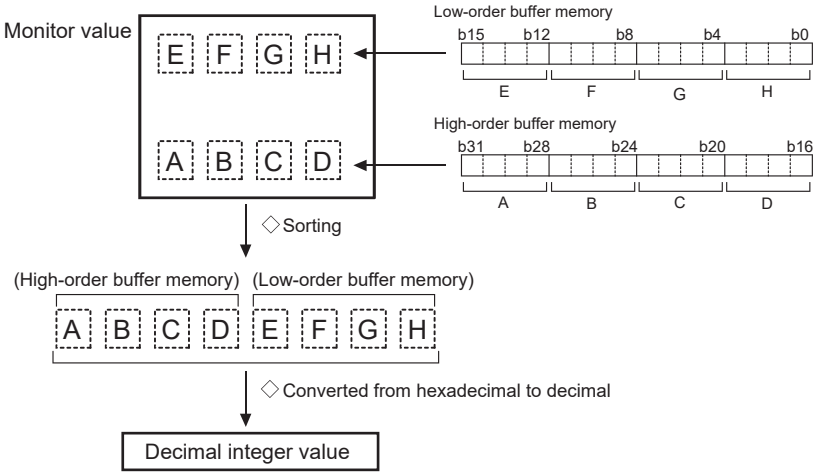
Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.102] Deviation counter value

This area stores the droop pulse.

As shown in the diagram below, the hexadecimal monitor value is changed to a decimal integer value. The decimal integer value can be converted into other units by multiplying said value by the following conversion values.



Unit	Conversion value
pulse	$\times 10^0$

(Buffer memory details × 1) pulse

Refresh cycle: Operation cycle

■Buffer memory address

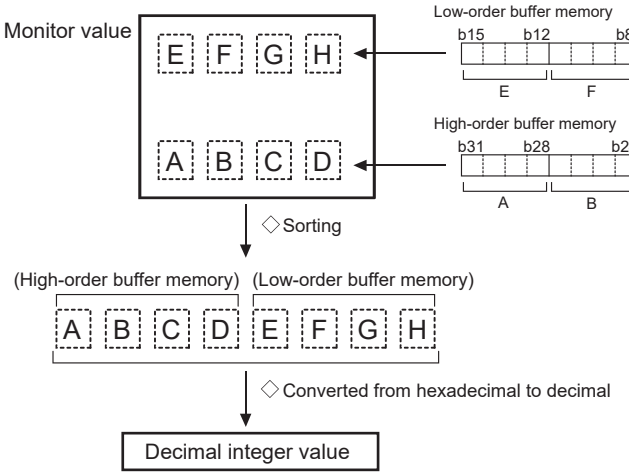
Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.103] Motor rotation speed

This area stores the motor speed updated in real time.

As shown in the diagram below, the hexadecimal monitor value is changed to a decimal integer value. The decimal integer value can be converted into other units by multiplying said value by the following conversion values.



Unit	Conversion value
r/min*1	× 10^{-2}

*1 The unit is mm/s at linear servo use.

(Buffer memory × 0.01) r/min

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.104] Motor current value

This area stores the current value of the motor.

The storage value converted into other units can be checked by multiplying said value by the following conversion values.

Unit	Conversion value
%	× 10^{-1}

(Buffer memory × 0.1)%

Refresh cycle: Operation cycle

■Buffer memory address

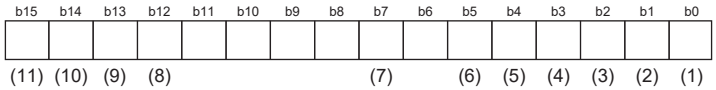
Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.108] Servo status1

This area stores the servo status1.

- READY ON: Indicates the ready ON/OFF.
- Servo ON: Indicates the servo ON/OFF.
- Control mode: Indicates the control mode of the servo amplifier.
- Gain switching: Turns ON during the gain switching.
- Fully closed loop control switching: Turns ON during the fully closed loop control.
- Servo alarm: Turns ON during the servo alarm.
- In-position: The dwell pulse turns ON within the servo parameter "in-position".
- Torque limit: Turns ON when the servo amplifier is having the torque restricted.
- Absolute position lost: Turns ON when the servo amplifier is lost the absolute position.
- Servo warning: Turns ON during the servo warning.

Buffer memory configuration	Stored items		Storage value
	(1)	READY ON	0: OFF 1: ON
	(2)	Servo ON	
	(3)	Control mode*1	
	(4)		
	(5)	Gain switching	
	(6)	Fully closed loop control switching	
	(7)	Servo alarm	
	(8)	In-position	
	(9)	Torque limit	
	(10)	Absolute position lost	
	(11)	Servo warning	

*1 The control modes are shown below.

b2	b3	Control mode
0	0	Position control mode
1	0	Speed control
0	1	Torque control

Refresh cycle: Operation cycle

Point

- When the forced stop of controller and servo amplifier occurs, the servo warning is turned ON. When the forced stop is reset, the servo warning is turned OFF.
- Confirm the status during continuous operation to torque control mode with "[Md.125] Servo status3".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.109] Regenerative load ratio/Optional data monitor output 1

- The rate of regenerative power to the allowable regenerative power is indicated as a percentage.
- When the regenerative option is used, the rate to the allowable regenerative power of the option is indicated.

(Buffer memory) %

- This area stores the content set in "[Pr.91] Optional data monitor: Data type setting 1" and "[Pr.591] Optional data monitor: Data type expansion setting 1" at optional data monitor data type setting.

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.110] Effective load torque/Optional data monitor output 2

- The continuous effective load current is indicated.
- The effective value for the past 15 seconds is displayed considering a rated current as 100%.

(Buffer memory) %

- This area stores the content set in "[Pr.92] Optional data monitor: Data type setting 2" and "[Pr.592] Optional data monitor: Data type expansion setting 2" at optional data monitor data type setting.

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.111] Peak torque ratio/Optional data monitor output 3

- The maximum torque is indicated. (Holding value)
- The peak values for the past 15 seconds are indicated, rated torque being 100%.

(Buffer memory) %

- This area stores the content set in "[Pr.93] Optional data monitor: Data type setting 3" and "[Pr.593] Optional data monitor: Data type expansion setting 3" at optional data monitor data type setting.

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.112] Optional data monitor output 4

This area stores the content set in "[Pr.94] Optional data monitor: Data type setting 4" and "[Pr.594] Optional data monitor: Data type expansion setting 4" at optional data monitor data type setting.

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.113] Semi/Fully closed loop status

The switching status of semi closed loop control/fully closed loop control is indicated.

Storage value	Semi/Fully closed loop status
0	In semi closed loop control
1	In fully closed loop control

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

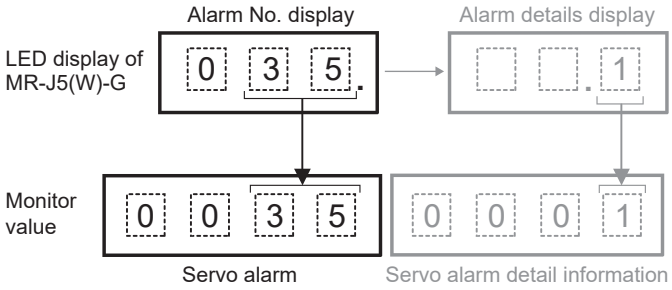
[Md.114] Servo alarm

- When a servo amplifier alarm/warning occurs, the alarm/warning No. is stored.
- When "[Cd.5] Axis error reset" is set to "1" after removing the cause of an alarm/warning on the servo amplifier side, the servo alarm is cleared (set to "0").

Ex.

For MR-J5(W)-G

When the servo alarm [AL35.1 Command frequency error] occurs on the drive unit, "0035H" is stored.



Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

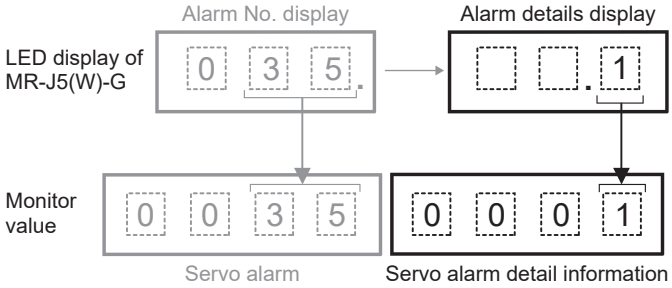
[Md.115] Servo alarm detail number

- When a servo amplifier alarm/warning occurs, the alarm/warning No. is stored.
- When "[Cd.5] Axis error reset" is set to "1" after removing the cause of an alarm/warning on the servo amplifier side, the servo alarm detail number is cleared (set to 0).

Ex.

For MR-J5(W)-G

When the servo alarm [AL35.1 Command frequency error] occurs on the drive unit, "0001H" is stored.



Refresh cycle: Immediate

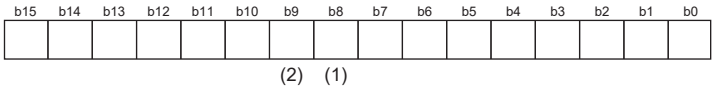
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.116] Encoder option information

The option information of encoder is indicated.

Buffer memory configuration	Stored items		Storage value
	(1)	Compatible with continuous operation to torque control	0: Incompatible 1: Compatible
	(2)	Compatible with scale measurement mode	

Refresh cycle: Servo amplifier's power supply ON

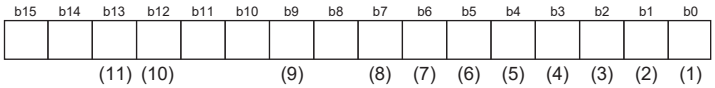
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.117]Statusword

Statusword is stored.

Buffer memory configuration	Stored items		Storage value
	(1)	Ready to switch on	0: OFF 1: ON
	(2)	Switched on	
	(3)	Operation enabled	
	(4)	Fault	
	(5)	Voltage enabled	
	(6)	Quick stop	
	(7)	Switch on disabled	
	(8)	Warning	
	(9)	Remote	
	(10)	Operation mode specific	
	(11)		

Refresh cycle: Operation cycle

■Buffer memory address

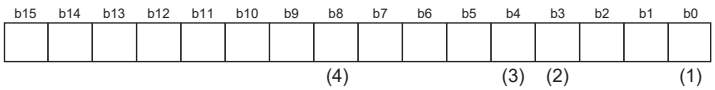
Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.119] Servo status2

This area stores the servo status2.

- Zero point pass: Turns ON if the zero point of the encoder has been passed even once.
- Zero speed: Turns ON when the motor speed is lower than the servo parameter "zero speed".
- Speed limit: Turns ON during the speed limit in torque control mode.
- PID control: Turns ON when the servo amplifier is PID control.

Buffer memory configuration	Stored items		Storage value
	(1)	Zero point pass	0: OFF 1: ON
	(2)	Zero speed	
	(3)	Speed limit	
	(4)	PID control	

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.120] Reverse torque limit stored value

"[Pr.17] Torque limit setting value", "[Cd.101] Torque output setting value", or "[Cd.113] Reverse new torque value" is stored.

- The value stored is 1 to 10000 (× 0.1%).
- During positioning start, JOG operation start, manual pulse generator operation: "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" is stored.
- When a value is set in "[Cd.22] New torque value/forward new torque value" or "[Cd.113] New reverse torque value" during operation: "[Cd.22] New torque value/forward new torque value" is stored when "0" is set in "[Cd.112] Torque change function switching request". "[Cd.113] New reverse torque value" is stored when "1" is set in "[Cd.112] Torque change function switching request".

Refresh cycle: Immediate

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.122] Speed during command

- This area stores the command speed during speed control mode.
- This area stores the command speed during continuous operation to torque control mode.
- "0" is stored other than during speed control mode or continuous operation to torque control mode.

The storage value converted into other units can be checked by multiplying said value by the following conversion values.

Unit	Conversion value
mm/min	$\times 10^{-2}$
inch/min	$\times 10^{-3}$
degree/min	$\times 10^{-3*1}$
pulse/s	$\times 10^{0}$

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, becomes " $\times 10^{-2}$.

Refresh cycle: Operation cycle (Only at speed control mode/Continuous operation to torque control mode)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.123] Torque during command

- This area stores the command torque during torque control mode. (Buffer memory × 0.1)%
- This area stores the command torque during continuous operation to torque control mode.
- "0" is stored other than during torque control mode or continuous operation to torque control mode.

The storage value converted into other units can be checked by multiplying said value by the following conversion values.

Unit	Conversion value
%	$\times 10^{-1}$

Refresh cycle: Operation cycle (Only at torque control mode/Continuous operation to torque control mode)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.124] Control mode switching status

This area stores the switching status of control mode.

Storage value	Control mode switching status
0	Not during control mode switching
1	Position control mode ⇔ continuous operation to torque control mode, speed control mode ⇔ continuous operation to torque control mode switching
2	Waiting for the completion of control mode switching condition

Refresh cycle: Operation cycle (Only at continuous operation to torque control mode)

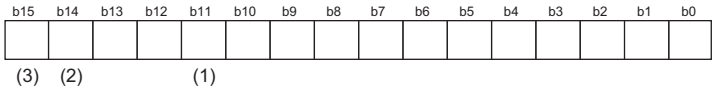
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.125] Servo status3

- This area stores the servo status3.
- Touch probe 1 enabled: Turns ON when the touch probe function using the TPR1 signal of the servo amplifier is enabled.
- Continuous operation to torque control mode: Turns ON during the continuous operation to torque control mode.
- Unsupported control mode: Turns ON during the unsupported control mode.

Buffer memory configuration	Servo status3		Storage value
	(1)	Touch probe 1 enabled	0: OFF 1: ON
	(2)	Continuous operation to torque control mode	
	(3)	Unsupported control mode	

Refresh cycle: Operation cycle

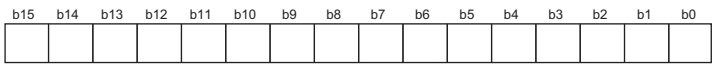
■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.126] Servo status4

- This area stores the servo status4.
- Touch probe 1 leading edge latch completion toggle status/Touch probe 1 trailing edge latch completion toggle status: Changes every time a time stamp is stored by signal detection when TPR1 on the servo amplifier side is valid.

Buffer memory configuration	Servo status4		Storage value
	(1)	Touch probe 1 leading edge latch completion toggle status	0: OFF 1: ON
	(2)	Touch probe 1 trailing edge latch completion toggle status	

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.190] Controller position value restoration complete status

Storage value	Controller position value restoration complete status
0	Incomplete restoration
1	Complete INC restoration
2	Complete ABS restoration

- When restoration is complete with the INC restoration method, "1" is set.
- When restoration is complete with the ABS restoration method, "2" is set.
- Changes to "0" when the device is disconnected.

Refresh cycle: 16.0 [ms]

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.503] Pre-reading data analysis status

Use this monitor when using the pre-reading start function.

- This area stores the positioning data analysis status.

Storage value	Pre-reading data analysis status
0	Standby
1	Analyzing
2	Completed

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

[Md.514] Home position return operating status

The HPR (home position return) operating status is stored.

Storage value	HPR operating status
FFFFH	The servo amplifier is not set to the home position return mode
0000H	Home position return is in progress
0001H	Home position return is interrupted or not started
0002H	Home position return is completed, but the target has not been reached
0003H	Home position return is completed successfully
0004H	Home position return error occurred, speed is not 0
0005H	Home position return error occurred, speed is 0

Refresh cycle: Operation cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 435 Axis monitor data

Axis monitor data (device station operation)

[Md.160] to [Md.163] Optional SDO transfer result

Used in the servo transient transmission function. Refer to the following for details.

☞ Page 382 Servo Transient Transmission Function

Refresh cycle: At request (Command request)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 446 Axis monitor data (device station operation)

[Md.164] to [Md.167] Optional SDO transfer status

Used in the servo transient transmission function. Refer to the following for details.

☞ Page 382 Servo Transient Transmission Function

Refresh cycle: At request (Command request)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 446 Axis monitor data (device station operation)

12.8 Control Data

The setting items of the control data are explained in this section.

System control data

[Cd.1] Flash ROM write request

- Writes not only "positioning data (No.1 to 600)" and "block start data (No.7000 to 7004)" stored in the buffer memory/ internal memory area, but also "parameters" and "servo parameters" to the flash ROM/internal memory (nonvolatile).
- The Motion module resets the value to "0" automatically when the write access completes. (This indicates the completion of write operation.)

Fetch cycle: 116 [ms]

Point

- Do not turn the power OFF or reset the CPU module while writing to the flash ROM. If the power is turned OFF or the CPU module is reset to forcibly end the process, the data backed up in the flash ROM will be lost.
- Do not write the data to the buffer memory before writing to the flash ROM is completed.
- The number of writes to the flash ROM with the program is 25 max. while the power is turned ON. Writing to the flash ROM beyond 25 times will cause "Flash ROM write number error" (error code: 1080H). Refer to ☞ Page 662 List of Error Codes for details.
- Monitoring is the number of writes to the flash ROM after the power is switched ON by "[Md.19] Number of write accesses to flash ROM".

■Setting value

- Set with a decimal.

Setting value	Details
1	Flash ROM write request

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 436 System control data

■Default value

Set to "0".

[Cd.2] Parameter initialization request

- Requests initialization of setting data.
- The Motion module resets the value to "0" automatically when the initialization completes. (This indicates the completion of parameter initialization.)

Refer to the following for initialized setting data.

☞ Page 313 Parameter Initialization Function

Initialization: Resetting of setting data to default values

Fetch cycle: 116 [ms]

Point

After completing the initialization of setting data, switch the power ON or reset the CPU module.

■Setting value

- Set with a decimal.

Setting value	Details
1	Parameter initialization request

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 436 System control data

■Default value

Set to "0".

[Cd.41] Deceleration start flag valid

Sets whether "[Md.48] Deceleration start flag" is made valid or invalid.

Fetch cycle: PLC READY [Y0] ON

Point

"[Cd.41] Deceleration start flag valid" become valid when PLC READY [Y0] turns from OFF to ON.

■Setting value

- Set with a decimal.

Setting value	Details
0	Deceleration start flag invalid
1	Deceleration start flag valid

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 436 System control data

■Default value

Set to "0".

[Cd.42] Stop command processing for deceleration stop selection

Sets the stop command processing for deceleration stop function (deceleration curve re-processing/deceleration curve continuation).

Fetch cycle: When condition is satisfied (At deceleration stop causes occurrence)

■Setting value

- Set with a decimal.

Setting value	Details
0	Deceleration curve re-processing
1	Deceleration curve continuation

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 436 System control data

■Default value

Set to "0".

[Cd.44] External input signal operation device

Operates the external input signal status (Upper/lower limit signal, proximity dog signal, stop signal) of the Motion module when "2" is set in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", "[Pr.118] DOG signal selection", and "[Pr.119] STOP signal selection".

Fetch cycle: Operation cycle

■Setting value

- Set with a hexadecimal.

Buffer memory		Details	Setting value	Buffer memory		Details	Setting value
5928	b0	Axis 1 Upper limit signal (FLS)	When "[Pr.22] Input signal logic selection" is negative logic 0: OFF 1: ON When "[Pr.22] Input signal logic selection" is positive logic 0: ON 1: OFF	5929	b0	Axis 5 Upper limit signal (FLS)	When "[Pr.22] Input signal logic selection" is negative logic 0: OFF 1: ON When "[Pr.22] Input signal logic selection" is positive logic 0: ON 1: OFF
	b1	Axis 1 Lower limit signal (RLS)			b1	Axis 5 Lower limit signal (RLS)	
	b2	Axis 1 Proximity dog signal (DOG)			b2	Axis 5 Proximity dog signal (DOG)	
	b3	Axis 1 STOP signal (STOP)			b3	Axis 5 STOP signal (STOP)	
	b4	Axis 2 Upper limit signal (FLS)			b4	Axis 6 Upper limit signal (FLS)	
	b5	Axis 2 Lower limit signal (RLS)			b5	Axis 6 Lower limit signal (RLS)	
	b6	Axis 2 Proximity dog signal (DOG)			b6	Axis 6 Proximity dog signal (DOG)	
	b7	Axis 2 STOP signal (STOP)			b7	Axis 6 STOP signal (STOP)	
	b8	Axis 3 Upper limit signal (FLS)			b8	Axis 7 Upper limit signal (FLS)	
	b9	Axis 3 Lower limit signal (RLS)			b9	Axis 7 Lower limit signal (RLS)	
	b10	Axis 3 Proximity dog signal (DOG)			b10	Axis 7 Proximity dog signal (DOG)	
	b11	Axis 3 STOP signal (STOP)			b11	Axis 7 STOP signal (STOP)	
	b12	Axis 4 Upper limit signal (FLS)			b12	Axis 8 Upper limit signal (FLS)	
	b13	Axis 4 Lower limit signal (RLS)			b13	Axis 8 Lower limit signal (RLS)	
	b14	Axis 4 Proximity dog signal (DOG)			b14	Axis 8 Proximity dog signal (DOG)	
	b15	Axis 4 STOP signal (STOP)			b15	Axis 8 STOP signal (STOP)	
5930	b0	Axis 9 Upper limit signal (FLS)	When "[Pr.22] Input signal logic selection" is negative logic 0: OFF 1: ON When "[Pr.22] Input signal logic selection" is positive logic 0: ON 1: OFF	5931	b0	Axis 13 Upper limit signal (FLS)	When "[Pr.22] Input signal logic selection" is negative logic 0: OFF 1: ON When "[Pr.22] Input signal logic selection" is positive logic 0: ON 1: OFF
	b1	Axis 9 Lower limit signal (RLS)			b1	Axis 13 Lower limit signal (RLS)	
	b2	Axis 9 Proximity dog signal (DOG)			b2	Axis 13 Proximity dog signal (DOG)	
	b3	Axis 9 STOP signal (STOP)			b3	Axis 13 STOP signal (STOP)	
	b4	Axis 10 Upper limit signal (FLS)			b4	Axis 14 Upper limit signal (FLS)	
	b5	Axis 10 Lower limit signal (RLS)			b5	Axis 14 Lower limit signal (RLS)	
	b6	Axis 10 Proximity dog signal (DOG)			b6	Axis 14 Proximity dog signal (DOG)	
	b7	Axis 10 STOP signal (STOP)			b7	Axis 14 STOP signal (STOP)	
	b8	Axis 11 Upper limit signal (FLS)			b8	Axis 15 Upper limit signal (FLS)	
	b9	Axis 11 Lower limit signal (RLS)			b9	Axis 15 Lower limit signal (RLS)	
	b10	Axis 11 Proximity dog signal (DOG)			b10	Axis 15 Proximity dog signal (DOG)	
	b11	Axis 11 STOP signal (STOP)			b11	Axis 15 STOP signal (STOP)	
	b12	Axis 12 Upper limit signal (FLS)			b12	Axis 16 Upper limit signal (FLS)	
	b13	Axis 12 Lower limit signal (RLS)			b13	Axis 16 Lower limit signal (RLS)	
	b14	Axis 12 Proximity dog signal (DOG)			b14	Axis 16 Proximity dog signal (DOG)	
	b15	Axis 12 STOP signal (STOP)			b15	Axis 16 STOP signal (STOP)	

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 436 System control data

■Default value

Set to "0000H".

[Cd.55] Input value for manual pulse generator via CPU

- Set the values used as the input values for the manual pulse generator via the high-speed counter module in order.
- Refer to the manual of the high-speed counter module for the input method.
  MELSEC iQ-R High-Speed Counter Module User's Manual (Startup)
  MELSEC iQ-R High-Speed Counter Module User's Manual (Application)

Fetch cycle: 8.0 [ms]

- Although "[Cd.55] Input value for manual pulse generator via CPU" is fetched every 8.0ms, synchronization with the scan time of the CPU module is not performed, so the speed change of the axis may become large if the refresh cycle of "[Cd.55] Input value for manual pulse generator via CPU" is slow. Use the following methods to smooth the speed change.

- Refresh "[Cd.55] Input value for manual pulse generator via CPU" in a cycle that is 8.0ms or less.
- Smooth the speed change by using the smoothing function of "[Pr.156] Manual pulse generator smoothing time constant".

- When executing manual pulse generator operation using "[Cd.55] Input value for manual pulse generator via CPU", set the following items as shown below in [Module Parameter] ⇨ [Basic Settings] of the high-speed counter module.

Setting item	Setting value
Pulse input mode	Set according to the system.
Counting speed setting	Set according to the system.
Counter type	Linear counter
Counter operation mode	Pulse count mode
Preset value setting	0
Coincidence output point No.1	0
Coincidence output point No.2	0
Ring counter upper limit value	Set according to the system.
Ring counter lower limit value	Set according to the system.

Restriction

Set the movement amount per fetch cycle in "[Cd.55] Input value for manual pulse generator via CPU" within the range of -2147483648 to 2147483647. When a value outside the range is set , the movement amount of the manual pulse generator and the movement amount of the output value may not match.

■Setting range

- Set with a decimal.

Setting range of [Cd.55] (Unit)
-2147483648 to 2147483647 (pulse)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 436 System control data

■Default value

Set to "0".

[Cd.158] Forced stop input

Set the forced stop input information.

Fetch cycle: Operation cycle

■Setting value

- Set with a hexadecimal.

Setting value	Details
0000H	Forced stop ON (Forced stop)
0001H	Forced stop OFF (Forced stop release)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 436 System control data

■Default value

Set to "0000H".

[Cd.3] Positioning start No.

Sets the positioning start No. (Only 1 to 600 for the Pre-reading start function. For details, refer to ☞ Page 273 Pre-reading start function.)

Fetch cycle: At start

■Setting value

- Set with a decimal.

Setting value	Details
1 to 600	Positioning data No.
7000 to 7004	Block start designation
9001	Machine home position return
9002	Fast-home position return
9003	Current value changing
9004	Simultaneous starting of multiple axes

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.4] Positioning starting point No.

- Sets a "starting point No." (1 to 50) if block start data is used for positioning. (Handled as "1" if the value other than 1 to 50 is set.)
- The Motion module resets the value to "0" automatically when the continuous operation is interrupted.

Fetch cycle: At start

■Setting range

- Set with a decimal.

Setting range of [Cd.4]
1 to 50

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.5] Axis error reset

- Clears the axis error detection, axis error No., axis warning detection and axis warning No.
- When the axis operation state of the Motion module is "in error occurrence", the error is cleared and the Motion module is returned to the "waiting" state.
- The Motion module resets the value to "0" automatically after the axis error reset is completed. (Indicates that the axis error reset is completed.)
- Clears both of the Motion module errors and servo amplifier alarms by axis error reset. (Some servo amplifier alarms cannot be reset even if error reset is requested. "0" is stored in "[Cd.5] Axis error reset" by the Motion module when the servo alarm cannot be reset at error reset request. For details, refer to each servo amplifier instruction manual.)
- The error cannot be reset during a forced stop. Execute the axis error reset after the forced stop is released.

Fetch cycle: 16.0 [ms]

■Setting value

- Set with a decimal.

Setting value	Details
1	Axis error is reset.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.6] Restart command

- When "1" is set in [Cd.6] after the positioning is stopped for any reason (while the axis operation state is "stopped"), the positioning will be carried out again from the stop position to the end point of the stopped positioning data.
- The Motion module resets the value to "0" automatically after restart acceptance is completed. (Indicates that the restart acceptance is completed.)

Fetch cycle: 16.0 [ms]

■Setting value

- Set with a decimal.

Setting value	Details
1	Restarts

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.7] M code OFF request

- The M code ON signal turns OFF.
- After the M code ON signal turns OFF, "0" is stored by the Motion module automatically. (Indicates that the OFF request is completed.)

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.

Setting value	Details
1	M code ON signal turns OFF

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.8] External command valid

Validates or invalidates external command signals.

Fetch cycle: At request by external command signal

■Setting value

- Set with a decimal.

Setting value	Details
0	Invalidates an external command.
1	Validates an external command.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.9] New position value

When changing the command position value using the start No. "9003", use this data item to specify a new feed value.

Fetch cycle: At change request

■Setting range

- Set with a decimal.
- The setting value range differs according to "[Pr.1] Unit setting".

Setting of "[Pr.1] Unit setting"	Value set with a program (unit)
0: mm	-2147483648 to 2147483647($\times 10^{-1}$mm)
1: inch	-2147483648 to 2147483647 ($\times 10^{-5}$inch)
2: degree	0 to 35999999 ($\times 10^{-5}$degree)
3: pulse	-2147483648 to 2147483647 (pulse)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.10] New acceleration time value

When changing the acceleration time during a speed change, use this data item to specify a new acceleration time.

Fetch cycle: At change request

■Setting range

• Set with a decimal.

Setting range of [Cd.10] (unit)
0 to 8388608 (ms)

Ex.

When "[Cd.10] New acceleration time value" is set as "60000ms", the buffer memory stores "60000".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.11] New deceleration time value

When changing the deceleration time during a speed change, use this data item to specify a new deceleration time.

Fetch cycle: At change request

■Setting range

• Set with a decimal.

Setting range of [Cd.11] (unit)
0 to 8388608 (ms)

Ex.

When "[Cd.11] New deceleration time value" is set as "60000ms", the buffer memory stores "60000".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.12] Accel/decel time change value during speed change, enable/disable

Enables or disables modifications to the acceleration/deceleration time during a speed change.

Fetch cycle: At change request

■Setting value

• Set with a decimal.

Setting value	Details
1	Enables modifications to acceleration/deceleration time
Other than 1	Disables modifications to acceleration/deceleration time

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.13] Positioning operation speed override

- To use the positioning operation speed override function, use this data item to specify an "override" value.
- If the command speed is set to less than the minimum unit using the override function, the speed is raised to the minimum unit and "Less than minimum speed" (warning code: 0D04H) occurs.
- If the override value "0 (%)" is set, the speed is set to "0" and the speed change 0 flag is set to "1". At the time, "Less than minimum speed" (warning code: 0D04H) does not occur.
- For details of the override function, refer to the following. ☞ Page 261 Override function

Fetch cycle: Operation cycle

■Setting range

- Set with a decimal.

Setting range of [Cd.13] (Unit)
0 to 300 (%)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "100".

[Cd.14] New speed value

- When changing the speed, use this data item to specify a new speed.
- The operation halts if you specify "0".

Fetch cycle: At change request

■Setting range

- Set with a decimal.
- The setting value range differs according to "[Pr.1] Unit setting".

Setting of "[Pr.1] Unit setting"	Value set with a program (unit)
0: mm	0 to 2000000000(× 10^{-2}mm/min)
1: inch	0 to 2000000000 (× 10^{-3}inch/min)
2: degree*1	0 to 2000000000 (× 10^{-3}degree/min)
3: pulse	0 to 1000000000 (pulse/s)

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 (× 10^{-2}degree/min).

Ex.

When "[Cd.14] New speed degree axis" is valid: "2" value" is set as "20000.00mm/min", the buffer memory stores "2000000".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.15] Speed change request

- After setting "[Cd.14] New speed value", set this data item to "1" to execute the speed change (through validating the new speed value).
- The Motion module resets the value to "0" automatically when the speed change request has been processed. (This indicates the completion of speed change request.)

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.

Setting value	Details
1	Executes speed change.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.16] Inching movement amount

- Use this data item to set the amount of movement by inching.
- The machine performs a JOG operation if "0" is set.

Fetch cycle: At start

■Setting range

- Set a value within the following range.

Setting of "[Pr.1] Unit setting"	Value set with a program (unit)*1
0: mm	0 to 65535 ($\times 10^{-1}$μm)
1: inch	0 to 65535 ($\times 10^{-5}$inch)
2: degree	0 to 65535 ($\times 10^{-5}$degree)
3: pulse	0 to 65535 (pulse)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

Ex.

When "[Cd.16] Inching movement amount" is set as "1.0μm", the buffer memory stores "10".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.17] JOG speed

Use this data item to set the JOG speed.

Fetch cycle: At start

■Setting range

- Set with a decimal.
- The setting value range differs according to "[Pr.1] Unit setting".

Setting of "[Pr.1] Unit setting"	Value set with a program (unit)
0: mm	1 to 2000000000(× 10^{-2}mm/min)
1: inch	1 to 2000000000 (× 10^{-3}inch/min)
2: degree*1	1 to 2000000000 (× 10^{-3}degree/min)
3: pulse	1 to 1000000000 (pulse/s)

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 1 to 2000000000 (× 10^{-2}degree/min).

Ex.

When "[Cd.17] JOG speed" is set as "20000.00mm/min", the buffer memory stores "2000000".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.18] Interrupt request during continuous operation

- To interrupt a continuous operation, set "1" to this data item.
- After processing the interruption request ("1"), the Motion module automatically resets the value to "0".

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.

Setting value	Details
1	Interrupts continuous operation control or continuous path control.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.19] Home position return request flag OFF request

- The program can use this data item to forcibly turn the home position return request flag from ON to OFF.
- The Motion module resets the value to "0" automatically when the home position return request flag is turned OFF. (This indicates the completion of home position return request flag OFF request.)

Fetch cycle: 16.0 [ms]

Point

This parameter is made valid when the increment system is valid.

■Setting value

- Set with a decimal.

Setting value	Details
1	Turns the "home position return request flag" from ON to OFF.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.20] Manual pulse generator 1 pulse input magnification

- This data item determines the factor by which the number of pulses from the manual pulse generator is magnified.
- Value "0": read as "1".
- Value "10001 or more" or negative value: read as "10000".

Fetch cycle: Operation cycle (At manual pulse generator enabled)

■Setting range

- Set with a decimal.

Setting range of [Cd.20]
1 to 10000

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "1".

[Cd.21] Manual pulse generator enable flag

This data item enables or disables operations using a manual pulse generator.

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.

Setting value	Details
0	Disable manual pulse generator operation.
1	Enable manual pulse generator operation.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.22] New torque value/forward new torque value

- When "0" is set in "[Cd.112] Torque change function switching request", a new torque limit value is set. (This value is set for the forward torque limit value and reverse torque limit value.) When "1" is set in "[Cd.112] Torque change function switching request", a new forward torque limit value is set.
- Set a value within "0" to "[Pr.17] Torque limit setting value". Set a ratio against the rated torque in 0.1% unit. (The new torque value is invalid when "0" is set, and "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" becomes valid. The range of torque change is 1 to "[Pr.17] Torque limit setting value".)

Fetch cycle: Operation cycle

■Setting range

- Set with a decimal.

Setting range of [Cd.22] (Unit)
0 to [Pr.17] Torque limit setting value (× 0.1%)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.23] Speed-position switching control movement amount change register

- During the speed control stage of the speed-position switching control (INC mode), it is possible to change the specification of the movement amount during the position control stage. For that, use this data item to specify a new movement amount.
- The new movement amount has to be set during the speed control stage of the speed-position switching control (INC mode).
- The value is reset to "0" when the next operation starts.

Fetch cycle: At switching request

■Setting range

- Set with a decimal.
- Set a value within the following range.

Setting of "[Pr.1] Unit setting"	Value set with a program (unit)
0: mm	0 to 2147483647 (× 10^{-1}μm)
1: inch	0 to 2147483647 (× 10^{-5}inch)
2: degree	0 to 2147483647 (× 10^{-5}degree)
3: pulse	0 to 2147483647 (pulse)

Ex.

If "[Cd.23] Speed-position switching control movement amount change register" is set as "20000.0μm", the buffer memory stores "200000".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.24] Speed-position switching enable flag

Sets whether the switching signal set in "[Cd.45] Speed-position switching device selection" is enabled or not.

Fetch cycle: At switching request

■Setting value

- Set with a decimal.

Setting value	Details
0	Speed control will not be taken over by position control even when the signal set in "[Cd.45] Speed-position switching device selection" comes ON.
1	Speed control will be taken over by position control even when the signal set in "[Cd.45] Speed-position switching device selection" comes ON.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.25] Position-speed switching control speed change register

- During the position control stage of the position-speed switching control, it is possible to change the specification of the speed during the speed control stage. For that, use this data item to specify a new speed.
- The new speed has to be set during the position control stage of the position-speed switching control.
- The value is reset to "0" when the next operation starts.

Fetch cycle: At switching request

■Setting range

- Set with a decimal.
- The setting value range differs according to "[Pr.1] Unit setting".

Setting of "[Pr.1] Unit setting"	Value set with a program (unit)
0: mm	0 to 2000000000(× 10^{-2}mm/min)
1: inch	0 to 2000000000 (× 10^{-3}inch/min)
2: degree*1	0 to 2000000000 (× 10^{-3}degree/min)
3: pulse	0 to 1000000000 (pulse/s)

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 (× 10^{-2}degree/min).

Ex.

If "[Cd.25] Position-speed switching control speed change register" is set as "2000.00mm/min", the buffer memory stores "200000".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.26] Position-speed switching enable flag

Sets whether the switching signal set in "[Cd.45] Speed-position switching device selection" is enabled or not.

Fetch cycle: At switching request

■Setting value

• Set with a decimal.

Setting value	Details
0	Position control will not be taken over by speed control even when the signal set in "[Cd.45] Speed-position switching device selection" comes ON.
1	Position control will be taken over by speed control when the signal set in "[Cd.45] Speed-position switching device selection" comes ON.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.27] Target position change value (New address)

When changing the target position during a positioning operation, use this data item to specify a new positioning address.

Fetch cycle: At change request

■Setting range

• Set with a decimal.

• The setting value range differs according to "[Pr.1] Unit setting".

Setting of "[Pr.1] Unit setting"	Setting value depending on program (ABS)(unit)	Setting value depending on program (INC)(unit)
0: mm	-2147483648 to 2147483647 ($\times 10^{-1}$μm)	-2147483648 to 2147483647 ($\times 10^{-1}$μm)
1: inch	-2147483648 to 2147483647 ($\times 10^{-5}$inch)	-2147483648 to 2147483647 ($\times 10^{-5}$inch)
2: degree	0 to 35999999 ($\times 10^{-5}$degree)	-2147483648 to 2147483647 ($\times 10^{-5}$degree)
3: pulse	-2147483648 to 2147483647 (pulse)	-2147483648 to 2147483647 (pulse)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.28] Target position change value (New speed)

- When changing the target position during a positioning operation, use this data item to specify a new speed.
- The speed will not change if "0" is set.

Fetch cycle: At change request

■Setting range

- Set with a decimal.
- The setting value range differs according to "[Pr.1] Unit setting".

Setting of "[Pr.1] Unit setting"	Value set with a program (unit)
0: mm	0 to 2000000000(× 10^{-2}mm/min)
1: inch	0 to 2000000000 (× 10^{-3}inch/min)
2: degree*1	0 to 2000000000 (× 10^{-3}degree/min)
3: pulse	0 to 1000000000 (pulse/s)

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 (× 10^{-2}degree/min).

Ex.

If "[Cd.28] Target position change value (New speed)" is set as "10000.00mm/min", the buffer memory stores "1000000".

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.29] Target position change request flag

- Set whether to change the target position during a positioning operation.
- The Motion module resets the value to "0" automatically when the new target position value has been written. (This indicates the completion of target position change request.)

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.

Setting value	Details
1	Requests a change in the target position

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.30] Simultaneous starting own axis start data No.

Use this data item to specify a start data No. of own axis at multiple axes simultaneous starting.

Fetch cycle: At start

■Setting range

• Set with a decimal.

Setting range of [Cd.30]
1 to 600

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.31] Simultaneous starting axis start data No.1

Use this data item to specify a start data No.1 for each axis that starts simultaneously.

Fetch cycle: At start

■Setting range

• Set with a decimal.

Setting range of [Cd.31]
1 to 600

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.32] Simultaneous starting axis start data No.2

Use this data item to specify a start data No.2 for each axis that starts simultaneously.

Point

For 2 axis simultaneous starting, the axis setting is not required. (Setting value is ignored.)

Fetch cycle: At start

■Setting range

• Set with a decimal.

Setting range of [Cd.32]
1 to 600

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.33] Simultaneous starting axis start data No.3

Use this data item to specify a start data No.3 for each axis that starts simultaneously.

Point

For 2 axis simultaneous starting and 3 axis simultaneous starting, the axis setting is not required. (Setting value is ignored.)

Fetch cycle: At start

■Setting range

- Set with a decimal.

Setting range of [Cd.33]
1 to 600

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.34] Step mode

To perform a step operation, use this data item to specify the units by which the stepping should be performed.

Fetch cycle: At start

■Setting value

- Set with a decimal.

Setting value	Details
0	Stepping by deceleration units
1	Stepping by data No. units

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.35] Step valid flag

This data item validates or invalidates step operations.

Fetch cycle: At start

■Setting value

- Set with a decimal.

Setting value	Details
0	Invalidates step operations
1	Validates step operations

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.36] Step start information

- To continue the step operation when the step function is used, set "1" in the data item.
- The Motion module resets the value to "0" automatically when processing of the step start request completes.

Fetch cycle: 16.0 [ms]

■Setting value

- Set with a decimal.

Setting value	Details
1	Continues step operation

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.37] Skip command

- To skip the current positioning operation, set "1" in this data item.
- The Motion module resets the value to "0" automatically when processing of the skip request completes.

Fetch cycle: Operation cycle (During positioning operation)

■Setting value

- Set with a decimal.

Setting value	Details
1	Issues a skip request to have the machine decelerate, stop, and then start the next positioning operation.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.38] Teaching data selection

- This data item specifies the teaching result write destination.
- Data are cleared to zero when the teaching ends.

Fetch cycle: At operation request

■Setting value

- Set with a decimal.

Setting value	Details
0	Takes the command position value as a positioning address.
1	Takes the command position value as an arc data.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.39] Teaching positioning data No.

- This data item specifies data to be produced by teaching.
- If a value between 1 and 600 is set, a teaching operation is done.
- The value is cleared to "0" when the Motion module is initialized and when teaching operation is completed. It is also cleared to "0" when an illegal value (601 or higher) is entered.

Fetch cycle: 116 [ms]

■Setting range

- Set with a decimal.

Setting range of [Cd.39]
1 to 600

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.40] ABS direction in degrees

This data item specifies the ABS moving direction carrying out the position control when "degree" is selected as the unit.

Fetch cycle: At start

■Setting value

- Set with a decimal.

Setting value	Details
0	Takes a shortcut. (Specified direction ignored.)
1	ABS circular right
2	ABS circular left

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.43] Simultaneous starting axis

- Set the number of simultaneous starting axes and target axis. When "2" is set as the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No.1. When "3" is set as the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No.1 and 2. When "4" is set as the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No.1 to 3.
- When the same axis No. or axis No. of own axis is set to the multiple simultaneous starting axis No, or the value outside the range is set to the number of simultaneous starting axes, "Error before simultaneous start" (error code: 1A90H, 1A91H) occurs and the operation is not executed.

Point

Do not set the simultaneous starting axis No.2 and 3 for 2-axis interpolation, and do not set the simultaneous starting axis No.3 for 3-axis interpolation. The setting value is ignored.

Fetch cycle: At start

■Setting value

- Set with a hexadecimal.

Buffer memory		Details	Setting value	
Low-order	b0 to b7	Simultaneous starting axis No.1	00H to 0FH	Axis 1 to axis 16
	b8 to b15	Simultaneous starting axis No.2		
High-order	b0 to b7	Simultaneous starting axis No.3		
	b8 to b15	Number of simultaneous starting axes	02H to 04H	Axis 2 to Axis 4

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0000H".

[Cd.45] Speed-position switching device selection

Select the device used for speed-position switching.

Point

If the setting is outside the range at start, operation is performed with the setting regarded as "0".

Fetch cycle: At start

■Setting value

- Set with a decimal.

Setting value	Details	
	Speed-position switching control	Position-speed switching control
0	Use the external command signal for switching from speed control to position control	Use the external command signal for switching from position control to speed control
1	Use the proximity dog signal for switching from speed control to position control	Use the proximity dog signal for switching from position control to speed control
2	Use "[Cd.46] Speed-position switching command" for switching from speed control to position control	Use "[Cd.46] Speed-position switching command" for switching from position control to speed control

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.46] Speed-position switching command

Speed-position control switching is performed when "2" is set in "[Cd.45] Speed-position switching device selection". Other than setting value is ignored.

Point

This parameter is made valid only when "2" is set in "[Cd.45] Speed-position switching device selection" at start.

Fetch cycle: Operation cycle

■Setting value

• Set with a decimal.

Setting value	Details	
	Speed-position switching control	Position-speed switching control
0	Not switch from speed control to position control	Not switch from position control to speed control
1	Switch from speed control to position control	Switch from position control to speed control

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.100] Servo OFF command

Executes servo OFF for each axis.

Fetch cycle: Operation cycle

Point

To execute servo ON for axes other than axis 1 being servo OFF, write "1" to storage buffer memory address of axis 1 and then turn ON all axis servo ON [Y1] signal.

■Setting value

• Set with a decimal.

Setting value	Details
0	Servo ON
1	Servo OFF

Valid only during servo ON for all axes.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.101] Torque output setting value

Sets the torque output value. Set a ratio against the rated torque in 0.1% unit.

Fetch cycle: At start

Point

- If "[Cd.101] Torque output setting value" is "0", "[Pr.17] Torque limit setting value" will be its value.
- If a value beside "0" is set in "[Cd.101] Torque output setting value", the torque generated by the servo motor will be limited by that value.
- "[Pr.17] Torque limit setting value" of the detailed parameter becomes effective at the PLC READY [Y0] leading edge.
- "[Cd.101] Torque output setting value" (refer to the start only), which is axis control data, can be changed at all times. Therefore, "[Cd.101] Torque output setting value" is used when changing the torque limit value for each positioning start is required. (☞ Page 266 Torque change function)

■Setting range

- Set with a decimal.

Setting range of [Cd.101] (Unit)
0 to 10000 (× 0.1%)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.108] Gain switching command flag

The command required to carry out "gain switching" of the servo amplifier from the Motion module.

Fetch cycle: Operation cycle

Point

If the setting is other than "0" and "1", operation is performed in the "gain switching" with the setting regard as "0".

For details, refer to the manual of each servo amplifier.

■Setting value

- Set with a decimal.

Setting value	Details
0	Gain switching command OFF
1	Gain switching command ON

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.112] Torque change function switching request

Sets "same setting/individual setting" of the forward torque limit value or reverse torque limit value in the torque change function.

Fetch cycle: Operation cycle

Point

- Set "0" normally. (when the forward torque limit value and reverse torque limit value are not divided.)
- When a value except "1" is set, it operates as "forward/reverse torque limit value same setting".

■Setting value

- Set with a decimal.

Setting value	Details
0	Forward/reverse torque limit value same setting
1	Forward/reverse torque limit value individual setting

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.113] New reverse torque value

- When "1" is set in "[Cd.112] Torque change function switching request", a new reverse torque limit value is set. (when "0" is set in "[Cd.112] Torque change function switching request", the setting value is invalid.)
- Set a value within "0" to "[Pr.17] Torque limit setting value". Set a ratio against the rated torque in 0.1% unit. (The new torque value is invalid when "0" is set, and "[Pr.17] Torque limit setting value" or "[Cd.101] Torque output setting value" becomes valid. The range of torque change is 1 to "[Pr.17] Torque limit setting value".)

Fetch cycle: Operation cycle

■Setting range

- Set with a decimal.

Setting range of [Cd.113] (Unit)
0 to [Pr.17] Torque limit setting value (× 0.1%)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.133] Semi/Fully closed loop switching request

Set the switching of semi closed control and fully closed loop control.

Fetch cycle: Operation cycle (Fully closed loop control servo amplifier only)

■Setting value

• Set with a decimal.

Setting value	Details
0	Semi closed loop control
1	Fully closed loop control

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.136] PI-PID switching request

Set the PI-PID switching to servo amplifier.

Fetch cycle: Operation cycle

■Setting value

• Set with a decimal.

Setting value	Details
1	PID control switching request
Other than 1	Not request

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.138] Control mode switching request

• Request the control mode switching. Set "1" after setting "[Cd.139] Control mode setting".

• The Motion module sets "0" at completion of control mode switching.

Fetch cycle: Operation cycle

■Setting value

• Set with a decimal.

Setting value	Details
1	Switching request
Other than 1	Not request

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.139] Control mode setting

Set the control mode to be changed in the speed-torque control.

Fetch cycle: At request (Mode switching)

■Setting value

• Set with a decimal.

Setting value	Details
0	Position control mode
10	Speed control mode
20	Torque control mode
30	Continuous operation to torque control mode

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.140] Command speed at speed control mode

Set the command speed at speed control mode.

Fetch cycle: Operation cycle (At speed control mode)

■Setting range

• Set with a decimal.

• The setting value range differs according to "[Pr.1] Unit setting".

Setting of "[Pr.1] Unit setting"	Value set with a program (unit)
0: mm	-2000000000 to 2000000000(× 10^{-2}mm/min)
1: inch	-2000000000 to 2000000000 (× 10^{-3}inch/min)
2: degree*1	-2000000000 to 2000000000 (× 10^{-3}degree/min)
3: pulse	-1000000000 to 1000000000 (pulse/s)

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is -2000000000 to 2000000000 (× 10^{-2} degree/min).

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.141] Acceleration time at speed control mode

Set the acceleration time at speed control mode. (Set the time for the speed to increase from "0" to "[Pr.8] Speed limit value".)

Fetch cycle: At request (Mode switching)

■Setting range

Setting range of [Cd.141] (Unit)*1
0 to 65535 (ms)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value
Set to "1000".

[Cd.142] Deceleration time at speed control mode
Set the deceleration time at speed control mode. (Set the time for the speed to decrease from "[Pr.8] Speed limit value" to "0".)
Fetch cycle: At request (Mode switching)

■Setting range

Setting range of [Cd.142] (Unit)*1
0 to 65535 (ms)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

■Buffer memory address
Refer to the following for the buffer memory address in this area.
☞ Page 437 Axis control data

■Default value
Set to "1000".

[Cd.143] Command torque at torque control mode
Set the command torque at torque control mode. Set a ratio against the rated torque in 0.1% unit.
Fetch cycle: Operation cycle (At torque control mode)

■Setting range
- Set with a decimal.

Setting range of [Cd.143] (Unit)
-10000 to 10000 (× 0.1%)

■Buffer memory address
Refer to the following for the buffer memory address in this area.
☞ Page 437 Axis control data

■Default value
Set to "0".

[Cd.144] Torque time constant at torque control mode (Forward direction)
Set the time constant at driving during torque control mode. (Set the time for the torque to increase from "0" to "[Pr.17] Torque limit setting value".)
Fetch cycle: At request (Mode switching)

■Setting range

Setting range of [Cd.144] (Unit)*1
0 to 65535 (ms)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

■Buffer memory address
Refer to the following for the buffer memory address in this area.
☞ Page 437 Axis control data

■Default value
Set to "1000".

[Cd.145] Torque time constant at torque control mode (Negative direction)

Set the time constant at regeneration during torque control mode. (Set the time for the torque to decrease from "[Pr.17] Torque limit setting value" to "0".)

Fetch cycle: At request (Mode switching)

■Setting range

Setting range of [Cd.145] (Unit)*1
0 to 65535 (ms)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "1000".

[Cd.146] Speed limit value at torque control mode

Set the speed limit value at torque control mode.

Fetch cycle: Operation cycle (At torque control mode)

■Setting range

- Set with a decimal.
- The setting value range differs according to "[Pr.1] Unit setting".

Setting of "[Pr.1] Unit setting"	Value set with a program (unit)
0: mm	0 to 2000000000(× 10^{-2}mm/min)
1: inch	0 to 2000000000 (× 10^{-3}inch/min)
2: degree*1	0 to 2000000000 (× 10^{-3}degree/min)
3: pulse	0 to 1000000000 (pulse/s)

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 (× 10^{-2}degree/min).

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "1".

[Cd.147] Speed limit value at continuous operation to torque control mode

Set the speed limit value at continuous operation to torque control mode.

Fetch cycle: Operation cycle (At continuous operation to torque control mode)

■Setting range

- Set with a decimal.
- The setting value range differs according to "[Pr.1] Unit setting".

Setting of "[Pr.1] Unit setting"	Value set with a program (unit)
0: mm	0 to 2000000000(× 10^{-2}mm/min)
1: inch	0 to 2000000000 (× 10^{-3}inch/min)
2: degree*1	0 to 2000000000 (× 10^{-3}degree/min)
3: pulse	0 to 1000000000 (pulse/s)

*1 When "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid, the setting range is 0 to 2000000000 (× 10^{-2}degree/min).

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.148] Acceleration time at continuous operation to torque control mode

Set the acceleration time at continuous operation to torque control mode. (Set the time for the speed to increase from "0" to "[Pr.8] Speed limit value".)

Fetch cycle: At request (Mode switching)

■Setting range

Setting range of [Cd.148] (Unit)*1
0 to 65535 (ms)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "1000".

[Cd.149] Deceleration time at continuous operation to torque control mode

Set the deceleration time at continuous operation to torque control mode. (Set the time for the speed to decrease from "[Pr.8] Speed limit value" to "0".)

Fetch cycle: At request (Mode switching)

■Setting range

Setting range of [Cd.149] (Unit)*1
0 to 65535 (ms)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "1000".

[Cd.150] Target torque at continuous operation to torque control mode

Set the target torque at continuous operation to torque control mode. Set a ratio against the rated torque in 0.1% unit.

Fetch cycle: Operation cycle (At continuous operation to torque control mode)

■Setting range

- Set with a decimal.

Setting range of [Cd.150] (Unit)
-10000 to 10000 (× 0.1%)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.151] Torque time constant at continuous operation to torque control mode (Forward direction)

Set the time constant at driving during continuous operation to torque control mode. (Set the time for the torque to increase from "0" to "[Pr.17] Torque limit setting value".)

Fetch cycle: At request (Mode switching)

■Setting range

Setting range of [Cd.151] (Unit)*1
0 to 65535 (ms)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "1000".

[Cd.152] Torque time constant at continuous operation to torque control mode (Negative direction)

Set the time constant at regeneration during continuous operation to torque control mode. (Set the time for the torque to decrease from "[Pr.17] Torque limit setting value" to "0".)

Fetch cycle: At request (Mode switching)

■Setting range

Setting range of [Cd.152] (Unit)*1
0 to 65535 (ms)

*1 0 to 32767: Set as a decimal
32768 to 65535: Convert into hexadecimal and set

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "1000".

[Cd.153] Control mode auto-shift selection

Set the switching condition when switching to continuous operation to torque control mode.

Fetch cycle: At request (Mode switching)

■Setting value

- Set with a decimal.

Setting value	Details	
0	No switching condition	Switching is executed at switching request to continuous operation to torque control mode.
1	Command position value pass	Switching is executed when "[Md.20] Command position value" passes the address set in "[Cd.154] Control mode auto-shift parameter" after switching request to continuous operation to torque control mode.
2	Actual position value pass	Switching is executed when "[Md.101] Actual position value" passes the address set in "[Cd.154] Control mode auto-shift parameter" after switching request to continuous operation to torque control mode.

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.154] Control mode auto-shift parameter

- Set the condition value when setting the control mode switching condition.
- The setting value differs depending on the value set in "[Cd.153] Control mode auto-shift selection". When "1" or "2" is set in "[Cd.153] Control mode auto-shift selection": Set the switching address.

Fetch cycle: At request (Mode switching)

■Setting range

- Set with a decimal.
- The setting value range differs according to "[Pr.1] Unit setting".

Setting of "[Pr.1] Unit setting"	Value set with a program (unit)
0: mm	-2147483648 to 2147483647 ($\times 10^{-1}$μm)
1: inch	-2147483648 to 2147483647 ($\times 10^{-5}$inch)
2: degree	0 to 35999999 ($\times 10^{-5}$degree)
3: pulse	-2147483648 to 2147483647 (pulse)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.180] Axis stop

- When the axis stop signal turns ON, the home position return control, positioning control, JOG operation, inching operation, manual pulse generator operation, speed-torque control, etc. will stop.
- By turning the axis stop signal ON during positioning operation, the positioning operation will be "stopped".
- Whether to decelerate stop or rapidly stop can be selected with "[Pr.39] Stop group 3 rapid stop selection".
- During interpolation control of the positioning operation, if the axis stop signal of any axis turns ON, all axes in the interpolation control will decelerate and stop.

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.

Setting value	Details
1	Axis stop requested
Other than 1	Axis stop not requested

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.181] Forward run JOG start, [Cd.182] Reverse run JOG start

- When the JOG start signal is ON, JOG operation will be carried out at "[Cd.17] JOG speed". When the JOG start signal turns OFF, the operation will decelerate and stop.
- When inching movement amount is set, the designated movement amount is output for one operation cycle and then the operation stops.

Fetch cycle: Operation cycle

■Setting value

- Set with a decimal.

Setting value	Details
1	JOG started
Other than 1	JOG not started

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

[Cd.183] Execution prohibition flag

If the execution prohibition flag is ON when the positioning start signal turns ON, positioning control does not start until the execution prohibition flag turns OFF. Used with the "Pre-reading start function". (☞ Page 273 Pre-reading start function)

Fetch cycle: At start

■Setting value

- Set with a decimal.

Setting value	Details
1	During execution prohibition
Other than 1	Not during execution prohibition

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 437 Axis control data

■Default value

Set to "0".

Axis control data (device station operation)

[Cd.160] to [Cd.163] Optional SDO transfer request

Used in the servo transient transmission function. Refer to the following for details.

☞ Page 382 Servo Transient Transmission Function

Fetch cycle: Main cycle

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 446 Axis control data (device station operation)

[Cd.164] to [Cd.167] Optional SDO transfer data

Used in the servo transient transmission function. Refer to the following for details.

☞ Page 382 Servo Transient Transmission Function

Fetch cycle: At request (Command request)

■Buffer memory address

Refer to the following for the buffer memory address in this area.

☞ Page 446 Axis control data (device station operation)

12.9 Memory Configuration and Data Process

The memory configuration and data transmission of the Motion module are explained in this section.
The Motion module is equipped with four memories. By understanding the configuration and roles of the four memories, the internal data transmission process of the Motion module, such as "when the power is turned ON" or "when PLC READY [Y0] changes from OFF to ON", can be easily understood. This also allows the transmission process to be carried out correctly when saving or changing the data.

Configuration and roles

The Motion module is equipped with the following four memories.
○: Setting and storage area provided, —: Setting and storage area not provided
Possible: Data is held even when power is turned OFF, Not possible: Data is lost when power is turned OFF

Memory configuration	Role	Area configuration						
		Parameter area*1	Monitor data area	Control data area	Positioning data area*1		Block start data area*1	
					(No.1 to 100)	(No.101 to 600)	(No.7000 to 7001)	(No.7002 to 7004)
Buffer memory	Area that can be directly accessed with a program with a CPU module	○	○	○	○	○	○	○
Internal memory	Area that can be set only with the engineering tool	—	—	—	—	—	—	—
	Area that can be set only using buffer memory	—	—	—	—	—	—	—
Flash ROM	Area for backing up data required for positioning	○	—	—	○	○	○	○
Internal memory (nonvolatile)	Area for backing up servo parameter or cam data	—	—	—	—	—	—	—

Memory configuration	Role	Area configuration			Backup
		Servo parameter area*1	Synchronous control area*1	Cam area*1	
Buffer memory	Area that can be directly accessed with a program with a CPU module	—	○	—	Not possible
Internal memory	Area that can be set only with the engineering tool	—	—	—	Not possible
	Area that can be set only using buffer memory	—	—	○	Not possible
Flash ROM	Area for backing up data required for positioning	—	○*2	—	Possible
Internal memory (nonvolatile)	Area for backing up servo parameter or cam data	—	—	○	Possible

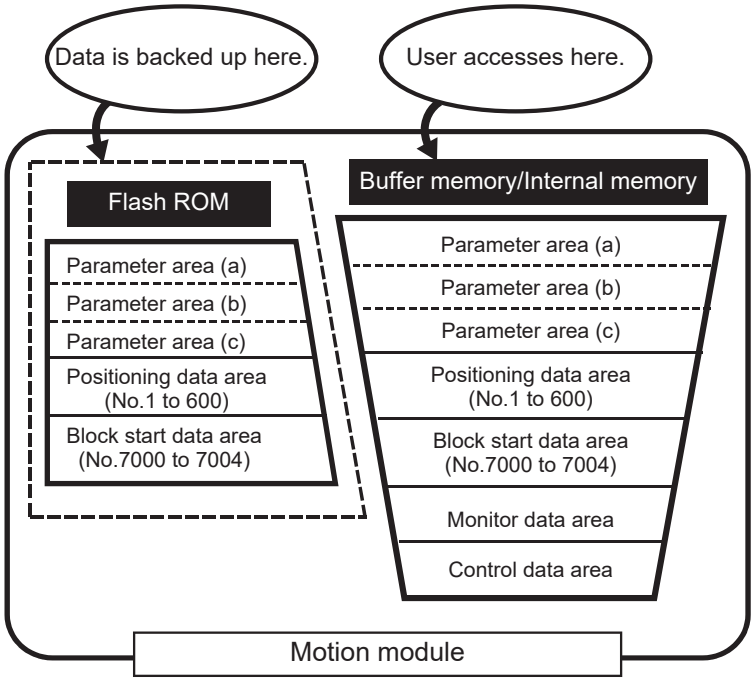
*1 The areas are included in the Simple Motion module setting.
*2 Parameter only

Details of areas

Area name	Description
Parameter area	Area where parameters, such as positioning parameters and home position return parameters, required for positioning control are set and stored.
Monitor data area	Area where the operation status of positioning system is stored.
Control data area	Area where data for operating and controlling positioning system is set and stored.
Positioning data area (No.1 to 600)	Area where positioning data No.1 to 600 is set and stored.
Block start data area (No.7000 to 7004)	Area where information required only when carrying out block No.7000 to 7004 high-level positioning is set and stored.
Synchronous control area*1	Area where parameters and control data required for synchronous control are set and stored. Also, the operation status of synchronous control is stored.
Cam area*1	Area where cam data, etc. are set and stored. There are cam storage area and cam open area.

*1 Refer to the following for details of synchronous control area and cam area.
MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

■Area



Area name	Description	
Parameter area (a)	Parameters validated when PLC READY [Y0] changes from OFF to ON	[Pr.1] to [Pr.4], [Pr.7], [Pr.11] to [Pr.22], [Pr.43] to [Pr.46], [Pr.51], [Pr.52], [Pr.55], [Pr.81] to [Pr.83], [Pr.90], [Pr.95], [Pr.116] to [Pr.119], [Pr.122], [Pr.123], [Pr.127], [Pr.156], [Pr.801], [Pr.805] to [Pr.807]
Parameter area (b)	Parameters validated when the TO command is executed from the CPU module (validated when the next control is started, at the time of request, and when condition is satisfied after the TO command is executed.)	[Pr.8] to [Pr.10], [Pr.25] to [Pr.42], [Pr.84], [Pr.112], [Pr.512] to [Pr.515]
Parameter area (c)	Parameters validated with power supply ON/ the CPU module reset	[Pr.91] to [Pr.94], [Pr.101], [Pr.116] to [Pr.119], [Pr.140] to [Pr.143], [Pr.152], [Pr.591] to [Pr.594], [Pr.800] to [Pr.811], [Pr.900] to [Pr.903], [Pr.910] to [Pr.913], [Pr.920] to [Pr.923], [Pr.930] to [Pr.933], [Pr.940] to [Pr.943], [Pr.950] to [Pr.953], [Pr.960] to [Pr.963], [Pr.970] to [Pr.973], [Pr.980] to [Pr.984], [Pr.990] to [Pr.1009], [Pr.1020] to [Pr.1023], [Pr.1030] to [Pr.1033], [Pr.1040] to [Pr.1043], [Pr.1050] to [Pr.1053], [Pr.1060] to [Pr.1063]

Buffer memory area configuration

The buffer memory of the Motion module has the area configuration as listed below.

n: Axis No. - 1

k: Mark detection setting No. - 1

p: Pointer No. - -1

j: Synchronous encoder axis No. - 1

Buffer memory area configuration		Buffer memory address[*1]	Writing possibility
		Axis 1 to axis 16	
Parameter area	Servo network composition parameter	58022+32n to 58029+32n	Possible
	Common parameter	35, 58003, 58011	
	Basic parameter	0+150n to 15+150n	
	Detailed parameter	17+150n to 69+150n 116+150n to 123+150n, 125+150n	
	Home position return basic parameter	70+150n to 75+150n	
	Home position return detailed parameter	82+150n, 83+150n, 87+150n	
	Extended parameter	92+150n to 95+150n, 100+150n to 103+150n,	
	Link device external signal assignment parameter	440000+320n to 440319+320n	
	Mark detection setting parameter	54000+20k to 54010+20k	
	Servo object specification parameter	460024+256n to 460031+256n	
Monitor data area	System monitor data	4000 to 4239, 31332, 31504, 87000, 87010+10p to 87016+10p	Not possible
	Axis monitor data	2400+100n to 2499+100n 59303+100n	
	Mark detection monitor data	54960+80k to 55025+80k	
	Axis monitor data (device station operation)	468192+2048n to 468232+2048n	
Control data area	System control data	5900 to 5947	Possible
	Axis control data	4300+100n to 4395+100n 30100+10n to 30103+10n	
	Mark detection control data	54640+10k to 54642+10k	
	Axis control data (device station operation)	534796+2048n to 535054+2048n	
Positioning data area (No.1 to 100)	Positioning data	6000+1000n to 6999+1000n 71000+1000n to 71991+1000n	Possible
Positioning data area (No.101 to 600)		200000+5000n to 204999+5000n 280000+5000n to 284991+5000n	
Block start data area (No.7000)	Block start data	22000+400n to 22049+400n	
		22050+400n to 22099+400n	
	Condition data	22100+400n to 22199+400n	
Block start data area (No.7001)	Block start data	22200+400n to 22249+400n	
		22250+400n to 22299+400n	
	Condition data	22300+400n to 22399+400n	
Block start data area (No.7002)	Block start data	360000+600n to 360099+600n	
	Condition data	360100+600n to 360199+600n	
Block start data area (No.7003)	Block start data	360200+600n to 360599+600n	
	Condition data		
Block start data area (No.7004)	Block start data		
	Condition data		

Buffer memory area configuration		Buffer memory address[*1]	Writing possibility
		Axis 1 to axis 16	
Synchronous control area[*2]	Servo input axis parameter	32800+10n to 32805+10n	Possible
	Servo input axis monitor data	33120+10n to 33127+10n	Not possible
	Synchronous encoder axis parameter	34720+20j to 34735+20j	Possible
	Synchronous encoder axis control data	35040+10j to 35048+10j	Possible
	Synchronous encoder axis monitor data	35200+20j to 35212+20j	Not possible
	Synchronous encoder axis parameters via link device	35520+20j to 35539+20j	Possible
	Synchronous control system control data	36320, 36322	Possible
	Synchronous parameter	36400+200n to 36513+200n	Possible
	Synchronous control monitor data	42800+40n to 42835+40n	Not possible
	Control data for synchronous control	44080+20n to 44090+20n	Possible
	Cam operation control data	45000 to 53791	Possible
	Cam operation monitor data	53800 to 53801	Not possible
	Command generation axis parameter	Set with the engineering tool.	Possible
	Command generation axis control data	61860+128n to 61978+128n	Possible
	Command generation axis monitor data	60900+120n to 61004+120n	Not possible
	Command generation axis positioning data	Set with the engineering tool.	Possible
CC-Link IE TSN network area[*3]	link device (RX)	1657344 to 1658367	Not possible
	Link device (RY)	1658368 to 1659391	Possible
	Link device (RWw)	1659392 to 1667583	Possible
	Link device (RWr)	1667584 to 1675775	Not possible
	Device station offset/size data	2845696 to 2849791	Not possible

*1 Use of skipped address Nos. is prohibited. If used, the system may not operate correctly.

*2 Refer to "List of Buffer Memory Addresses (for Synchronous Control)" in the following manual for details.
MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

*3 Refer to "Buffer Memory (When Using the Simple Motion Mode)" in the following manual for details.
MELSEC iQ-R Motion Module User's Manual (Network)

Data transmission timing

The parameters of the Motion module are classified as the module parameter or Simple Motion module setting. Each parameter is reflected in the buffer memory of the Motion module at the following reflection timing.

Parameter reflection timing	Operation	Parameter setting value reflected in the buffer memory	
		Module parameter*1	Simple Motion module setting*2
Power ON	Power ON	Parameter set with the engineering tool*3	Parameter stored in the Motion module
Module initialization	[Cd.2] Module initialization request	Initial value (factory-set value)	

*1 Some module parameters are reflected in the Motion module by turning PLC READY [Y0] from OFF to ON.

*2 When no parameter to be reflected exists at the reflection timing, refer to the following.
☞ Page 591 (1) Transmitting data when power is turned ON or CPU module is reset

*3 When parameters are not set with the engineering tool, the initial values are reflected.

Data transmission process

The data is transmitted among the memories of the Motion module with steps (1) to (9) shown below.
The data transmission patterns correspond to the numbers (1) to (9) in the following referential drawings.

Data transmission pattern		Referential drawing
(1)	Transmitting data when power is turned ON or CPU module is reset	Page 594 Pattern (1) to (4)
(2)	Transmitting data with TO command from CPU module	
(3)	Valid parameters when PLC READY [Y0] changes from OFF to ON	
(4)	Accessing with FROM command from CPU module	
(5)	Writing the flash ROM by a CPU module request	Page 595 Pattern (5) and (6)
(6)	Writing the flash ROM by a request from the engineering tool	
(7)	Reading data from buffer memory/internal memory to the engineering tool	Page 596 Pattern (7) and (8)
(8)	Writing data from the engineering tool to buffer memory/internal memory	
(9)	Transmitting servo parameter	—

(1) Transmitting data when power is turned ON or CPU module is reset

When the power is turned ON or the CPU module is reset, the "parameter area (c)[*1]", "positioning data", and "block start data" stored (backed up) in the flash ROM/internal memory (nonvolatile) are transmitted to the buffer memory and internal memory.

*1 For details, refer to the following.
☞ Page 587 Details of areas

(2) Transmitting data with TO command from CPU module

The parameters or data is written from the CPU module to the buffer memory using the TO command.
At this time, when the "parameter area (b)[*1]", "positioning data", "block start data", and "control data" are written into the buffer memory with the TO command, it is simultaneously validated.

*1 For details, refer to the following.
☞ Page 587 Details of areas

(3) Valid parameters when PLC READY [Y0] changes from OFF to ON

When PLC READY [Y0] changes from OFF to ON, the data stored in the buffer memory's "parameter area (a)[*1]" is validated.

*1 For details, refer to the following.
☞ Page 587 Details of areas

Point

The setting values of the parameters that correspond to parameter area (b) are valid when written into the buffer memory with the TO command. However, the setting values of the parameters that correspond to parameter area (a) are not validated until PLC READY [Y0] changes from OFF to ON.

(4) Accessing with FROM command from CPU module

The data is read from the buffer memory to the CPU module using the FROM command.

(5) Writing the flash ROM by a CPU module request

The following transmission process is carried out by setting "1" in "[Cd.1] Flash ROM write request".

- The "parameters", "positioning data (No.1 to 600)", and "block start data (No.7000 to 7004)" in the buffer memory/internal memory area are transmitted to the flash ROM/internal memory (nonvolatile).

(6) Writing the flash ROM by a request from the engineering tool

The following transmission processes are carried out with [flash ROM write request] from the engineering tool. This transmission process is the same as (6) above.

- The "parameters", "positioning data (No.1 to 600)", and "block start data (No.7000 to 7004)" in the buffer memory/internal memory area are transmitted to the flash ROM/internal memory (nonvolatile).

Point

- Do not turn the power OFF or reset the CPU module while writing to the flash ROM. If the power is turned OFF or the CPU module is reset to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.
- Do not write the data to the buffer memory/internal memory before writing to the flash ROM is completed.
- The number of writes to the flash ROM with the program is 25 max. while the power is turned ON. Writing to the flash ROM beyond 25 times will cause "Flash ROM write number error" (error code: 1080H). Refer to ☞ Page 662 List of Error Codes for details.
- Monitoring is the number of writes to the flash ROM after the power is switched ON by "[Md.19] Number of write accesses to flash ROM".

(7) Reading data from buffer memory/internal memory to the engineering tool

The following transmission processes are carried out with [Read from module] from the engineering tool.

- The "parameters", "positioning data (No.1 to 600)", and "block start data (No.7000 to 7004)" in the buffer memory/internal memory area are transmitted to the engineering tool via the CPU module.

The following transmission processes are carried out with [Monitor] from the engineering tool.

- The "monitor data" in the buffer memory area is transmitted to the engineering tool via the CPU module.

(8) Writing data from the engineering tool to buffer memory/internal memory

The following transmission processes are carried out with [Write to module] from the engineering tool.

- The "parameters", "positioning data (No.1 to 600)", and "block start data (No.7000 to 7004)" in the engineering tool are transmitted to the buffer memory/internal memory via the CPU module.

At this time, when [Flash ROM automatic write] is set with the engineering tool, the transmission processes indicated with "(7) Writing the flash ROM by a request from the engineering tool" are carried out.

(9) Transmitting servo parameter

On the CC-Link IE TSN network, when device station parameter automatic setting is set to "Enabled", servo parameters controlled by the CPU module are transmitted when communications with the servo amplifier start.

When device station parameter automatic setting is set to "Enabled", servo parameters controlled by the servo amplifier are enabled.

For the device station parameter automatic setting, refer to "Others" of the following manual.

MELSEC iQ-R Motion Module User's Manual (Network)

The Motion module checks whether the servo parameters transmitted from the CPU module and the servo parameters controlled by the servo amplifier are in the recommended setting when communications with the servo amplifier start.

When the parameters are not in the recommended setting, "Servo parameter invalid" (error code: 1DC8H) occurs and the setting values of the servo parameters are overwritten from the Motion module.

For details of the recommended setting of servo parameters, refer to the following.

☞ Page 702 Devices Compatible with CC-Link IE TSN

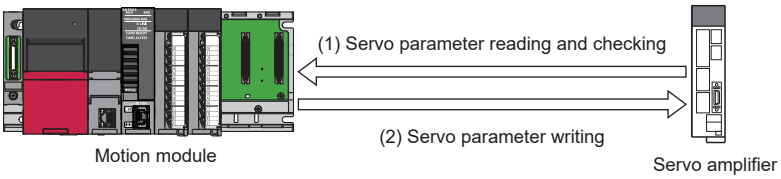
Point

When "Servo parameter invalid" (error code: 1DC8H) occurs, "[Md.190] Controller position value restoration complete status" becomes "0: Incomplete restoration" and servo ON cannot be performed.

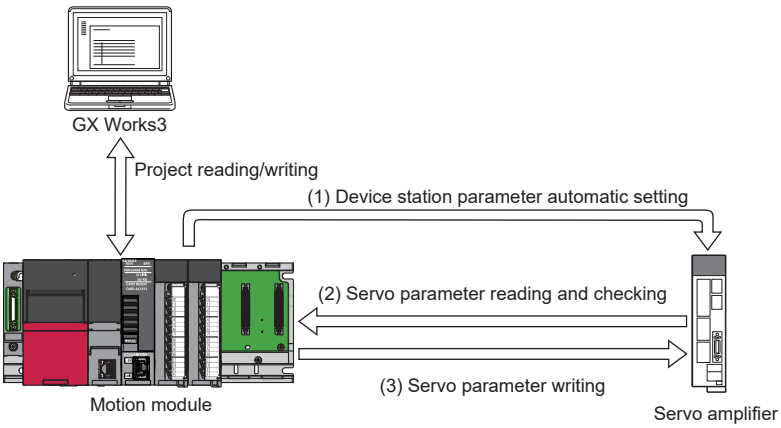
After resetting the error, cycle the power of the servo amplifier.

■Control details

• When device station parameter automatic setting is set to "Disabled"



• When device station parameter automatic setting is set to "Enabled"



Point

- The transient communication (SLMP) is used for reading and writing servo parameters. At writing, servo parameters are saved by using the Store parameters request. For details of the Store parameters request, refer to the manual of the servo amplifier.
- To enable "automatic update of the saved parameters (automatic update when parameters are updated on the device station side)" when the device station parameter automatic setting is used, the servo parameter "Parameter automatic backup update interval (PN20)"*1 must be set.
  Parameters are backed up when there is a difference between the parameters distributed last time and the current parameters at the set time intervals after the power-on. To apply the parameters after the change to the project, open the servo parameter setting screen again, read parameters directly from the servo amplifier with "Read", and apply the servo parameters to the project.
- Timing to read and check the servo parameters of the Motion module are as follows according to the device station parameter automatic setting.
  When device station parameter automatic setting is set to "Enabled": After servo parameters are transferred from the CPU module
  When device station parameter automatic setting is set to "Disabled": At the start of communication with the servo amplifier

*1 The number of writing to the data memory of the CPU module has a limit. For details, refer to the following.
For MR-J5(W)-G: MR-J5-G/MR-J5W-G User's Manual (Parameters)

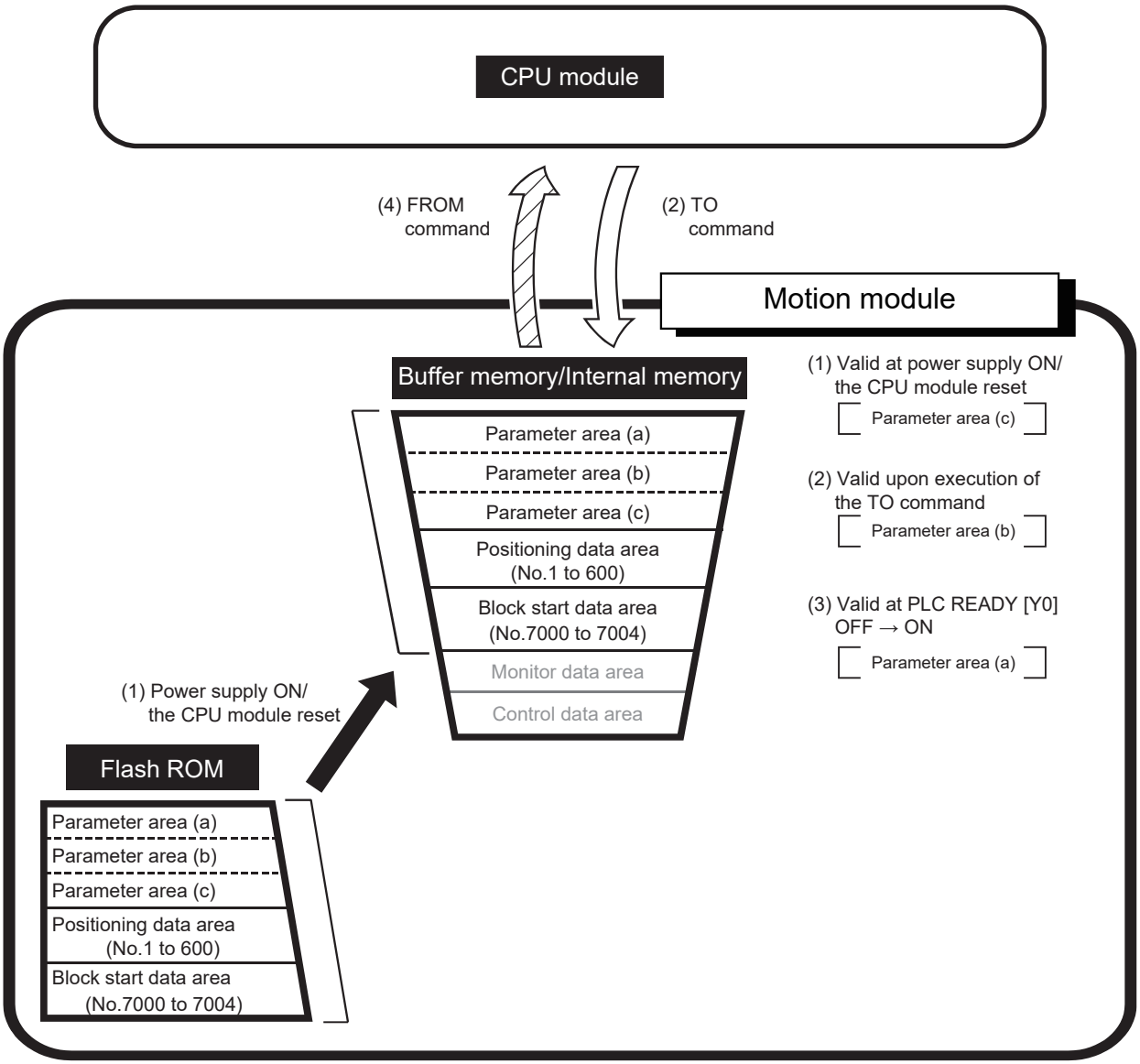
■Restrictions

Turning OFF the power of the servo amplifier while servo parameters are being changed to the recommended setting may corrupt the servo parameters. Turn OFF the power of the servo amplifier after checking that the Motion module is in one of the following two statuses.

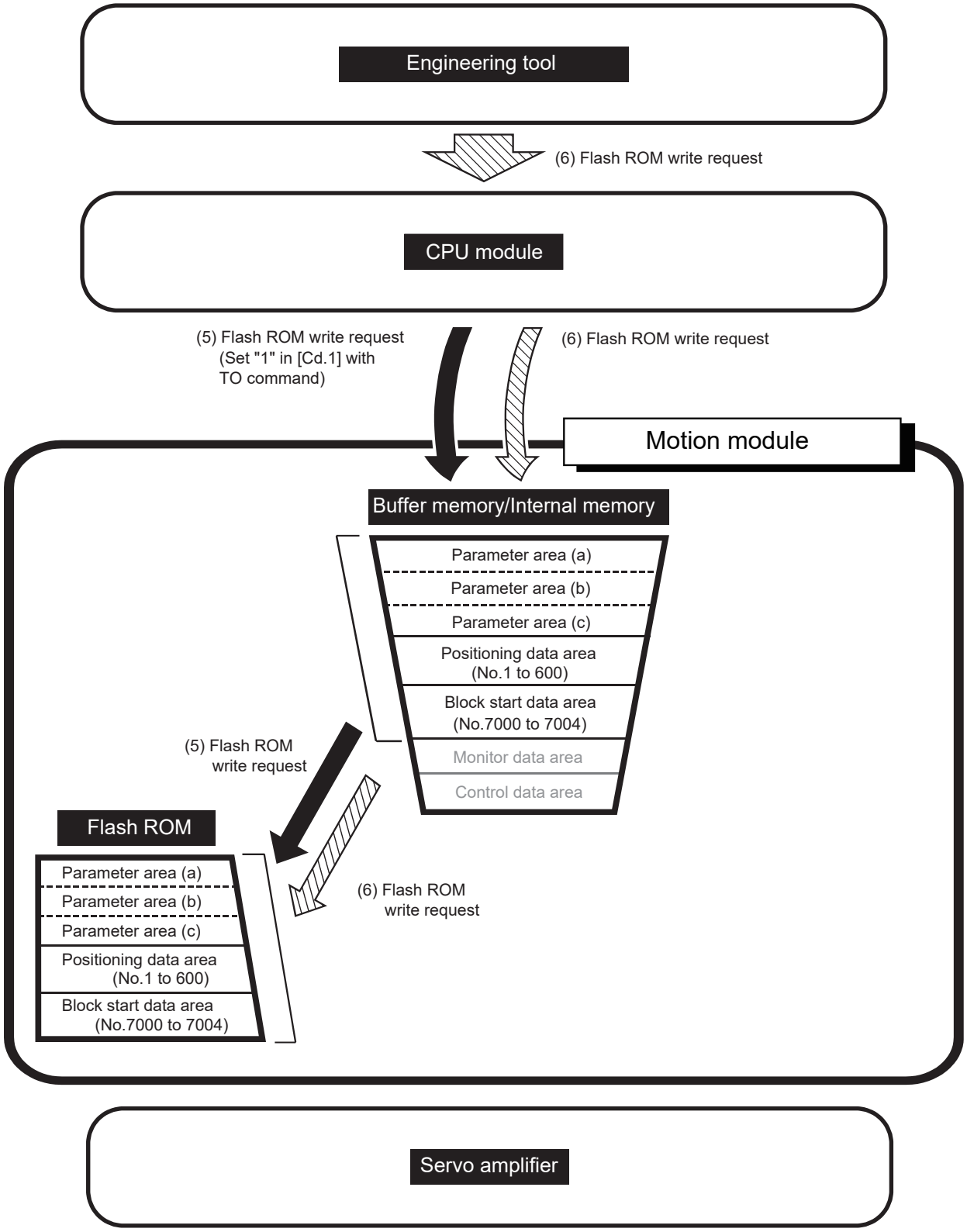
- "Servo parameter invalid" (error code: 1DC8H) has occurred.
- "[Md.190] Controller position value restoration complete status" is "1: Complete INC restoration" or "2: Complete ABS restoration".

Data transmission patterns

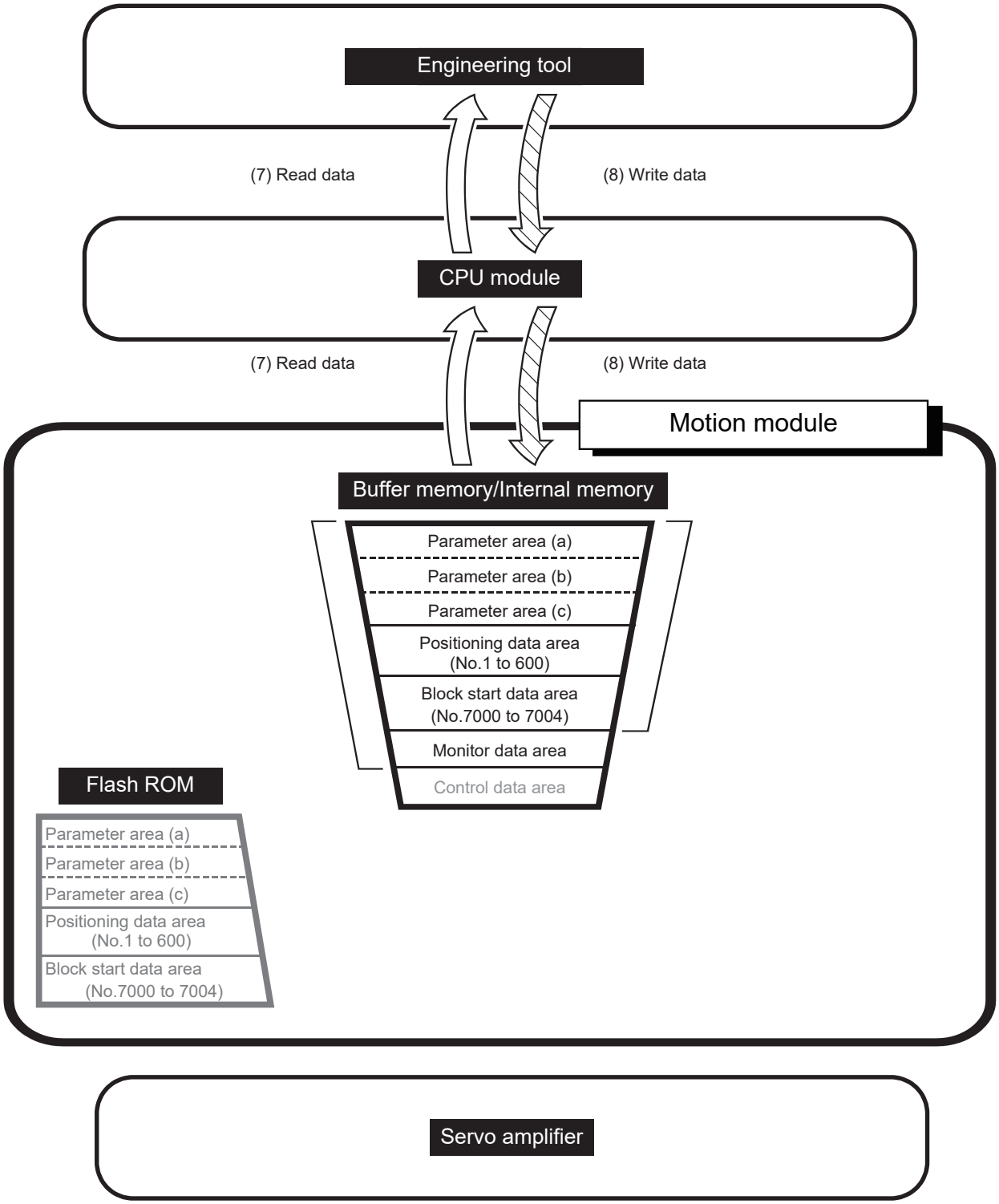
■Pattern (1) to (4)



■Pattern (5) and (6)



■**Pattern (7) and (8)**



13 PROGRAMMING

This chapter describes the programs required to carry out positioning control with the Motion module. The program required for control is created allowing for the "start conditions", "start time chart", "device settings" and general control configuration. (The parameters, positioning data, block start data, condition data, etc., must be set in the Motion module according to the control to be executed, and a setting program for the control data or a start program for the various controls must be created.)

13.1 Precautions for Creating Program

The common precautions to be taken when writing data from the CPU module to the buffer memory of the Motion module are described below.

Reading/writing the data

The data explained in this chapter (various parameters, positioning data, block start data) should be set using an engineering tool. To set it with the program, many programs and devices must be used. This will not only complicate the program, but will also increase the scan time. When rewriting the positioning data during continuous path control or continuous positioning control, rewrite the data before the execution of the positioning data four prior to the data to be rewritten. Otherwise, the process will be carried out as if the data was not rewritten.

Restrictions to speed change execution interval

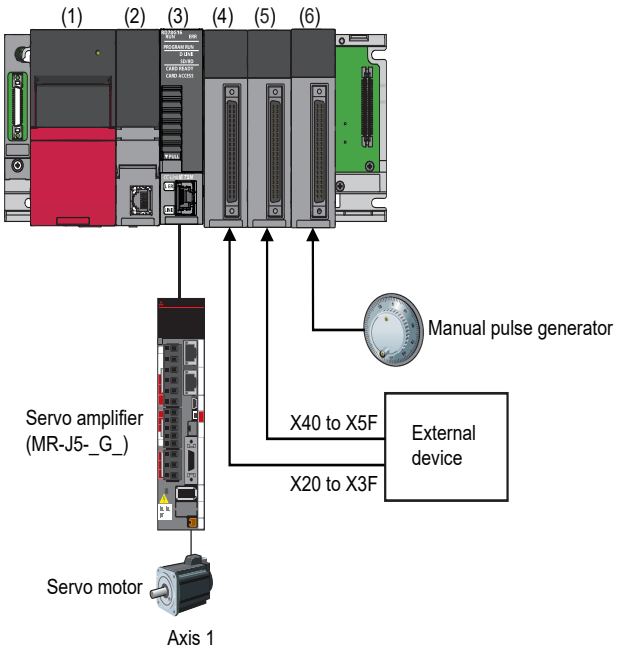
Be sure there is an interval between the speed changes of 10ms or more when carrying out consecutive speed changes by the speed change function or override function with the Motion module.

Process during overrun

Overrun is prevented by the setting of the upper and lower stroke limits with the detailed parameter 1. However, this applies only when the Motion module is operating correctly. It is recommended to create an external circuit including a boundary limit switch to ensure the whole system safety as follows: the external circuit that turns OFF the main circuit power of the servo amplifier when the boundary limit switch operates.

System configuration

The following figure shows the system configuration used for the program examples.



(1) R61P
(2) R16CPU
(3) RD78G16 (X0 to X1F/Y0 to Y1F)
(4) RX41C4 (X20 to X3F)
(5) RX41C4 (X40 to X5F)
(6) RD62P2

13.2 List of Labels Used

In the program examples, the labels to be used are assigned as follows.

Module label

Classification	Label name	Description
Input signal	RD78GS_1.bReady_D	READY
	RD78GS_1.bSynchronizationFlag_D	Synchronization flag
	RD78GS_1.bnBusy_D[0]	Axis 1 BUSY signal
Output signal	RD78GS_1.bAllAxisServoOn_D	All axis servo ON
	RD78GS_1.bPLC_Ready	PLC READY [Y0]
	RD78GS_1.bPLC_Ready_D	
	RD78GS_1.bnPositioningStart[0]	Axis 1 Positioning start signal
Parameter	RD78GS_1.stnAxPrm_D[0].dHomePosition_D	Axis 1 Home position address
	RD78GS_1.stnAxPrm_D[0].dSoftwareStrokeLowerLimit_D	Axis 1 Software stroke limit lower limit value
	RD78GS_1.stnAxPrm_D[0].dSoftwareStrokeUpperLimit_D	Axis 1 Software stroke limit upper limit value
	RD78GS_1.stnAxPrm_D[0].uExternalCommandFunctionMode_D	Axis 1 External command function selection
	RD78GS_1.stnAxPrm_D[0].uExternalCommandSignalMode_D	Axis 1 External command signal selection
	RD78GS_1.stnAxPrm_D[0].uUnitMagnification_D	Axis 1 Unit magnification (AM)
	RD78GS_1.stnAxPrm_D[0].uUnit_D	Axis 1 Unit setting
	RD78GS_1.stnAxPrm_D[0].uVP_Mode_D	Axis 1 Speed-position function selection
	RD78GS_1.stnAxPrm_D[0].uV_CommandPosition_D	Axis 1 Command position value during speed control
	RD78GS_1.stnAxPrm_D[0].udHomingSpeed_D	Axis 1 Home position return speed
	RD78GS_1.stnAxPrm_D[0].udJogSpeedLimit_D	Axis 1 JOG speed limit value
	RD78GS_1.stnAxPrm_D[0].udMovementAmountPerRotation_D	Axis 1 Movement amount per rotation (AL)
	RD78GS_1.stnAxPrm_D[0].udPulsesPerRotation_D	Axis 1 Number of pulses per rotation (AP)
	RD78GS_1.stnAxPrm_D[0].udSpeedLimitValue_D	Axis 1 Speed limit value
Axis monitor data	RD78GS_1.stnAxMntr_D[0].uStatus_D.3	Axis 1 Home position return request flag
	RD78GS_1.stnAxMntr_D[0].uStatus_D.9	Axis 1 Axis warning detection
	RD78GS_1.stnAxMntr_D[0].uStatus_D.C	Axis 1 M code ON
	RD78GS_1.stnAxMntr_D[0].uStatus_D.D	Axis 1 Error detection
	RD78GS_1.stnAxMntr_D[0].uStatus_D.E	Axis 1 Start complete

Classification	Label name	Description
Axis control data 1	RD78GS_1.stnAxCtrl1_D[0].uClearHomingRequestFlag_D	Axis 1 Home position return request flag OFF request
	RD78GS_1.stnAxCtrl1_D[0].uClear_M_Code_D	Axis 1 M code OFF request
	RD78GS_1.stnAxCtrl1_D[0].uEnablePV_Switching_D	Axis 1 Position-speed switching enable flag
	RD78GS_1.stnAxCtrl1_D[0].uEnableVP_Switching_D	Axis 1 Speed-position switching enable flag
	RD78GS_1.stnAxCtrl1_D[0].uExternalCommandValid_D	Axis 1 External command valid
	RD78GS_1.stnAxCtrl1_D[0].uForwardNewTorque_D	Axis 1 New torque value/forward new torque value
	RD78GS_1.stnAxCtrl1_D[0].uInchingMovementAmount_D	Axis 1 Inching movement amount
	RD78GS_1.stnAxCtrl1_D[0].uInterruptOperation_D	Axis 1 Interrupt request during continuous operation
	RD78GS_1.stnAxCtrl1_D[0].uOverride_D	Axis 1 Positioning operation speed override
	RD78GS_1.stnAxCtrl1_D[0].uSkip_D	Axis 1 Skip command
	RD78GS_1.stnAxCtrl1_D[0].uStepMode_D	Axis 1 Step mode
	RD78GS_1.stnAxCtrl1_D[0].uStepStartInformation_D	Axis 1 Step start information
	RD78GS_1.stnAxCtrl1_D[0].uStepValid_D	Axis 1 Step valid flag
	RD78GS_1.stnAxCtrl1_D[0].uTeachingDataSelection_D	Axis 1 Teaching data selection
	RD78GS_1.stnAxCtrl1_D[0].uTeachingPositioningDataNo_D	Axis 1 Teaching positioning data No.
	RD78GS_1.stnAxCtrl1_D[0].udJOG_Speed_D	Axis 1 JOG speed
	RD78GS_1.stnAxCtrl1_D[0].udPV_NewSpeed_D	Axis 1 Position-speed switching control speed change register
	RD78GS_1.stnAxCtrl1_D[0].udVP_NewMovementAmount_D	Axis 1 Speed-position switching control movement amount change register
System control data	RD78GS_1.stSysCtrl_D.dInputValueForManualPulseGeneratorViaCPU_D	Axis 1 Input value for manual pulse generator via CPU
Axis control data 2	RD78GS_1.stnAxCtrl2_D[0].uStopAxis_D.0	Axis 1 Axis stop

Global label

The following describes the global labels used in the program examples. Set the global labels as follows.

- Global label that the assignment device is to be set

	Label Name	Data Type		Class	Assign (Device/Label)
1	G_bInputOPRReqFlagOffReq	Bit	...	VAR_GLOBAL	X20
2	G_bInputExternalCommandValidReq	Bit	...	VAR_GLOBAL	X21
3	G_bInputExternalCommandInvalidReq	Bit	...	VAR_GLOBAL	X22
4	G_bInputOPRStartReq	Bit	...	VAR_GLOBAL	X23
5	G_bInputFastOPRStartReq	Bit	...	VAR_GLOBAL	X24
6	G_bInputSetStartPositioningNoReq	Bit	...	VAR_GLOBAL	X25
7	G_bInputSpeedPositionSwitchingReq	Bit	...	VAR_GLOBAL	X26
8	G_bInputSpeedPositionSwitchingEnableReq	Bit	...	VAR_GLOBAL	X27
9	G_bInputSpeedPositionSwitchingDisableReq	Bit	...	VAR_GLOBAL	X28
10	G_bInputChangeSpeedPositionSwitchingMovementAmount	Bit	...	VAR_GLOBAL	X29
11	G_bInputStartAdvancedPositioningReq	Bit	...	VAR_GLOBAL	X2A
12	G_bInputStartPositioningReq	Bit	...	VAR_GLOBAL	X2B
13	G_bInputMcodeOffReq	Bit	...	VAR_GLOBAL	X2C
14	G_bInputSetJogSpeedReq	Bit	...	VAR_GLOBAL	X2D
15	G_bInputForwardJogStartReq	Bit	...	VAR_GLOBAL	X2E
16	G_bInputReverseJogStartReq	Bit	...	VAR_GLOBAL	X2F
17	G_bInputStartMPGReq	Bit	...	VAR_GLOBAL	X30
18	G_bInputChangeSpeedReq	Bit	...	VAR_GLOBAL	X32
19	G_bInputOverrideReq	Bit	...	VAR_GLOBAL	X33
20	G_bInputChangeAccDecTimeReq	Bit	...	VAR_GLOBAL	X34
21	G_bInputChangeAccDecTimeDisable	Bit	...	VAR_GLOBAL	X35
22	G_bInputChangeTorqueReq	Bit	...	VAR_GLOBAL	X36
23	G_bInputStepOperationReq	Bit	...	VAR_GLOBAL	X37
24	G_bInputSkipReq	Bit	...	VAR_GLOBAL	X38
25	G_bInputTeachingReq	Bit	...	VAR_GLOBAL	X39
26	G_bInputStopContinuousOperationReq	Bit	...	VAR_GLOBAL	X3A
27	G_bInputRestartReq	Bit	...	VAR_GLOBAL	X3B
28	G_bInputInitializeParameterReq	Bit	...	VAR_GLOBAL	X3C
29	G_bInputWriteFlashReq	Bit	...	VAR_GLOBAL	X3D
30	G_bInputErrResetReq	Bit	...	VAR_GLOBAL	X3E
31	G_bInputStopReq	Bit	...	VAR_GLOBAL	X3F
32	G_bInputPositionSpeedSwitchingReq	Bit	...	VAR_GLOBAL	X40
33	G_bInputPositionSpeedSwitchingEnableReq	Bit	...	VAR_GLOBAL	X41
34	G_bInputPositionSpeedSwitchingDisableReq	Bit	...	VAR_GLOBAL	X42
35	G_bInputChangePositionSpeedSwitchingSpeedReq	Bit	...	VAR_GLOBAL	X43
36	G_bInputSetInchingMovementAmountReq	Bit	...	VAR_GLOBAL	X44
37	G_bInputTargetPositionChangeReq	Bit	...	VAR_GLOBAL	X45
38	G_bInputStepStartInformationReq	Bit	...	VAR_GLOBAL	X46
39	G_bInputSpeedPositionSwitchingAbsSetReq	Bit	...	VAR_GLOBAL	X4D
40	G_bAllAxisServoOnReq	Bit	...	VAR_GLOBAL	X4F
41	G_bInputServoParamChange	Bit	...	VAR_GLOBAL	X53
42	G_bInputServoParamRead	Bit	...	VAR_GLOBAL	X54
43			...		

- Global label that the assignment device is not to be set (The unused internal relay and data device are automatically assigned when the assignment device is not set.)

	Label Name	Data Type		Class	Assign (Device/Label)
1	G_bInitializeParameterReq	Bit	...	VAR_GLOBAL	
2	G_bWriteFlashReq	Bit	...	VAR_GLOBAL	
3	G_bDuringJogInchingOperation	Bit	...	VAR_GLOBAL	
4	G_bDuringMPGOperation	Bit	...	VAR_GLOBAL	
5			...		

13.3 Creating a Program

The "positioning control operation program" actually used is explained in this section.

General configuration of program

The general configuration of the positioning control operation program is shown below.

No.	Program name	Remark
1	Parameter setting program	• The program is not required when the parameter, positioning data, block start data, and servo parameter are set using an engineering tool. • The setting of the home position return parameters is not required when the machine home position return control is not executed.
2	Positioning data setting program	
3	Block start data setting program	
4	Home position return request OFF program	Not required when the machine home position return control is executed.
5	External command function valid setting program	—
6	PLC READY [Y0] ON program	
7	All axis servo ON program	
8	Positioning start No. setting program	
9	Positioning start program	—
10	M code OFF program	Not required when the M code output function is not used.
11	JOG operation setting program	Not required when the JOG operation is not used.
12	Inching operation setting program	Not required when the inching operation is not used.
13	JOG operation/inching operation execution program	Not required when the JOG operation or the inching operation is not used.
14	Manual pulse generator operation program	Not required when the manual pulse generator operation is not used.
15	Speed change program	Add the program as necessary.
16	Override program	
17	Acceleration/deceleration time change program	
18	Torque change program	
19	Target position change program	
20	Servo parameter reading/writing program	
21	Step operation program	
22	Skip program	
23	Teaching program	
24	Continuous operation interrupt program	
25	Restart program	
26	Parameter initialization program	
27	Flash ROM write program	
28	Error reset program	
29	Axis stop program	—

13.4 Positioning Program Examples

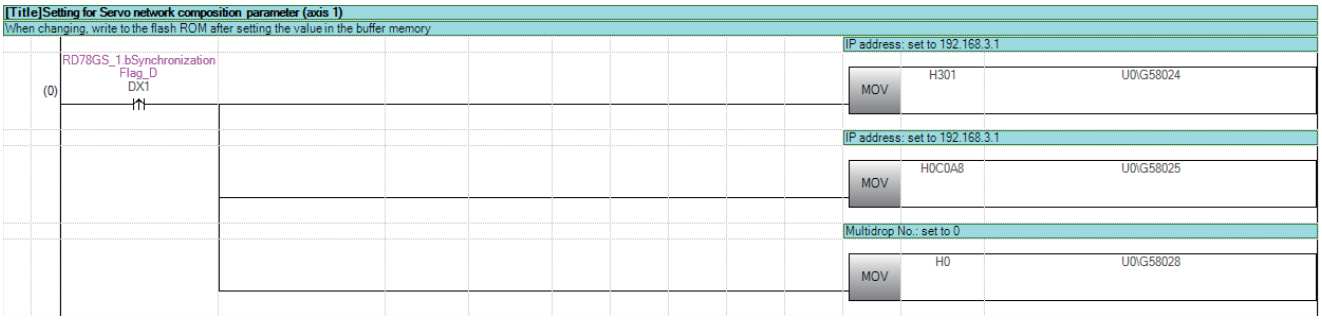
Parameter setting program

The program is not required when the parameter is set by "Module Parameter" using an engineering tool.

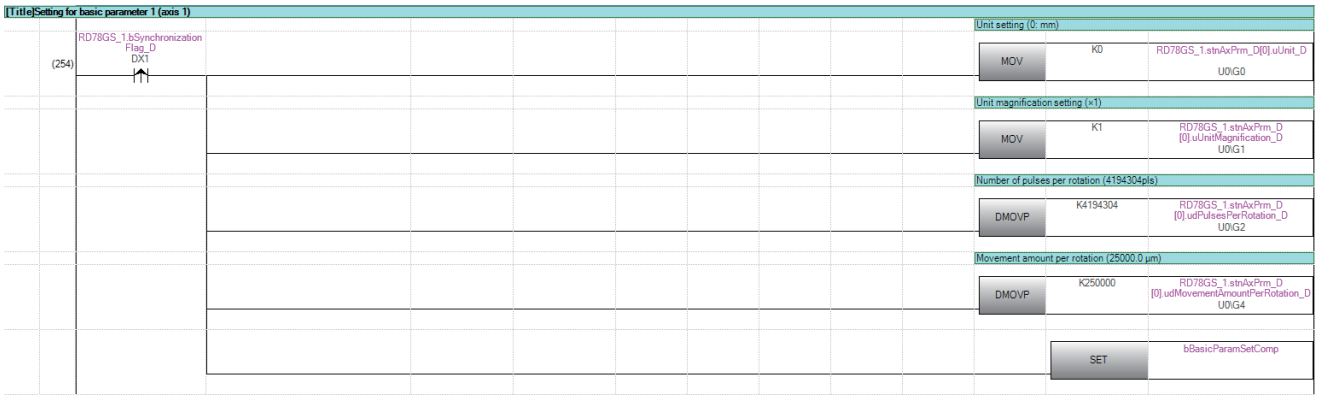
Set the local labels as follows.

	Label Name	Data Type		Class
1	bServoNetworkCompositionParamSetComp	Bit	...	VAR
2	bBasicParamSetComp	Bit	...	VAR
3	bDetailedParamSetComp	Bit	...	VAR
4	bOPRParamSetComp	Bit	...	VAR
5			...	

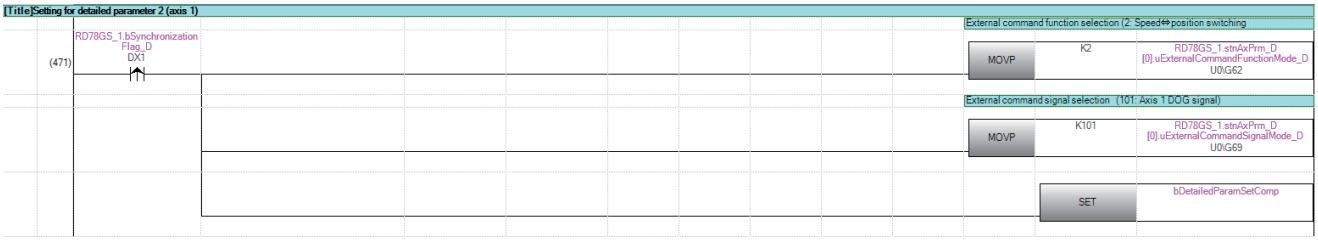
■Setting for servo network configuration parameter (axis 1)



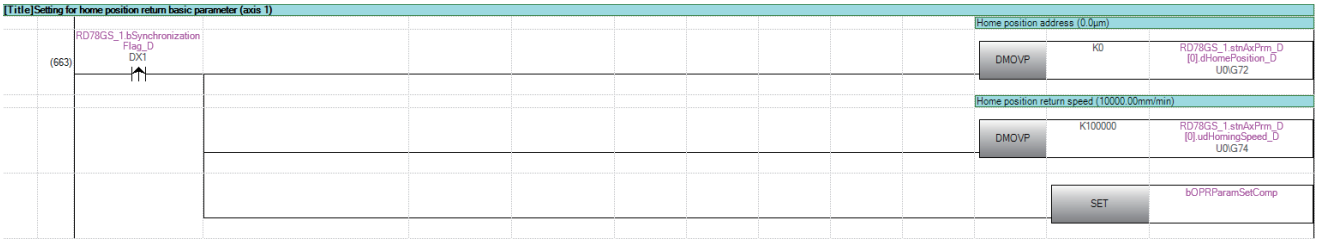
■Setting for basic parameter 1 (axis 1)



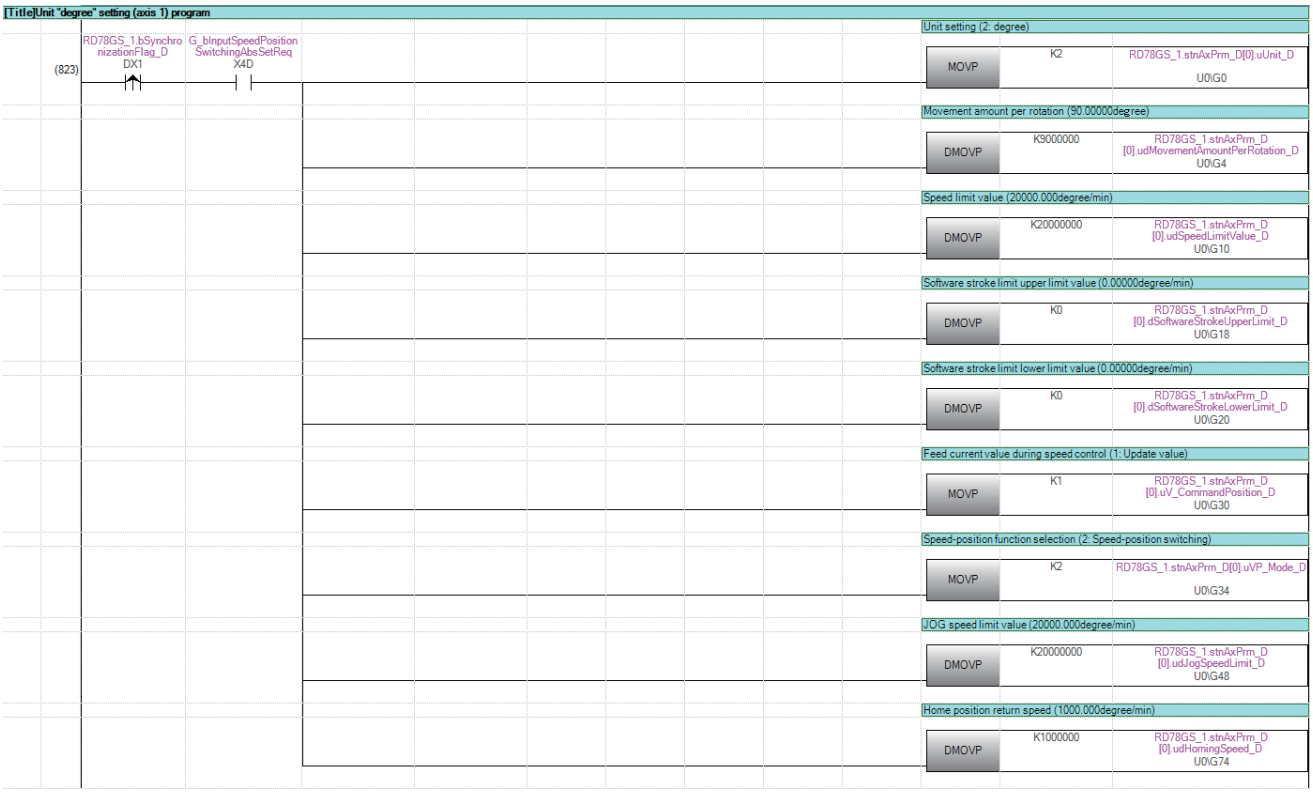
■Setting for detailed parameter 2 (axis 1)



■Setting for home position return basic parameter (axis 1)



■Unit "degree" setting (axis 1) program



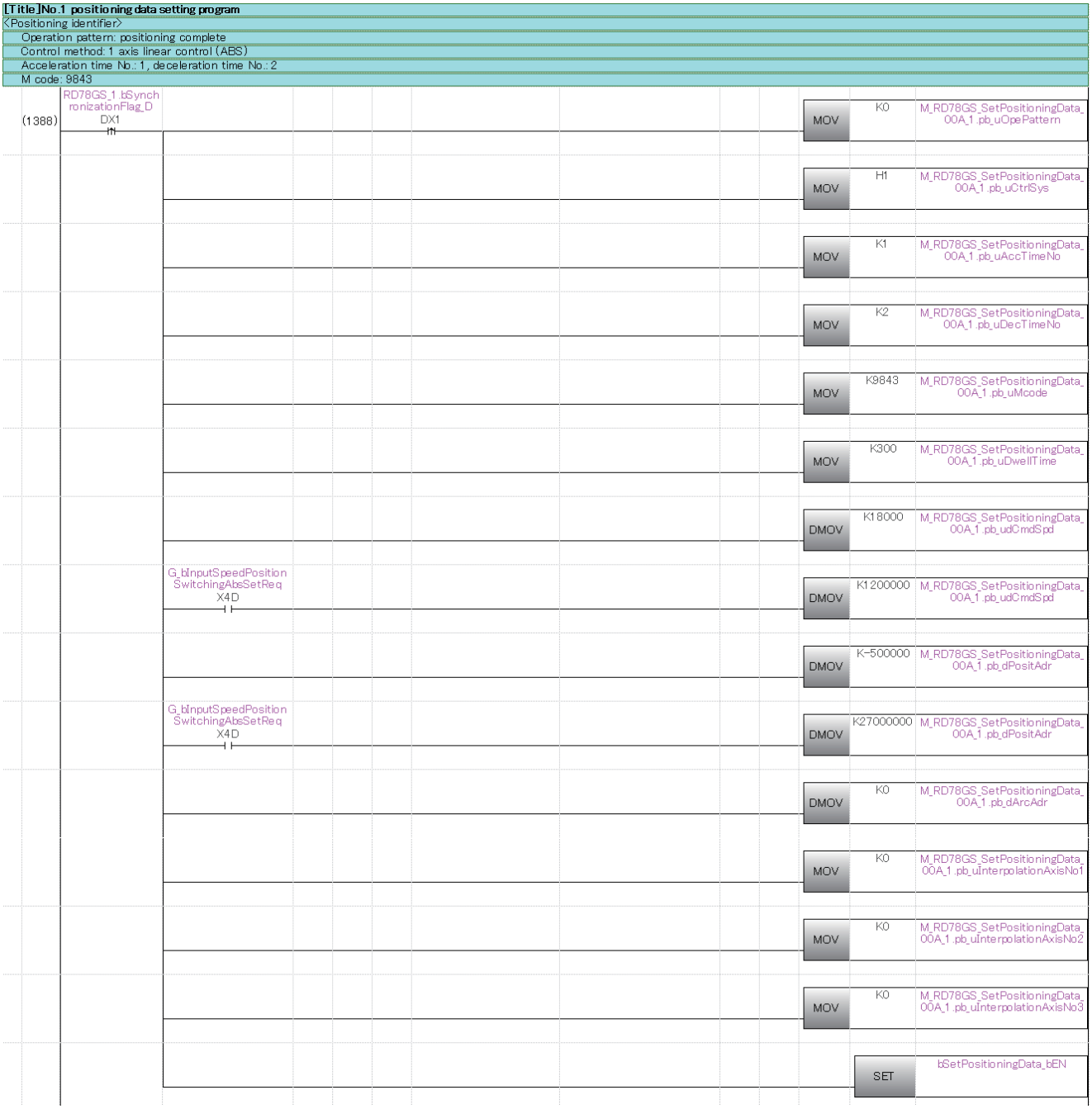
Positioning data setting program

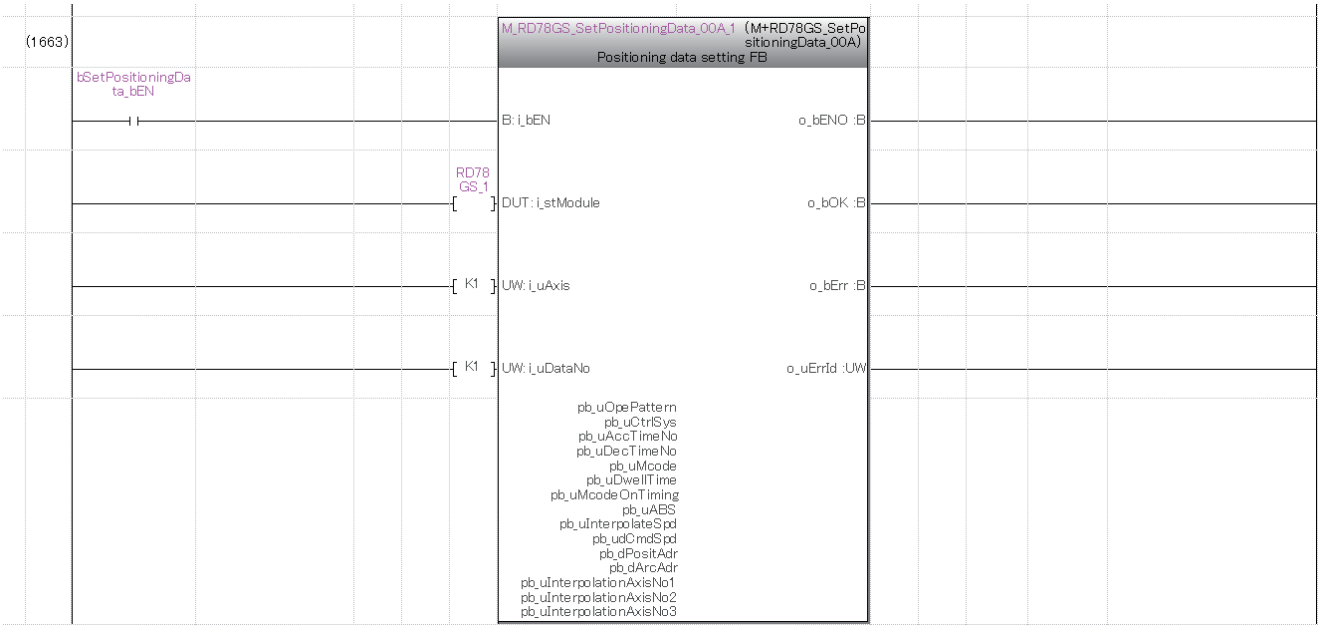
The program is not required when the data is set by "Positioning Data" using an engineering tool.

Set the local labels as follows.

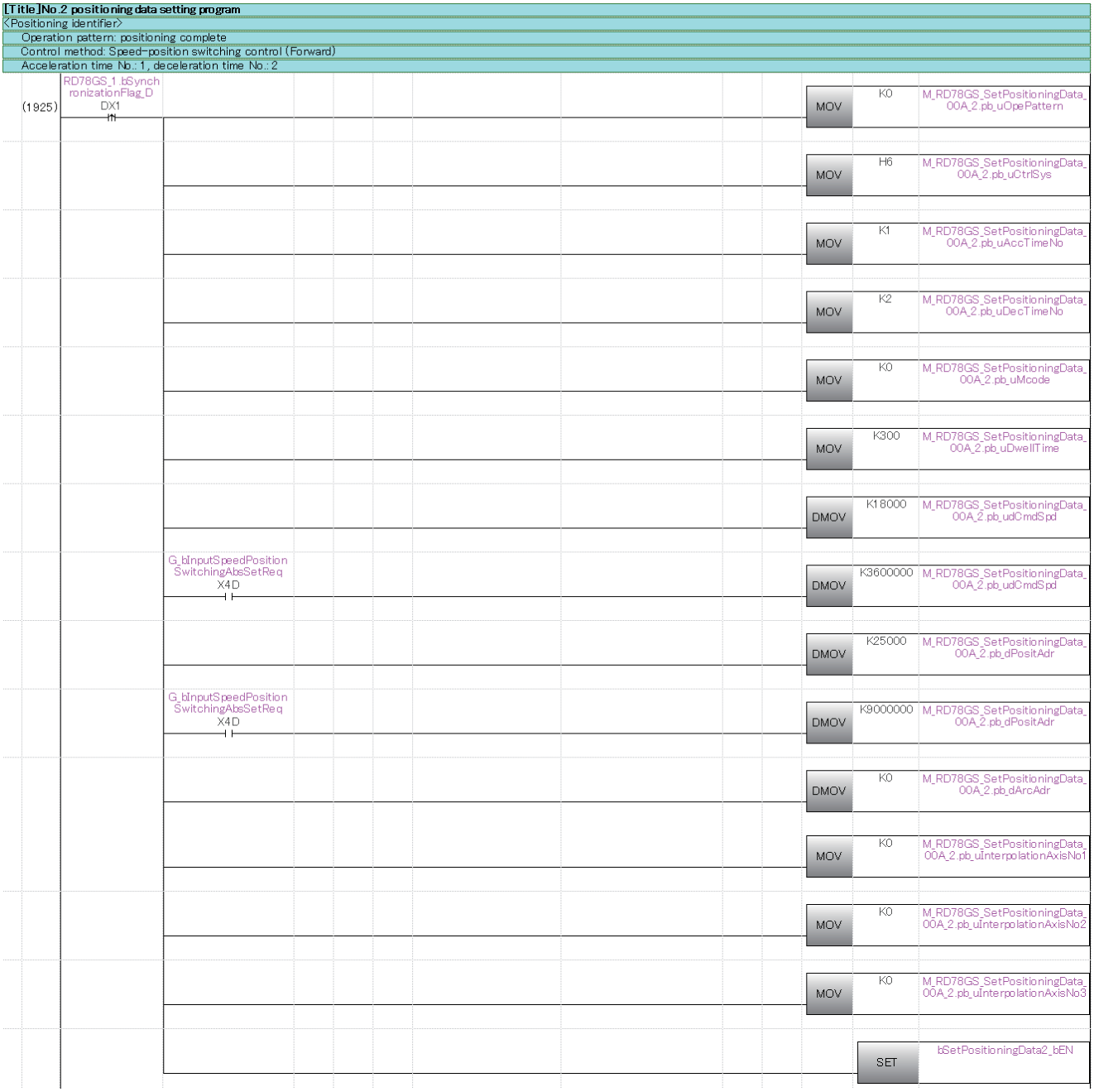
	Label Name	Data Type		Class
1	bSetPositioningData_bEN	Bit	...	VAR
2	bSetPositioningData2_bEN	Bit	...	VAR
3	bSetPositioningData3_bEN	Bit	...	VAR
4	bSetPositioningData4_bEN	Bit	...	VAR
5	bSetPositioningData5_bEN	Bit	...	VAR
6	bSetPositioningData6_bEN	Bit	...	VAR
7	bSetPositioningData10_bEN	Bit	...	VAR
8	bSetPositioningData11_bEN	Bit	...	VAR
9	bSetPositioningData15_bEN	Bit	...	VAR
10			...	

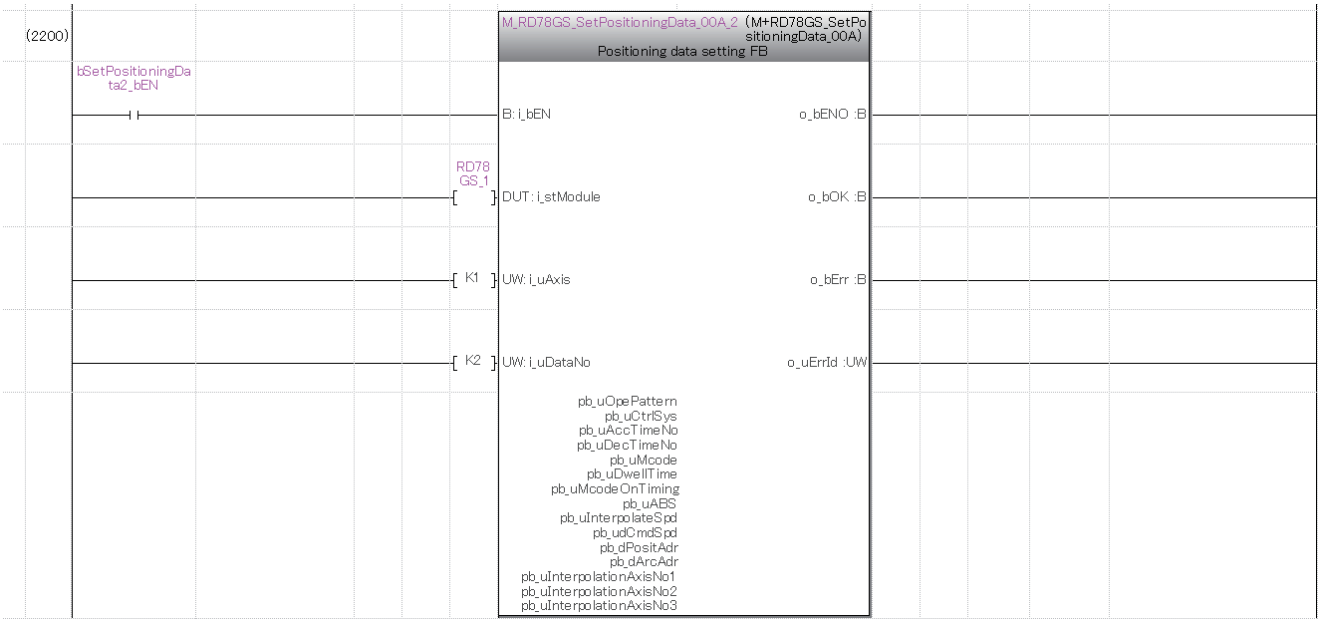
■No.1 positioning data setting program



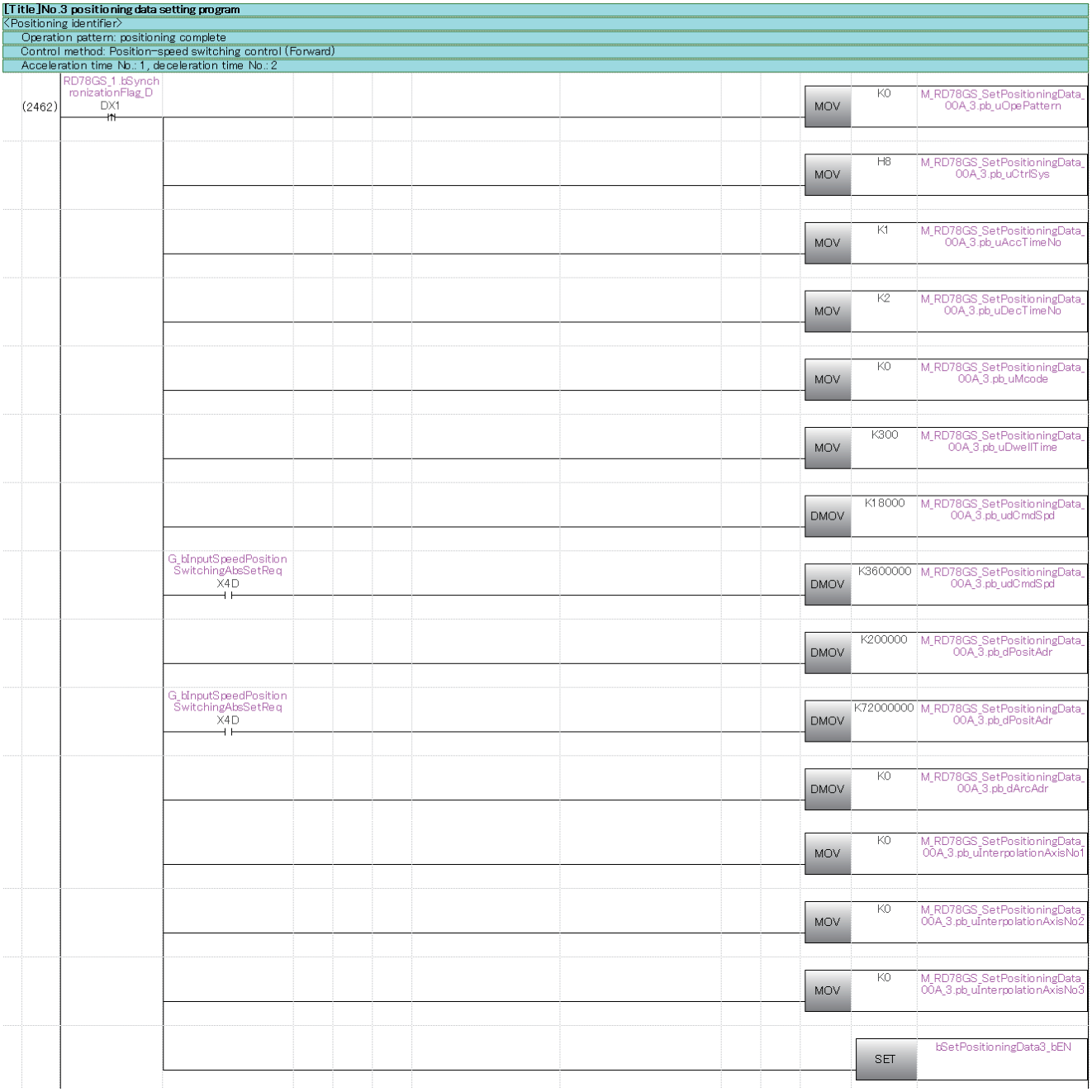

(1663)
bSetPositioningDa
ta_bEN
M_RD78GS_SetPositioningData_00A_1
(M+RD78GS_SetPo
sitioningData_00A)
Positioning data setting FB
B: i_bEN
o_bENO :B
RD78
GS_1
DUT: i_stModule
o_bOK :B
K1
UW: i_uAxis
o_bErr :B
K1
UW: i_uDataNo
o_uErrId :UW
pb_uOpePattern
pb_uCtrlSys
pb_uAccTimeNo
pb_uDecTimeNo
pb_uMcode
pb_uDwellTime
pb_uMcodeOnTiming
pb_uABS
pb_uInterpolateSpd
pb_udCmdSpd
pb_dPositAdr
pb_dArcAdr
pb_uInterpolationAxisNo1
pb_uInterpolationAxisNo2
pb_uInterpolationAxisNo3

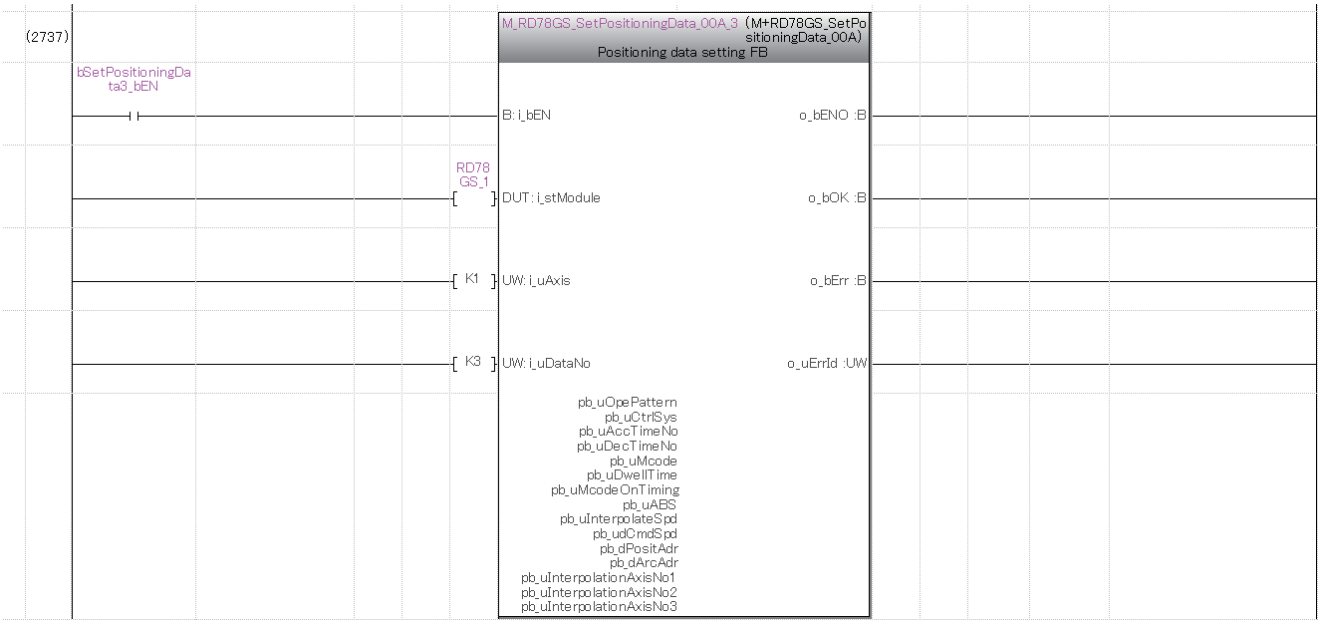
■No.2 positioning data setting program



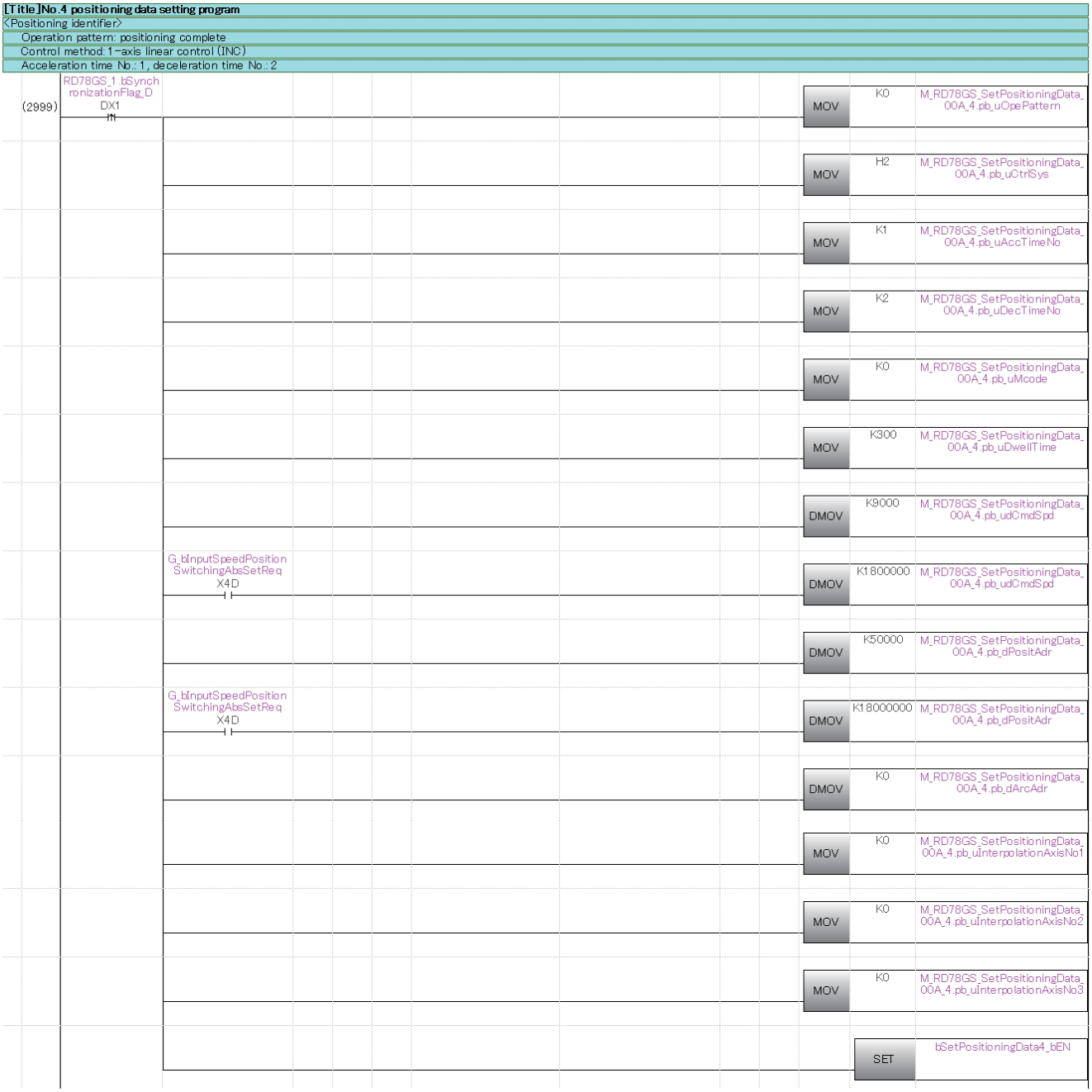

(2200)
bSetPositioningDa
ta2_bEN
M_RD78GS_SetPositioningData_00A_2
(M+RD78GS_SetPo
sitioningData_00A)
Positioning data setting FB
B: i_bEN
o_bENO :B
RD78
GS_1
DUT: i_stModule
o_bOK :B
K1
UW: i_uAxis
o_bErr :B
K2
UW: i_uDataNo
o_uErrId :UW
pb_uOpePattern
pb_uCtrlSys
pb_uAccTimeNo
pb_uDecTimeNo
pb_uMcode
pb_uDwellTime
pb_uMcodeOnTiming
pb_uABS
pb_uInterpolateSpd
pb_udCmdSpd
pb_dPositAdr
pb_dArcAdr
pb_uInterpolationAxisNo1
pb_uInterpolationAxisNo2
pb_uInterpolationAxisNo3

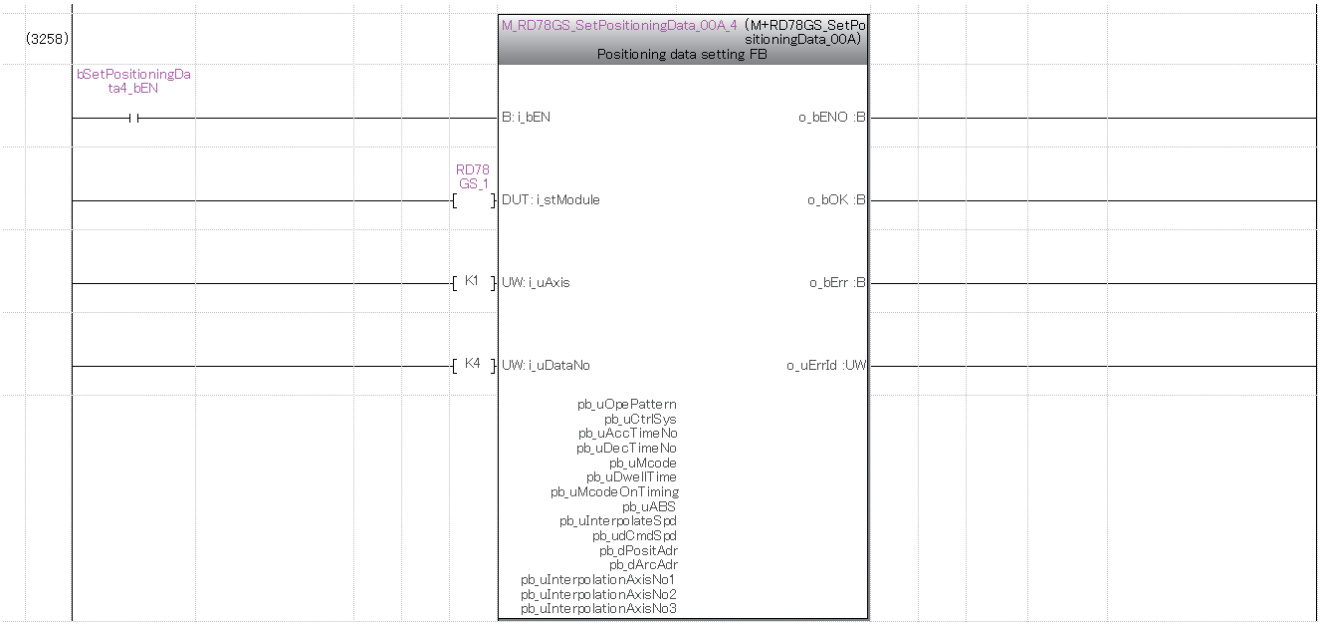
■No.3 positioning data setting program



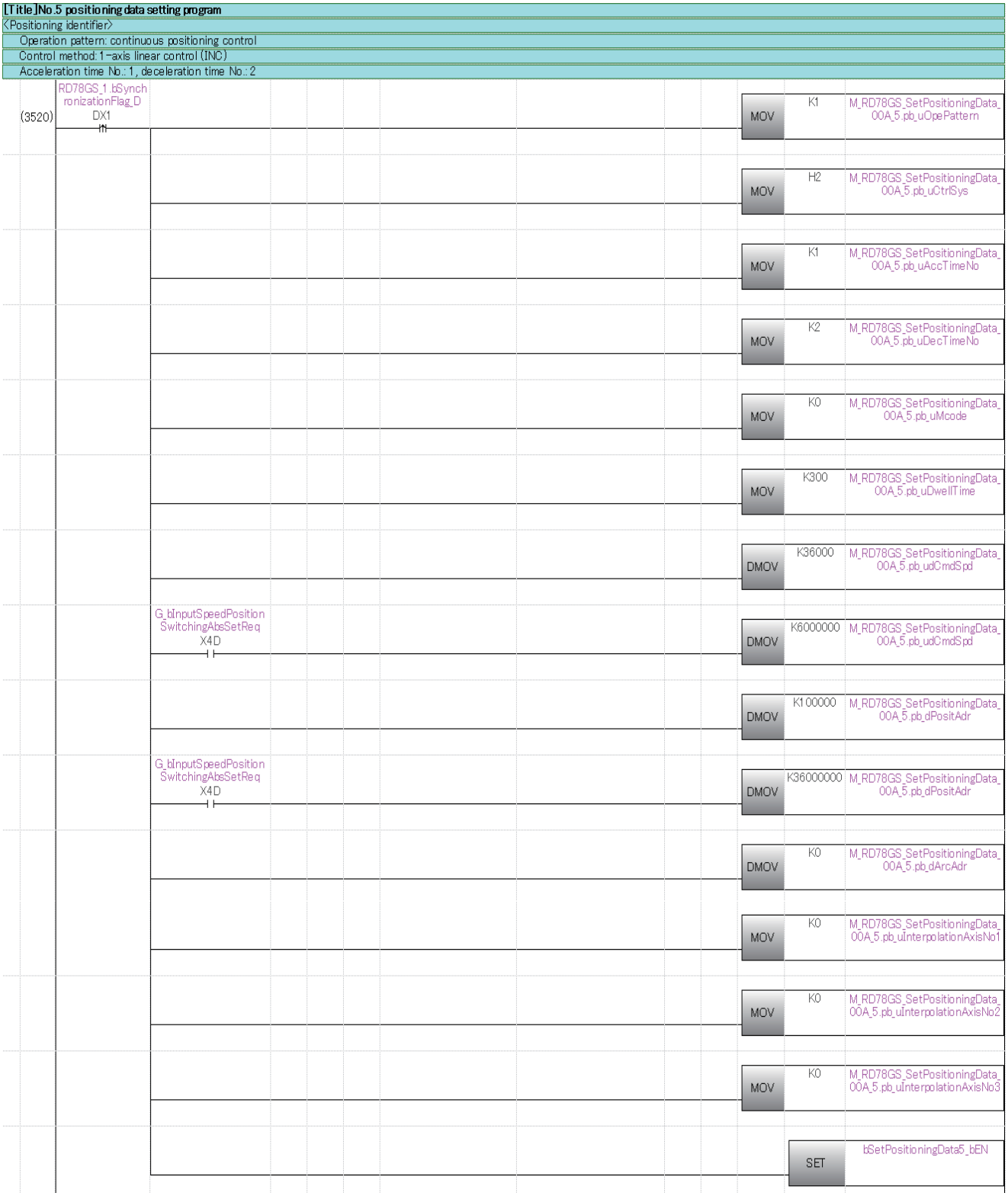

(2737)
bSetPositioningDa
ta3_bEN
M_RD78GS_SetPositioningData_00A_3
(M+RD78GS_SetPo
sitioningData_00A)
Positioning data setting FB
B: i_bEN
o_bENO :B
RD78
GS_1
DUT : i_stModule
o_bOK :B
K1
UW: i_uAxis
o_bErr :B
K3
UW: i_uDataNo
o_uErrId :UW
pb_uOpePattern
pb_uCtrlSys
pb_uAccTimeNo
pb_uDecTimeNo
pb_uMcode
pb_uDwellTime
pb_uMcodeOnTiming
pb_uABS
pb_uInterpolateSpd
pb_udCmdSpd
pb_dPositAdr
pb_dArcAdr
pb_uInterpolationAxisNo1
pb_uInterpolationAxisNo2
pb_uInterpolationAxisNo3

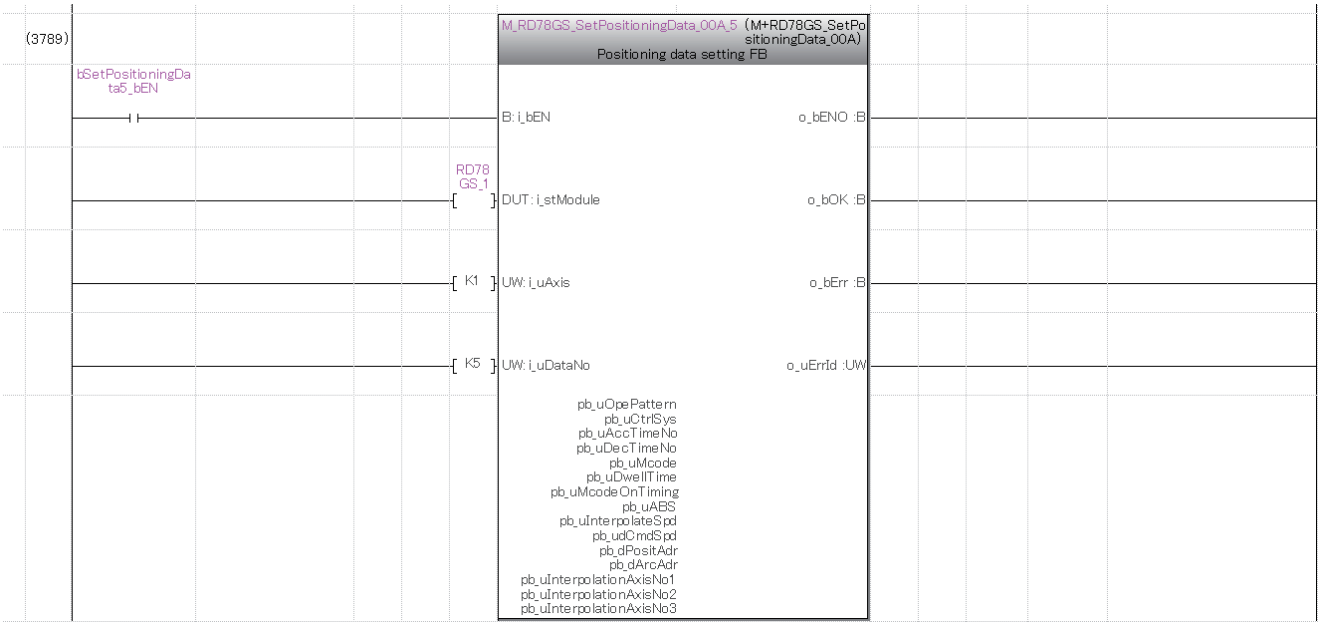
■No.4 positioning data setting program



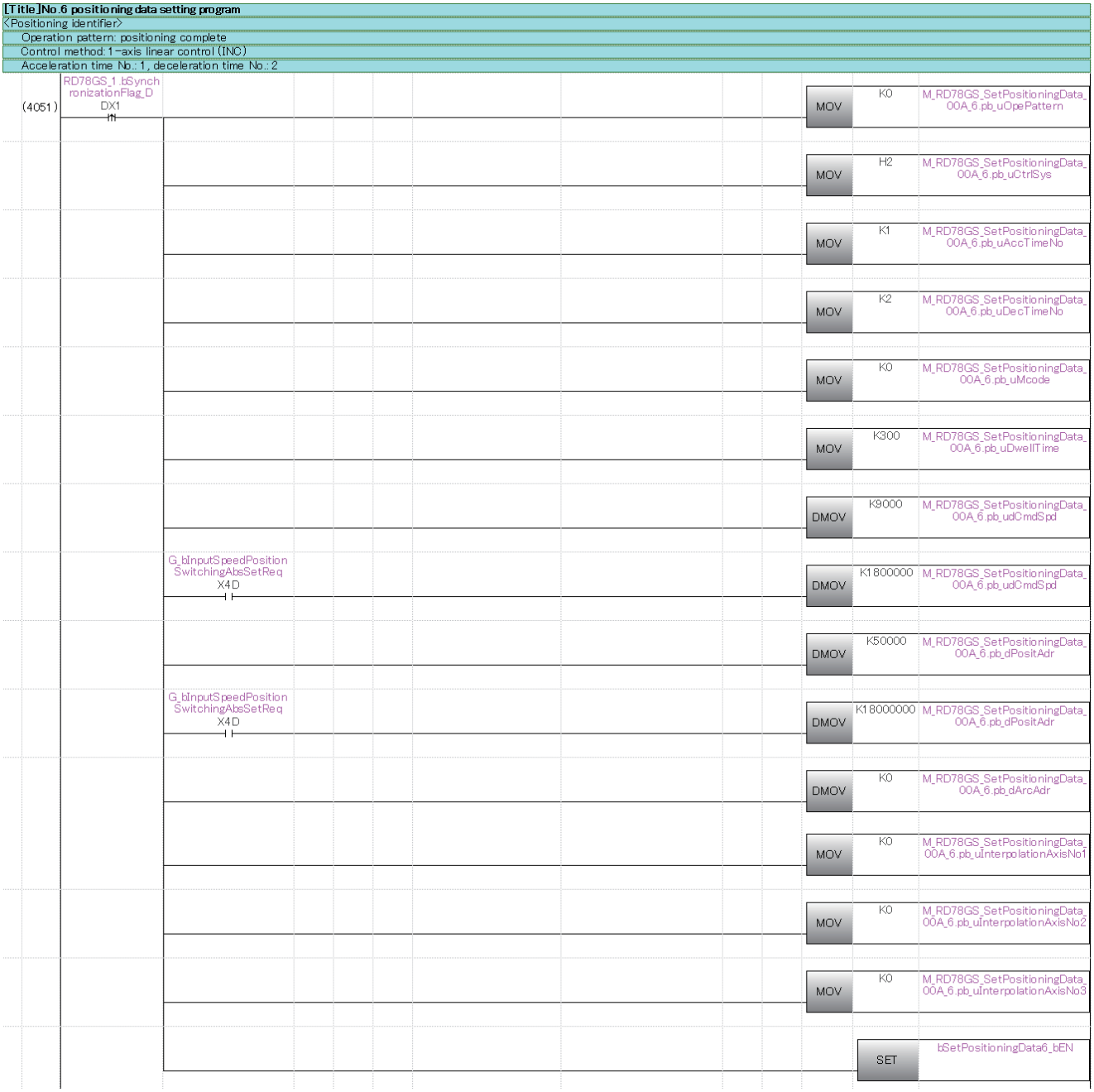

(3258)
bSetPositioningDa
ta4_bEN
M_RD78GS_SetPositioningData_00A_4
(M+RD78GS_SetPo
sitioningData_00A)
Positioning data setting FB
B: i_bEN
o_bENO :B
RD78
GS_1
DUT: i_stModule
o_bOK :B
K1
UW: i_uAxis
o_bErr :B
K4
UW: i_uDataNo
o_uErrId :UW
pb_uOpePattern
pb_uCtrlSys
pb_uAccTimeNo
pb_uDecTimeNo
pb_uMcode
pb_uDwellTime
pb_uMcodeOnTiming
pb_uABS
pb_uInterpolateSpd
pb_udCmdSpd
pb_dPositAdr
pb_dArcAdr
pb_uInterpolationAxisNo1
pb_uInterpolationAxisNo2
pb_uInterpolationAxisNo3

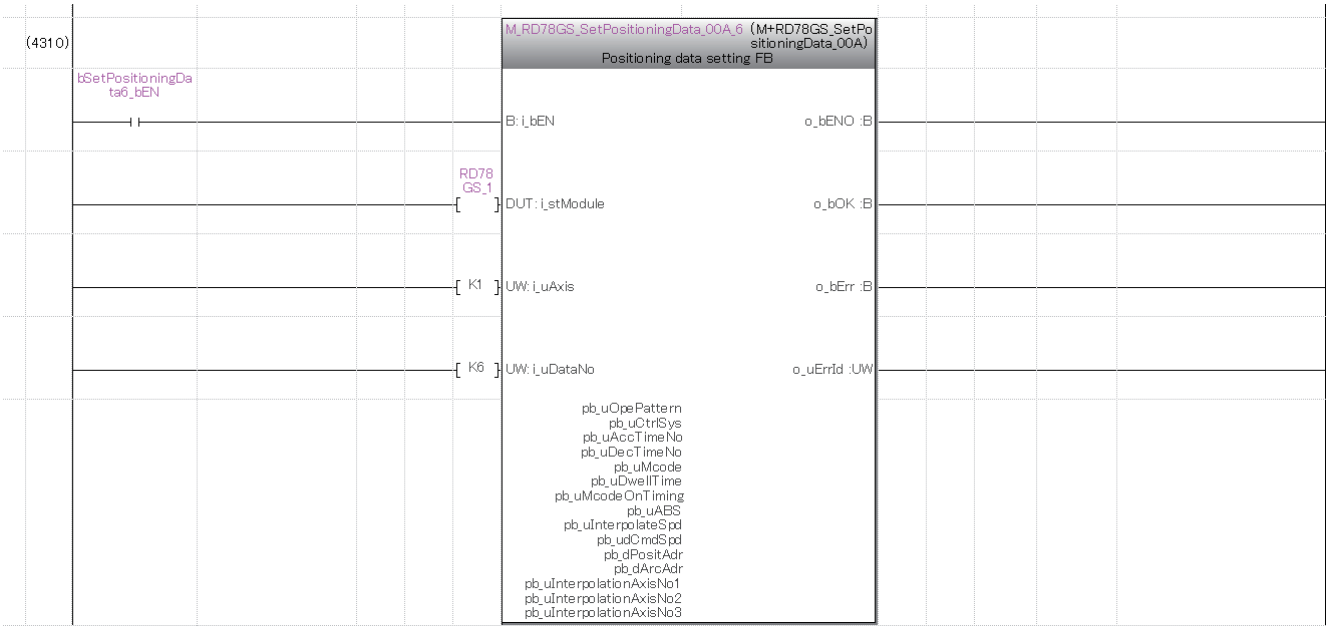
■No.5 positioning data setting program



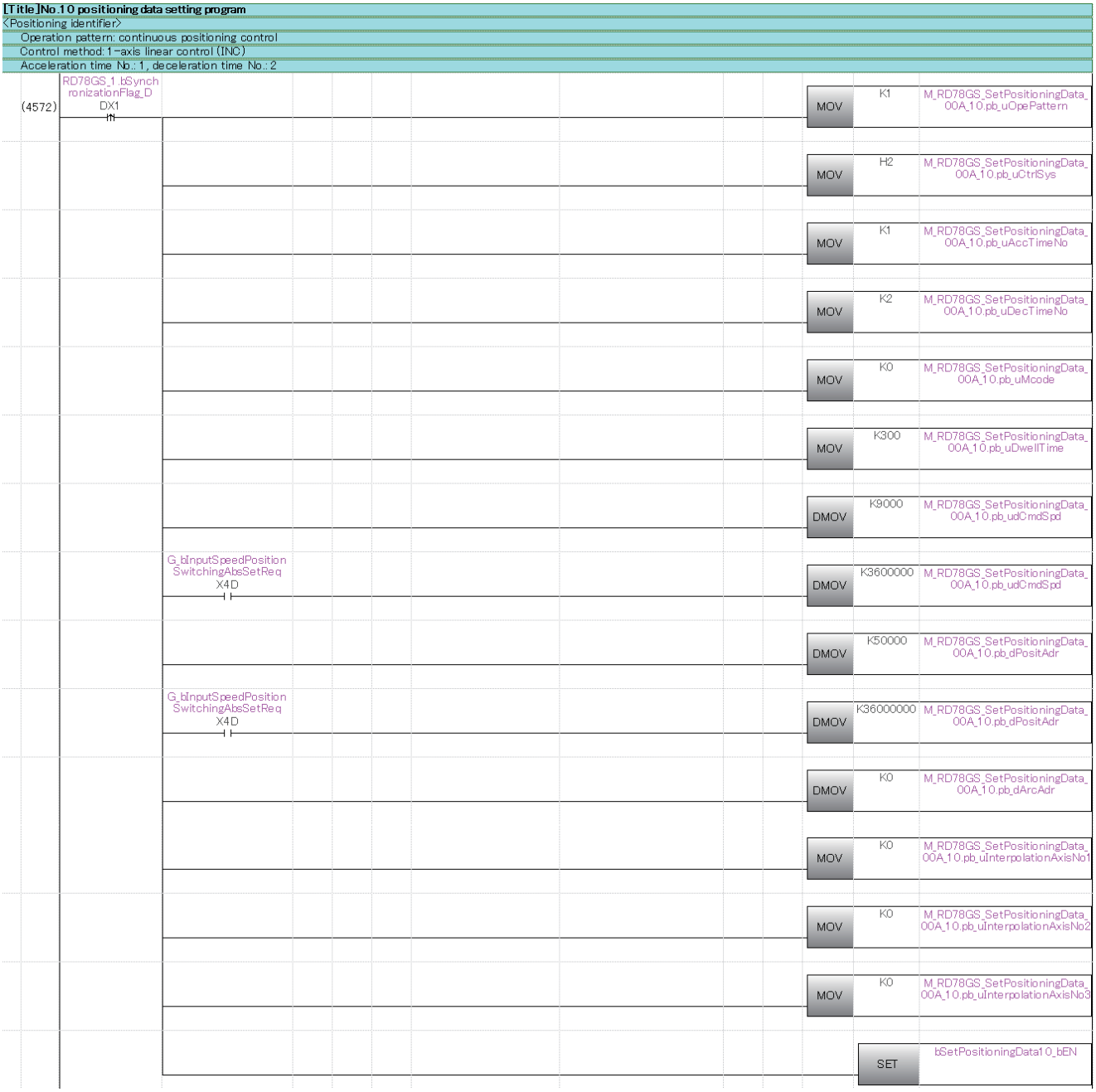

(3789)
bSetPositioningDa
ta5_bEN
M_RD78GS_SetPositioningData_00A_5
(M+RD78GS_SetPo
sitioningData_00A)
Positioning data setting FB
B: i_bEN
o_bENO :B
RD78
GS_1
DUT: i_stModule
o_bOK :B
K1
UW: i_uAxis
o_bErr :B
K5
UW: i_uDataNo
o_uErrId :UW
pb_uOpePattern
pb_uCtrlSys
pb_uAccTimeNo
pb_uDecTimeNo
pb_uMcode
pb_uDwellTime
pb_uMcodeOnTiming
pb_uABS
pb_uInterpolateSpd
pb_udCmdSpd
pb_dPositAdr
pb_dArcAdr
pb_uInterpolationAxisNo1
pb_uInterpolationAxisNo2
pb_uInterpolationAxisNo3

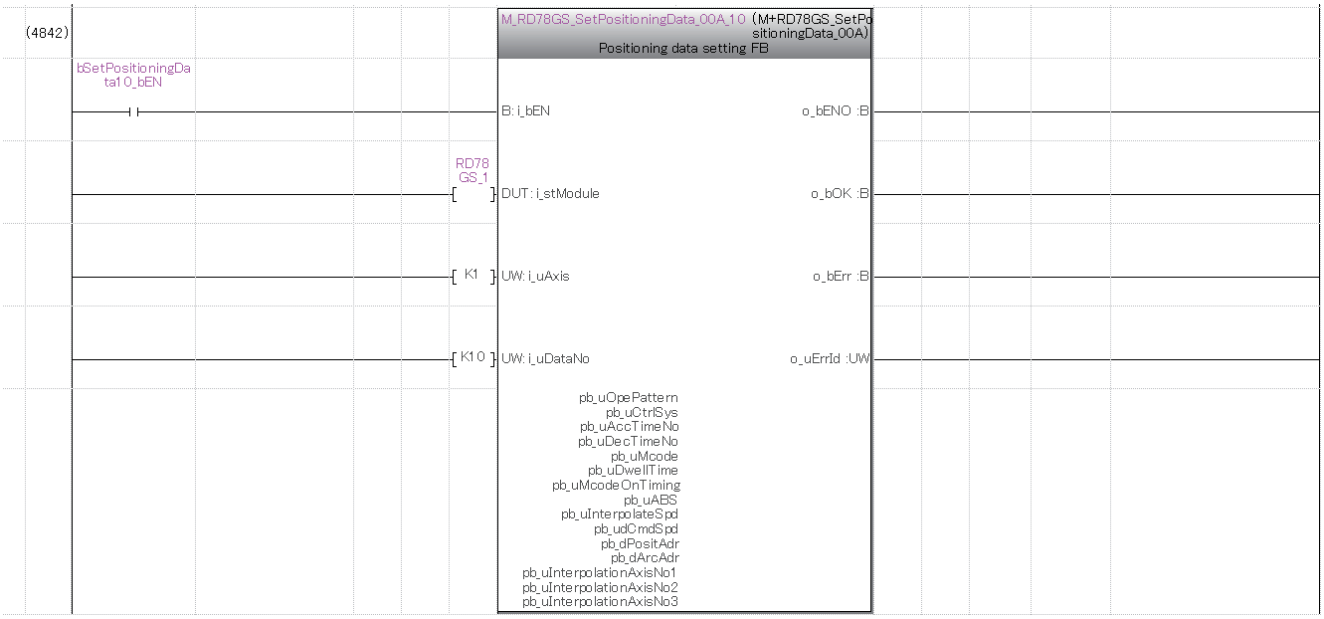
■No.6 positioning data setting program



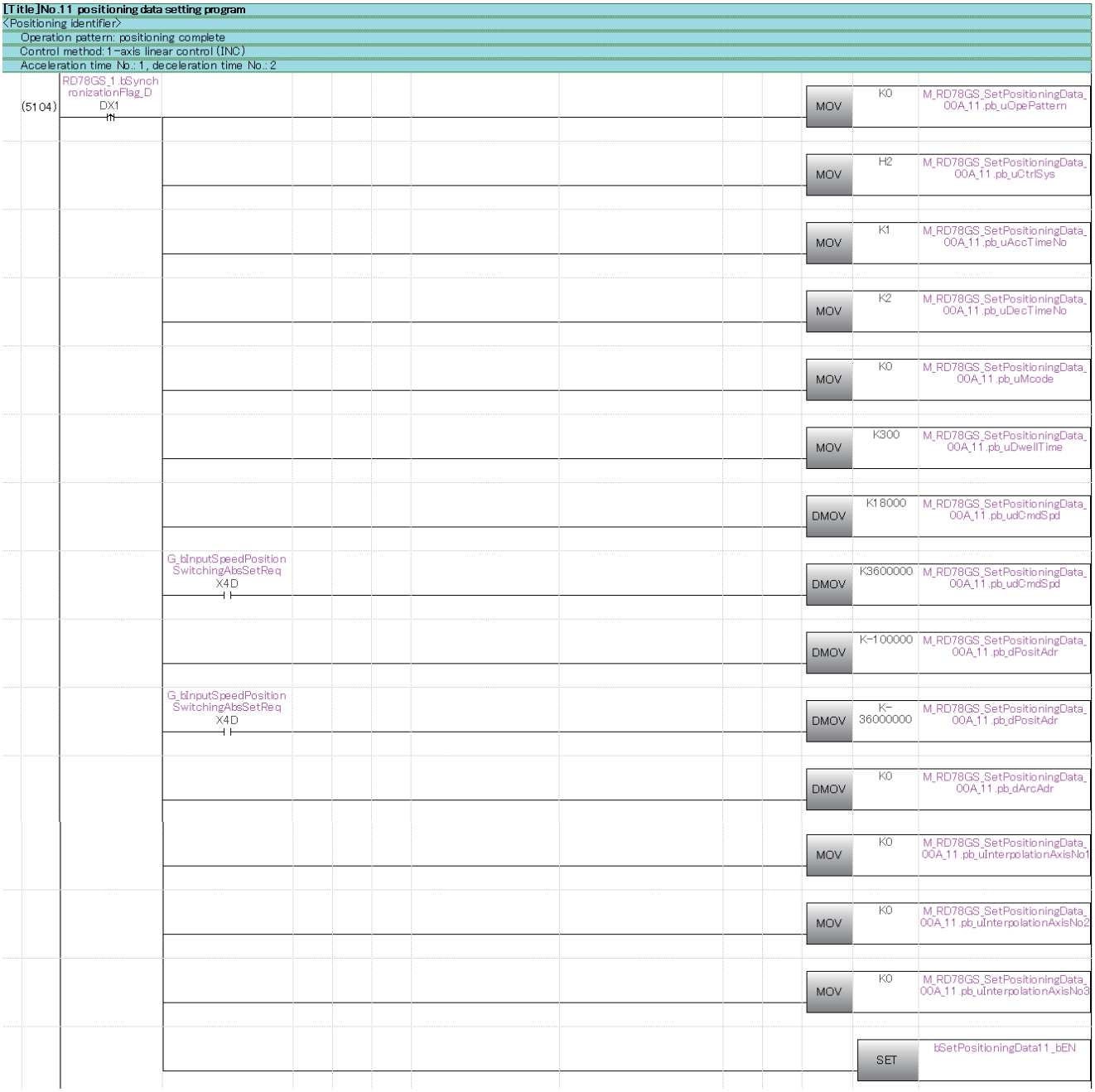

(4310)
bSetPositioningDa
ta6_bEN
M_RD78GS_SetPositioningData_00A_6 (M+RD78GS_SetPo
sitioningData_00A)
Positioning data setting FB
B: i_bEN
o_bENO :B
RD78
GS_1
DUT: i_stModule
o_bOK :B
K1
UW: i_uAxis
o_bErr :B
K6
UW: i_uDataNo
o_uErrId :UW
pb_uOpePattern
pb_uCtrlSys
pb_uAccTimeNo
pb_uDecTimeNo
pb_uMcode
pb_uDwellTime
pb_uMcodeOnTiming
pb_uABS
pb_uInterpolateSpd
pb_udCmdSpd
pb_dPositAdr
pb_dArcAdr
pb_uInterpolationAxisNo1
pb_uInterpolationAxisNo2
pb_uInterpolationAxisNo3

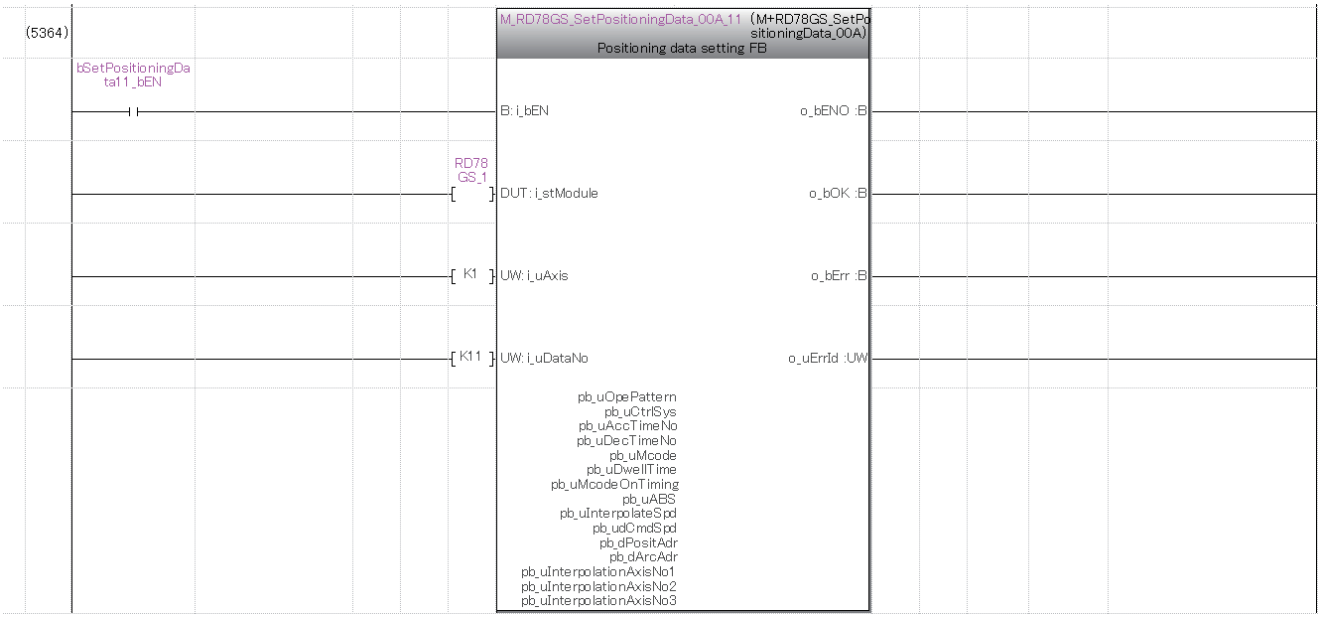
■No.10 positioning data setting program



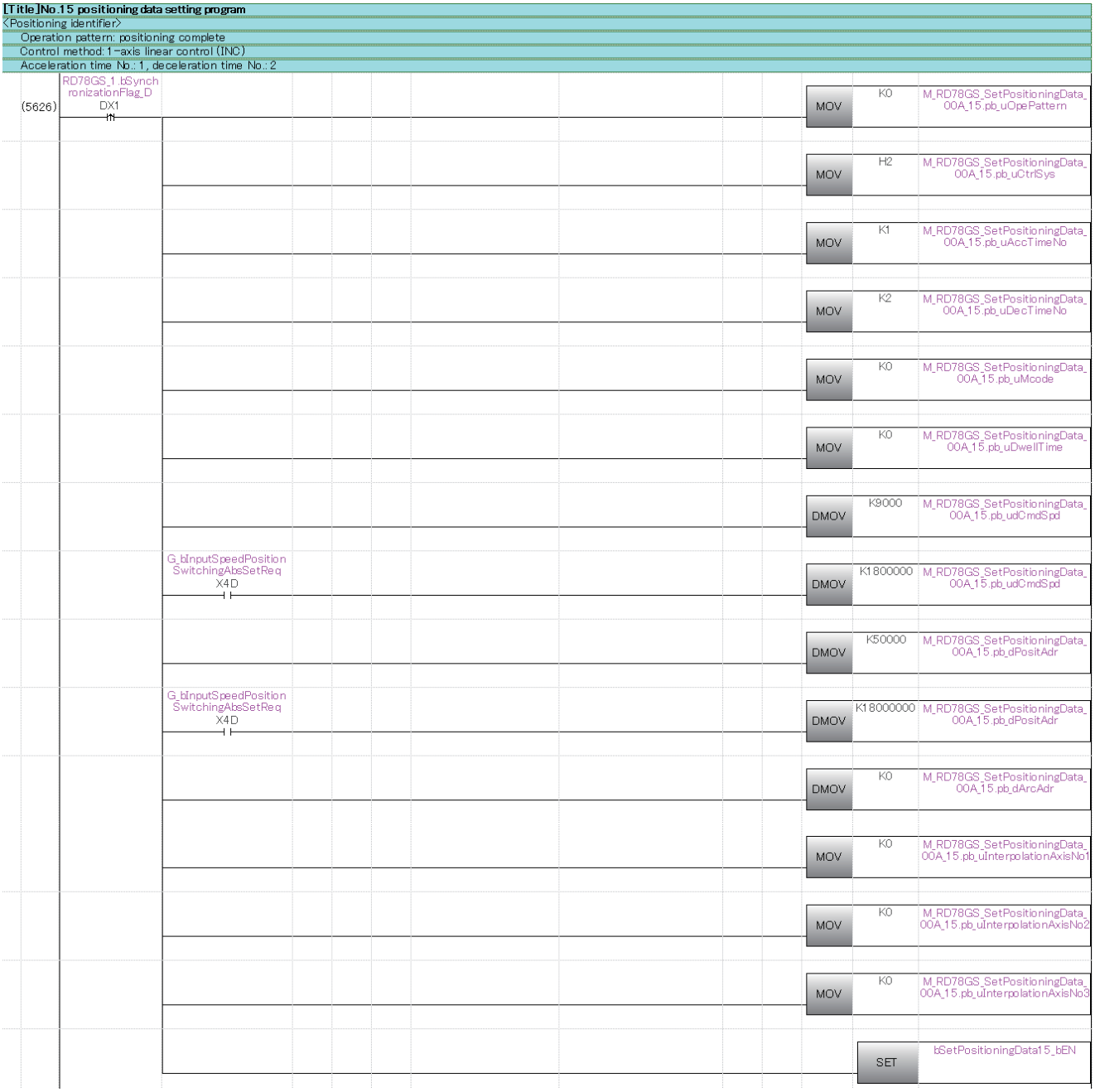

(4842)
bSetPositioningData10_bEN
M_RD78GS_SetPositioningData_00A_10
(M+RD78GS_SetPositioningData_00A)
Positioning data setting FB
B: i_bEN
o_bENO :B
RD78GS_1
DUT: i_stModule
o_bOK :B
K1
UW: i_uAxis
o_bErr :B
K10
UW: i_uDataNo
o_uErrId :UW
pb_uOpePattern
pb_uCtrlSys
pb_uAccTimeNo
pb_uDecTimeNo
pb_uMcode
pb_uDwellTime
pb_uMcodeOnTiming
pb_uABS
pb_uInterpolateSpd
pb_udCmdSpd
pb_dPositAdr
pb_dArcAdr
pb_uInterpolationAxisNo1
pb_uInterpolationAxisNo2
pb_uInterpolationAxisNo3

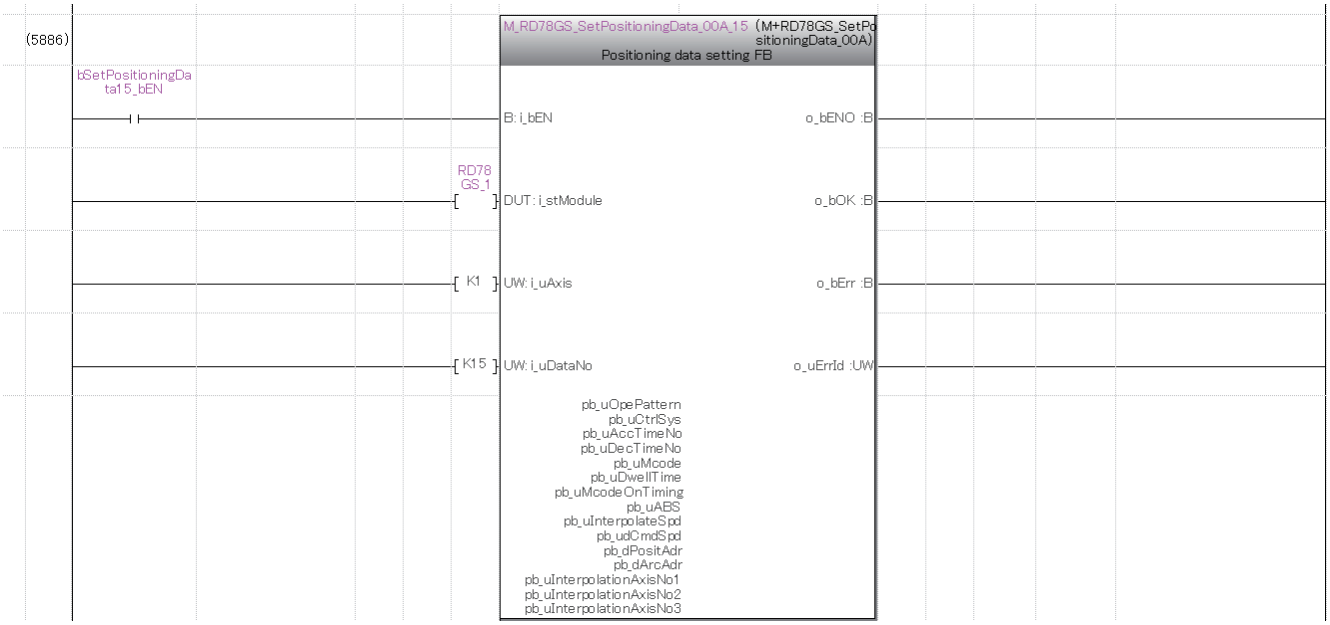
■No.11 positioning data setting program




(5364)
bSetPositioningDa
ta11_bEN
M_RD78GS_SetPositioningData_00A_11
(M+RD78GS_SetPo
sitioningData_00A)
Positioning data setting FB
B: i_bEN
o_bENO :B
RD78
GS_1
DUT: i_stModule
o_bOK :B
K1
UW: i_uAxis
o_bErr :B
K11
UW: i_uDataNo
o_uErrId :UW
pb_uOpePattern
pb_uCtrlSys
pb_uAccTimeNo
pb_uDecTimeNo
pb_uMcode
pb_uDwellTime
pb_uMcodeOnTiming
pb_uABS
pb_uInterpolateSpd
pb_udCmdSpd
pb_dPositAdr
pb_dArcAdr
pb_uInterpolationAxisNo1
pb_uInterpolationAxisNo2
pb_uInterpolationAxisNo3

■No.15 positioning data setting program



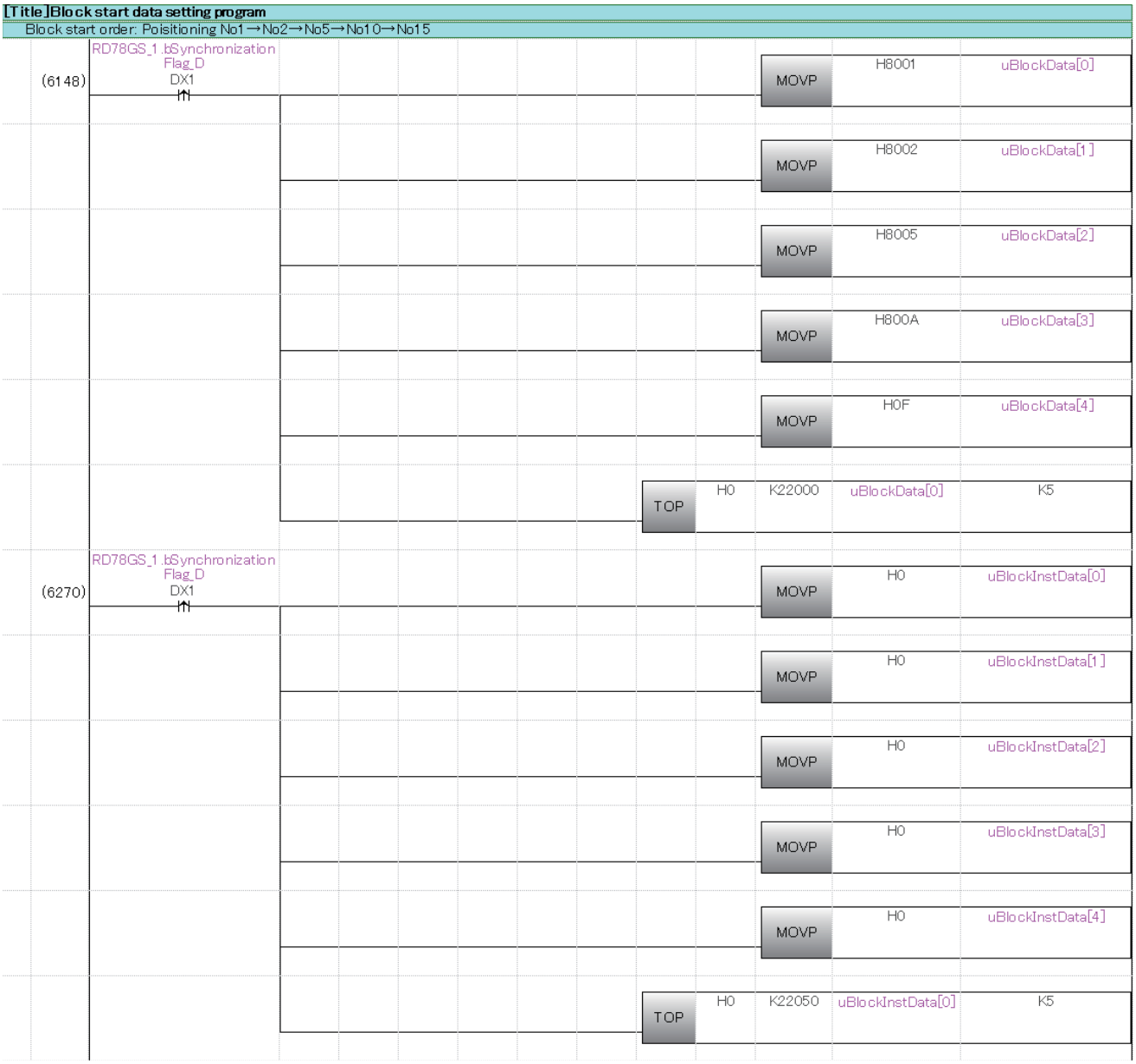

(5886)
bSetPositioningData15_bEN
M_RD78GS_SetPositioningData_00A_15
(M+RD78GS_SetPositioningData_00A)
Positioning data setting FB
B: i_bEN
o_bENO :B
RD78GS_1
DUT: i_stModule
o_bOK :B
K1
UW: i_uAxis
o_bErr :B
K15
UW: i_uDataNo
o_uErrId :UW
pb_uOpePattern
pb_uCtrlSys
pb_uAccTimeNo
pb_uDecTimeNo
pb_uMcode
pb_uDwellTime
pb_uMcodeOnTiming
pb_uABS
pb_uInterpolateSpd
pb_udCmdSpd
pb_dPositAdr
pb_dArcAdr
pb_uInterpolationAxisNo1
pb_uInterpolationAxisNo2
pb_uInterpolationAxisNo3

Block start data setting program

The program is not required when the data is set by "Block Start Data" using an engineering tool.

Set the local labels as follows.

	Label Name	Data Type		Class
1	uBlockData	Word [Unsigned]/Bit String [16-bit](0..4)	...	VAR
2	uBlockInstData	Word [Unsigned]/Bit String [16-bit](0..4)	...	VAR
3			...	

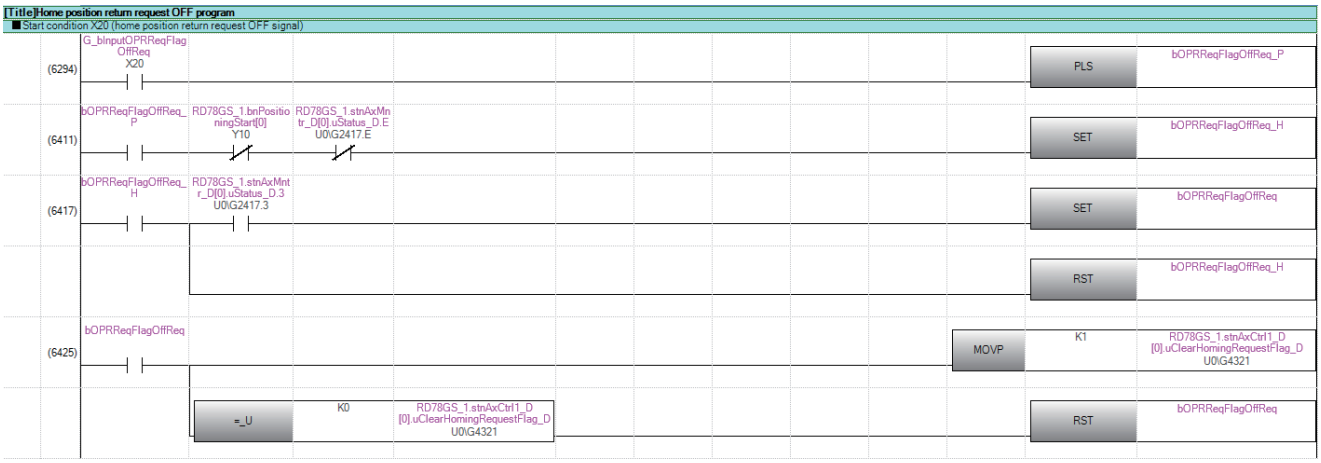


Home position return request OFF program

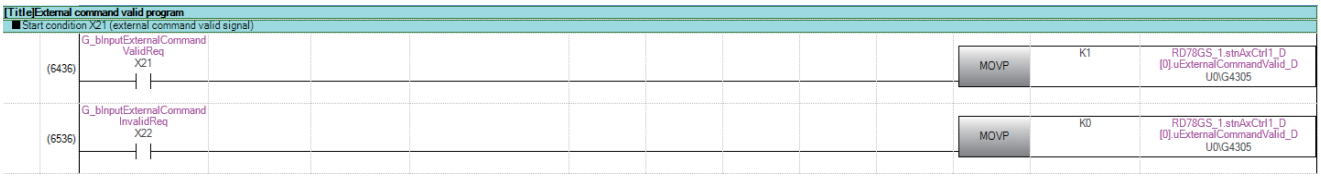
The program is not required when "1: Positioning control is executed." is set in "[Pr.55] Operation setting for incompletion of home position return" by "Home Position Return Detailed Parameters" using an engineering tool.

Set the local labels as follows.

	Label Name	Data Type		Class
1	bOPRReqFlagOffReq_P	Bit	...	VAR
2	bOPRReqFlagOffReq_H	Bit	...	VAR
3	bOPRReqFlagOffReq	Bit	...	VAR
4			...	



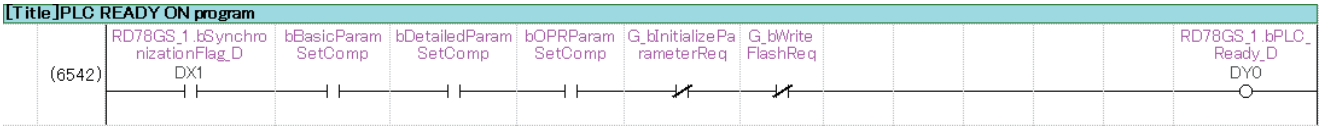
External command function valid setting program



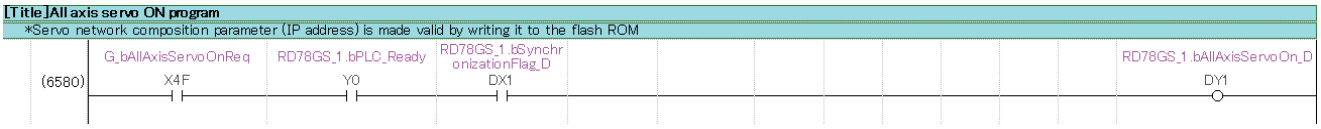
PLC READY [Y0] ON program

Set the local labels as follows.

	Label Name	Data Type		Class
1	bBasicParamSetComp	Bit	...	VAR
2	bDetailedParamSetComp	Bit	...	VAR
3	bOPRParamSetComp	Bit	...	VAR
4			...	



All axis servo ON program

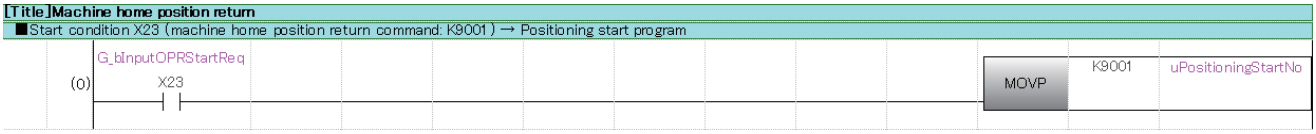


Positioning start No. setting program

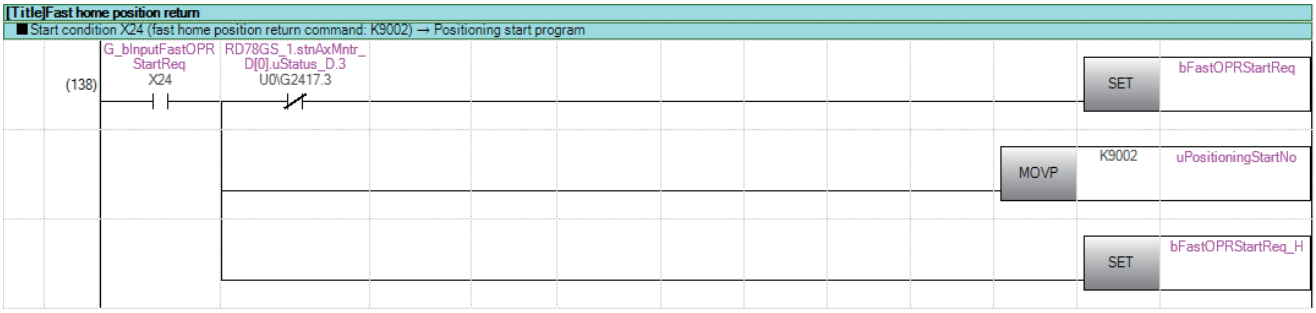
Set the local labels as follows.

	Label Name	Data Type		Class
1	uPositioningStartNo	Word [Unsigned]/Bit String [16-bit]	...	VAR
2	bFastOPRStartReq	Bit	...	VAR
3	bFastOPRStartReq_H	Bit	...	VAR
4	bPositioningStartReq	Bit	...	VAR
5	udMovementAmount	Double Word [Unsigned]/Bit String [32-bit]	...	VAR
6	udSpeed	Double Word [Unsigned]/Bit String [32-bit]	...	VAR
7	bInputSpeedPositionSwitching	Bit	...	VAR
8			...	

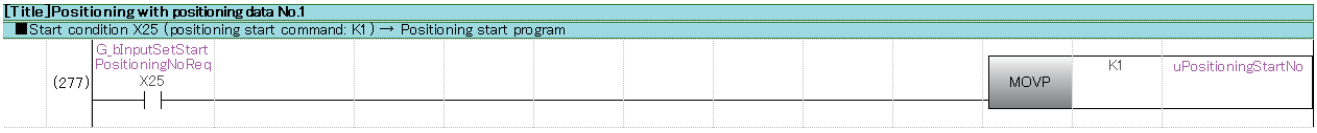
■Machine home position return



■Fast home position return

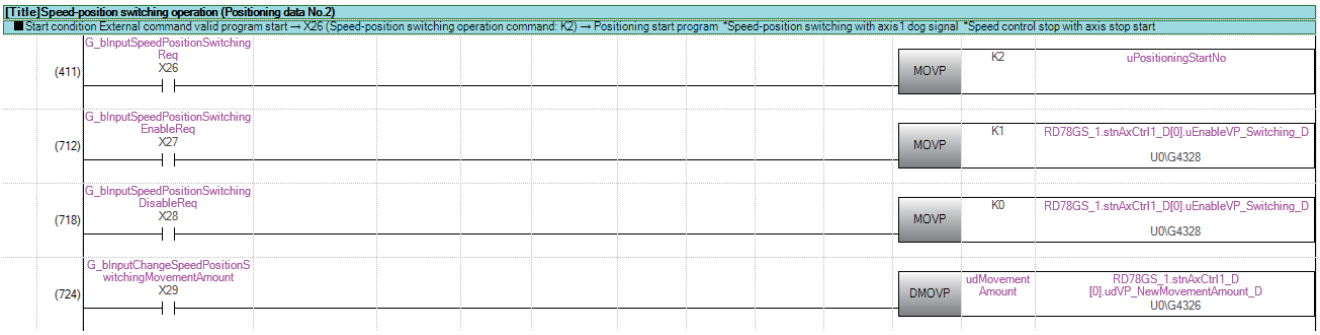


■Positioning with positioning data No.1

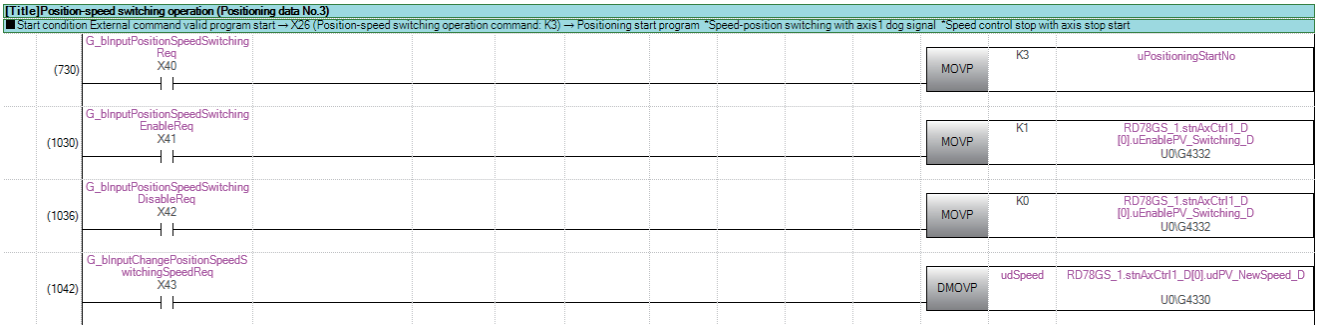


■Speed-position switching operation (Positioning data No.2)

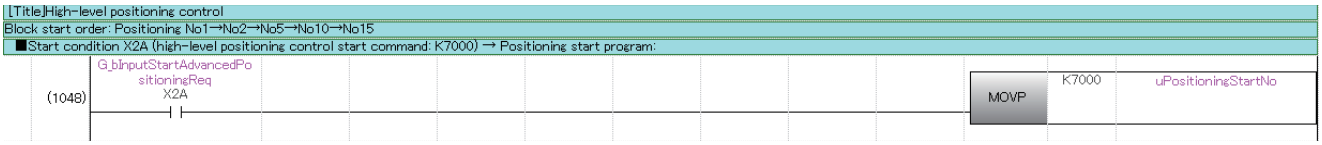
In the ABS mode, new movement amount is not needed to be written.



■Position-speed switching operation (Positioning data No.3)

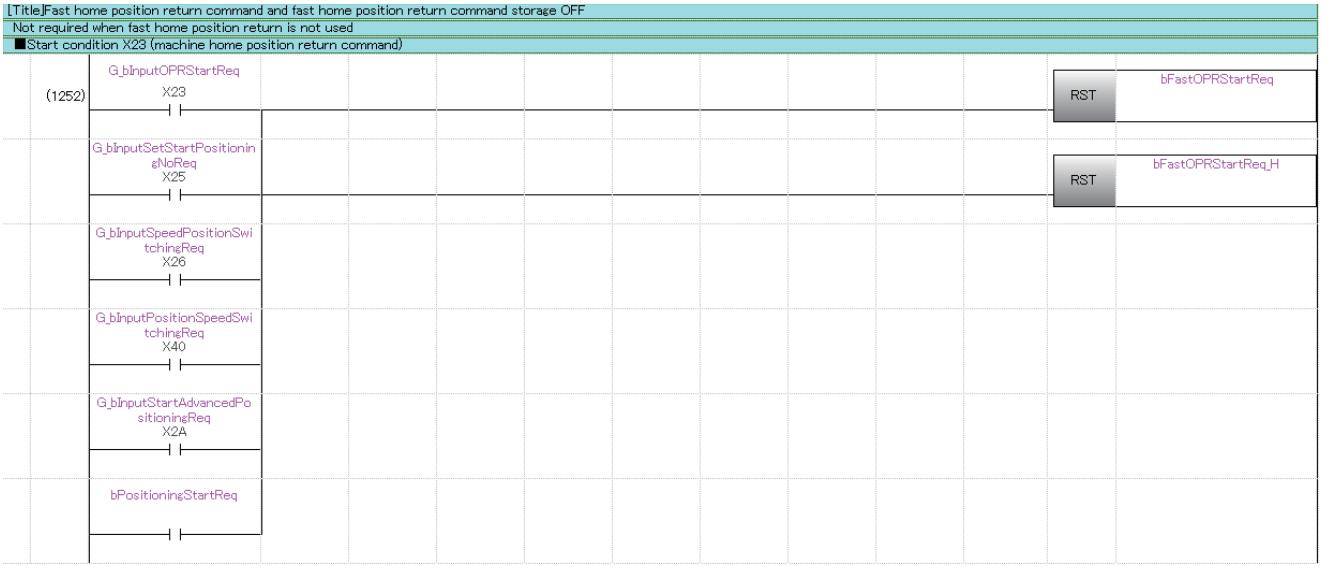


■High-level positioning control



■Fast home position return command and fast home position return command storage OFF

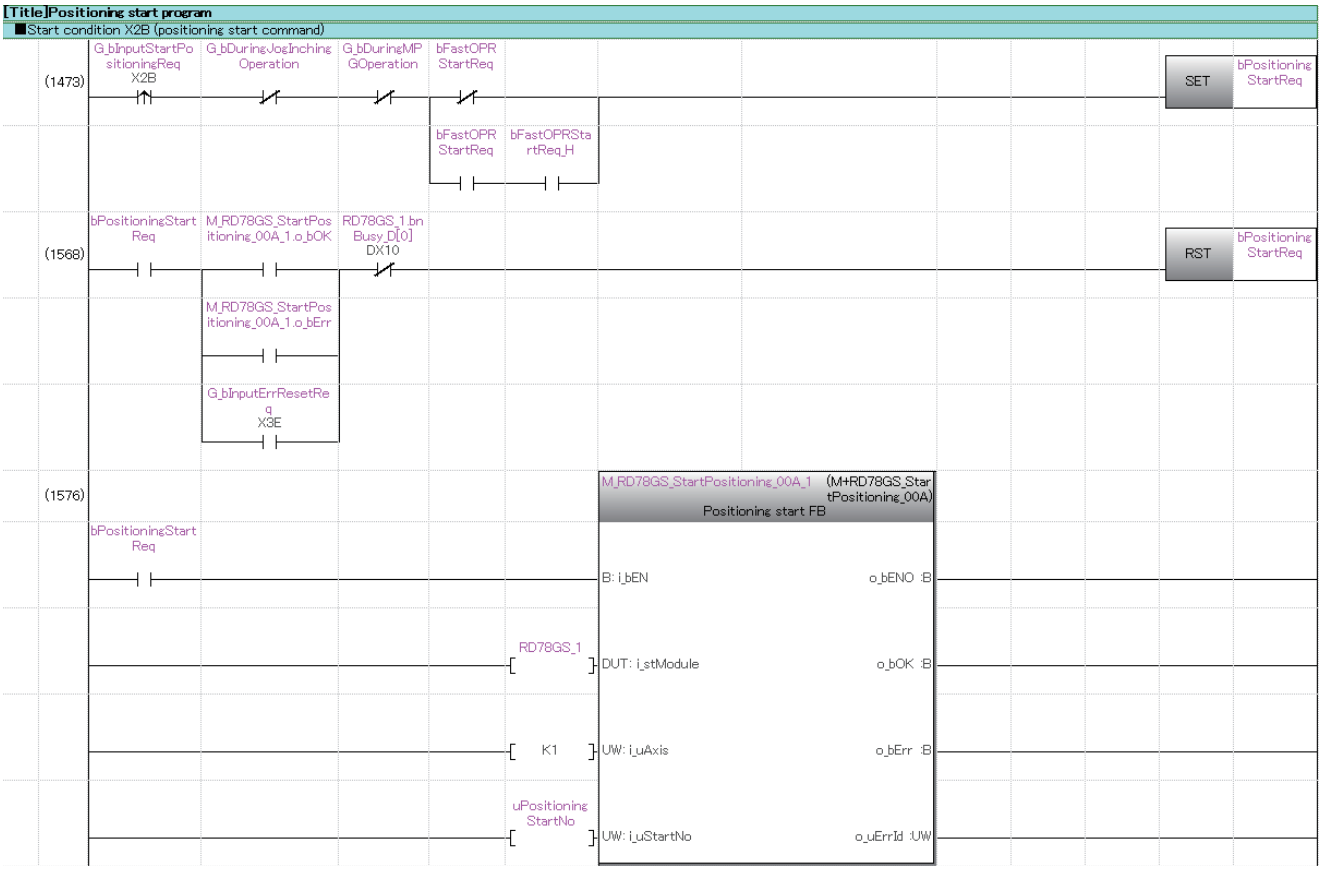
Not required when fast home position return is not used.



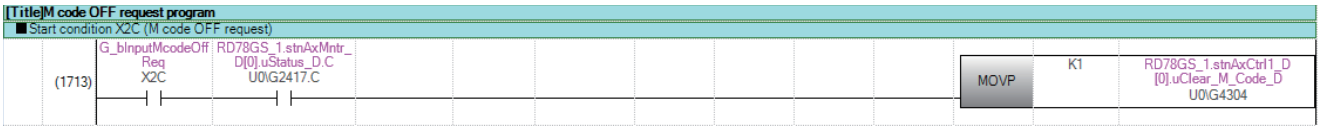
Positioning start program

Set the local labels as follows.

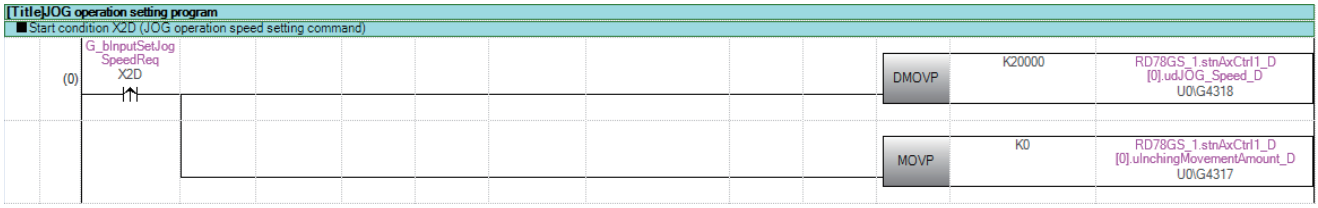
	Label Name	Data Type		Class
1	uPositioningStartNo	Word [Unsigned]/Bit String [16-bit]	...	VAR
2	bFastOPRStartReq	Bit	...	VAR
3	bFastOPRStartReq_H	Bit	...	VAR
4	bPositioningStartReq	Bit	...	VAR
5			...	



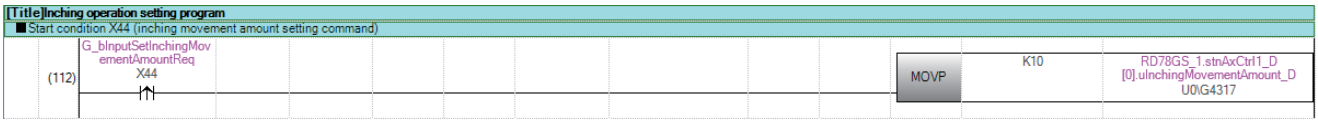
M code OFF program



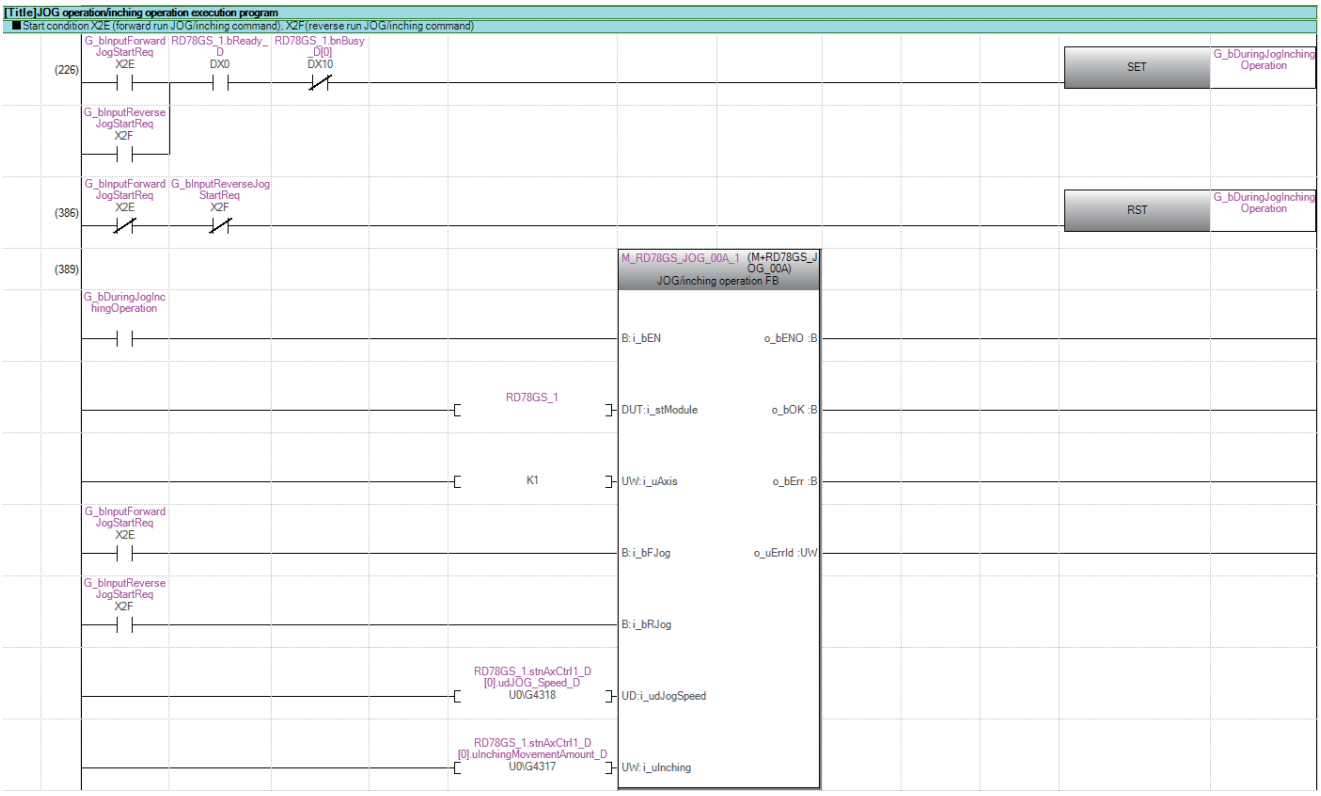
JOG operation setting program



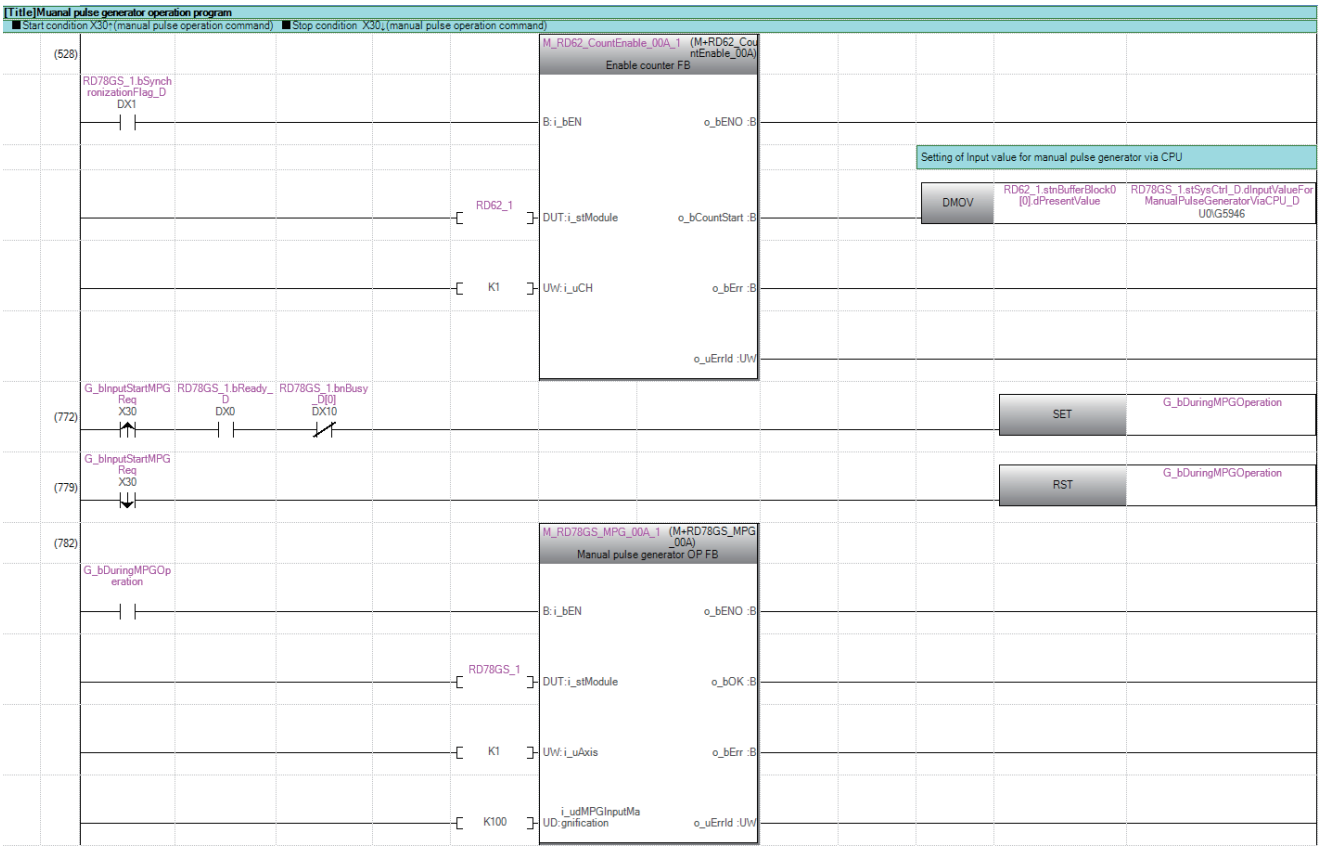
Inching operation setting program



JOG operation/inching operation execution program



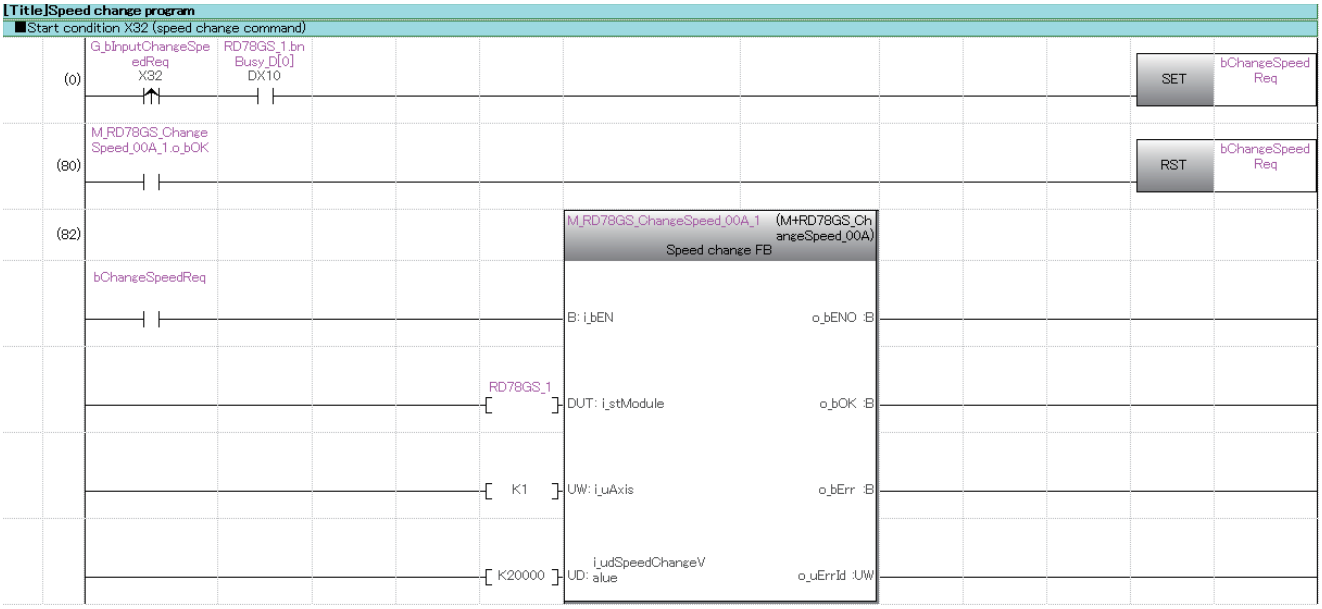
Manual pulse generator operation program



Speed change program

Set the local labels as follows.

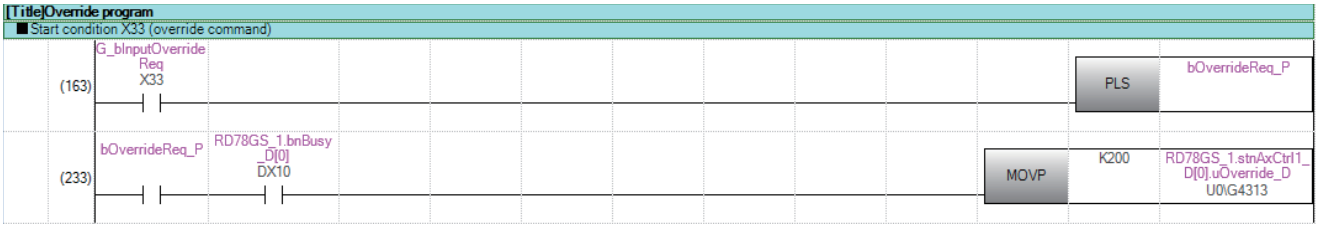
	Label Name	Data Type		Class
1	bChangeSpeedReq	Bit	...	VAR
2			...	



Override program

Set the local labels as follows.

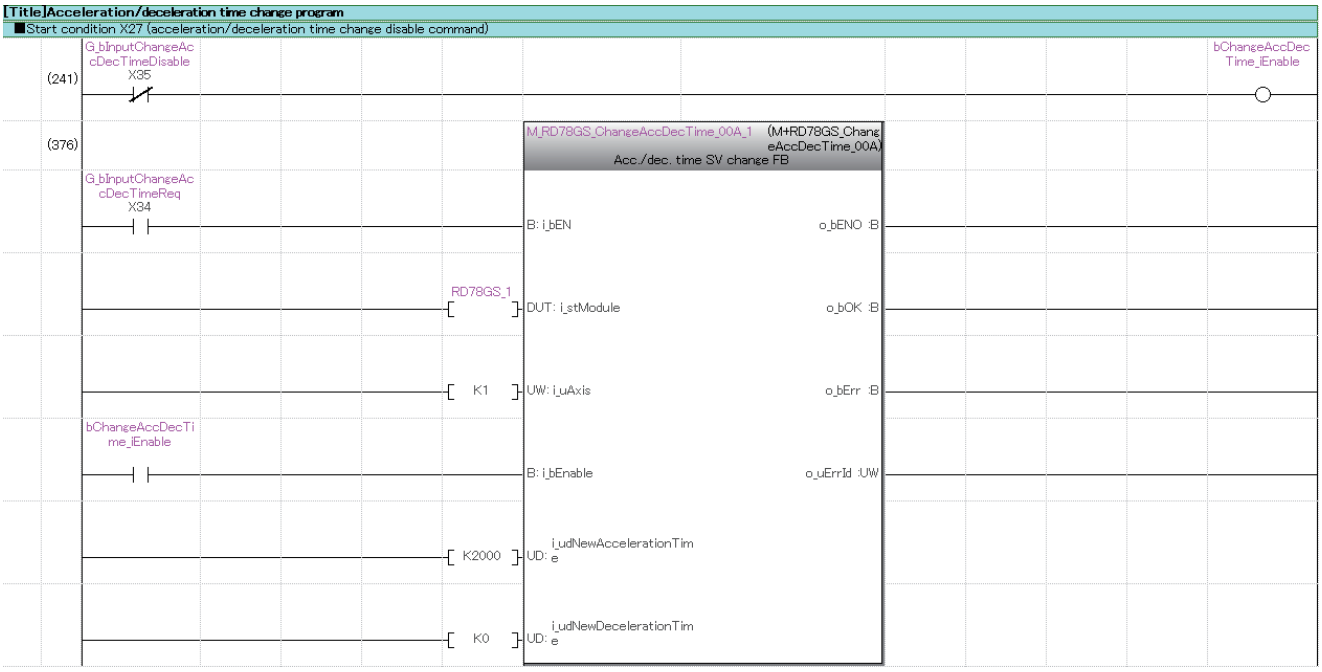
	Label Name	Data Type		Class
1	bOverrideReq_P	Bit	...	VAR
2			...	



Acceleration/deceleration time change program

Set the local labels as follows.

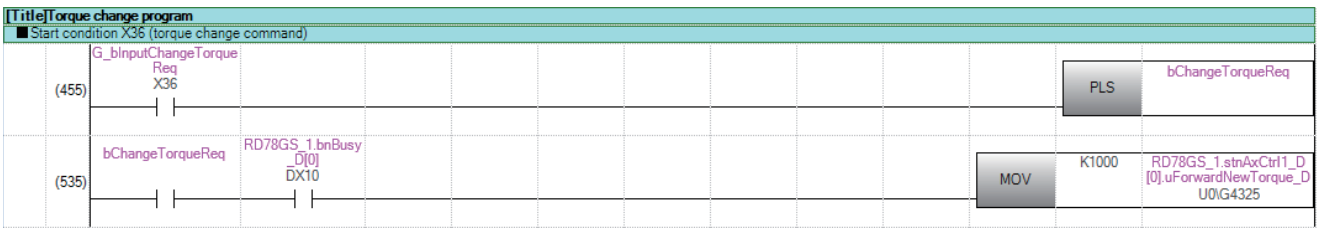
	Label Name	Data Type		Class
1	bChangeAccDecTime_iEnable	Bit	...	VAR
2			...	



Torque change program

Set the local labels as follows.

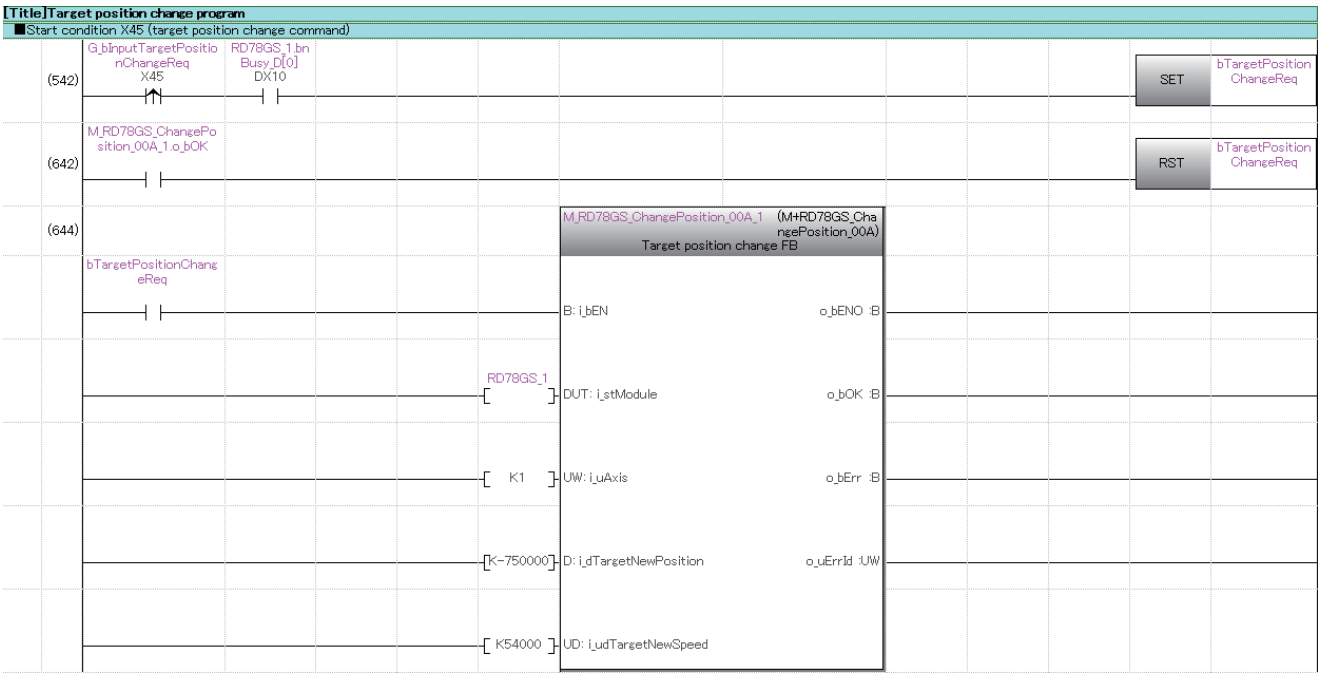
	Label Name	Data Type		Class
1	bChangeTorqueReq	Bit	...	VAR
2			...	



Target position change program

Set the local labels as follows.

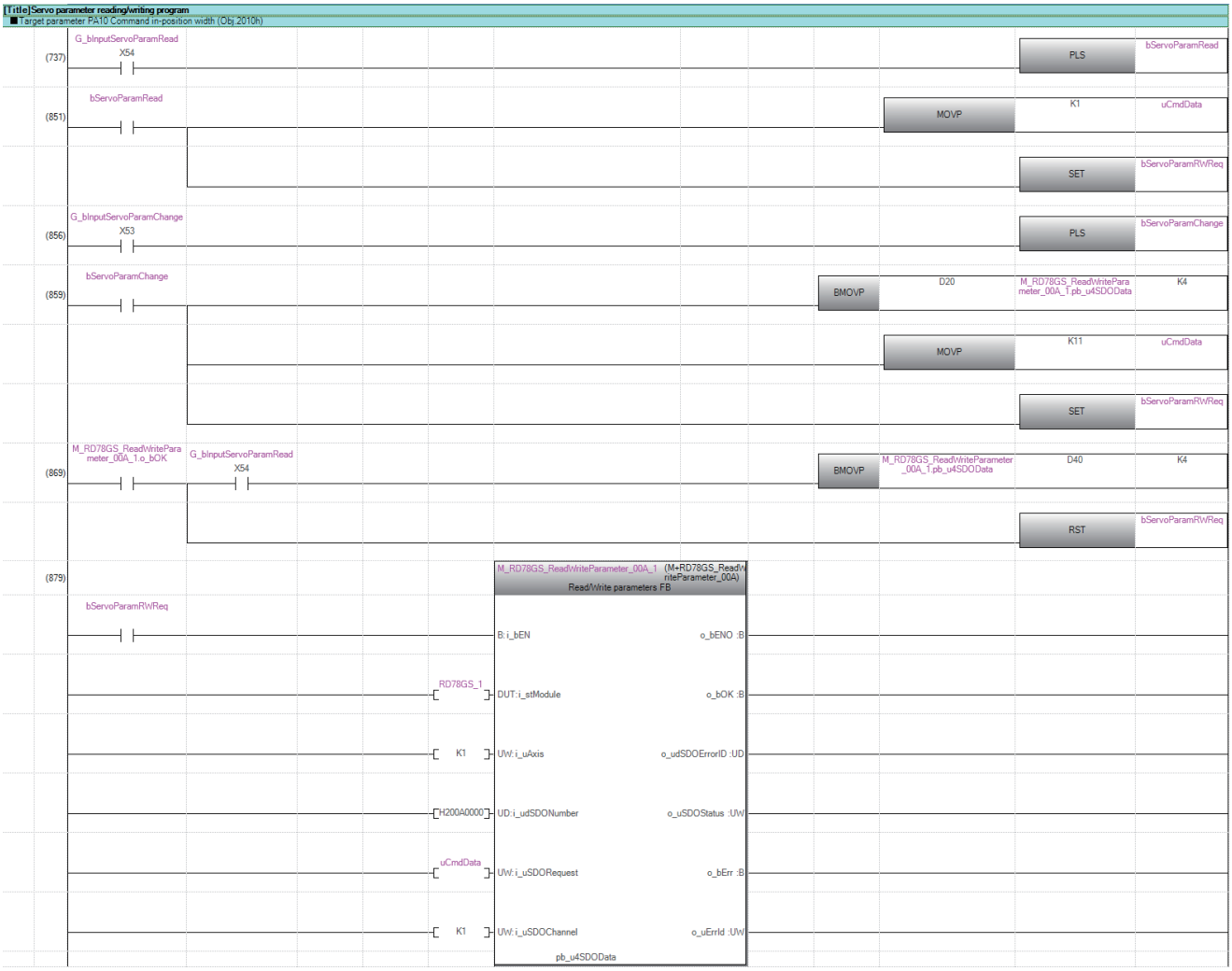
	Label Name	Data Type		Class
1	bTargetPositionChangeReq	Bit	...	VAR
2			...	



Servo parameter reading/writing program

Set the local labels as follows.

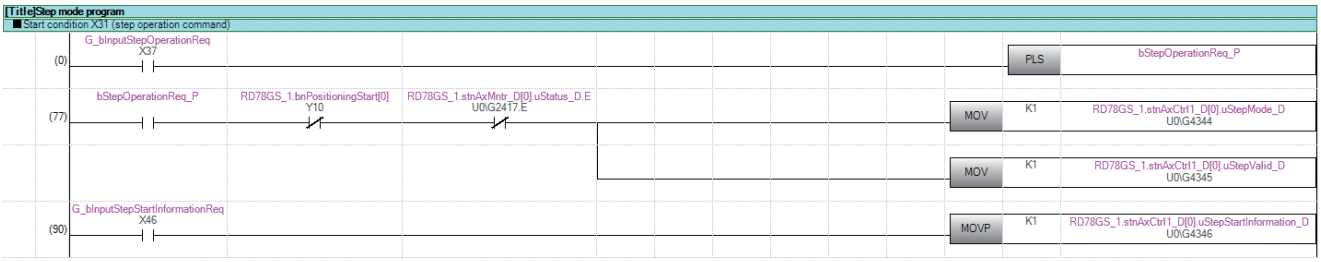
	Label Name	Data Type		Class
1	bServoParamRWReq	Bit	...	VAR
2	uCmdData	Word [Unsigned]/Bit String [16-bit]	...	VAR
3	bServoParamChange	Bit	...	VAR
4	bServoParamRead	Bit	...	VAR
5			...	



Step operation program

Set the local labels as follows.

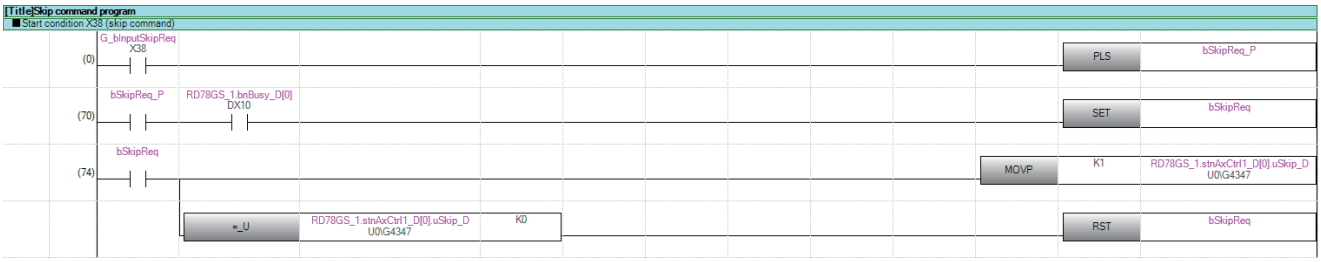
	Label Name	Data Type		Class
1	bStepOperationReq_P	Bit	...	VAR
2			...	



Skip program

Set the local labels as follows.

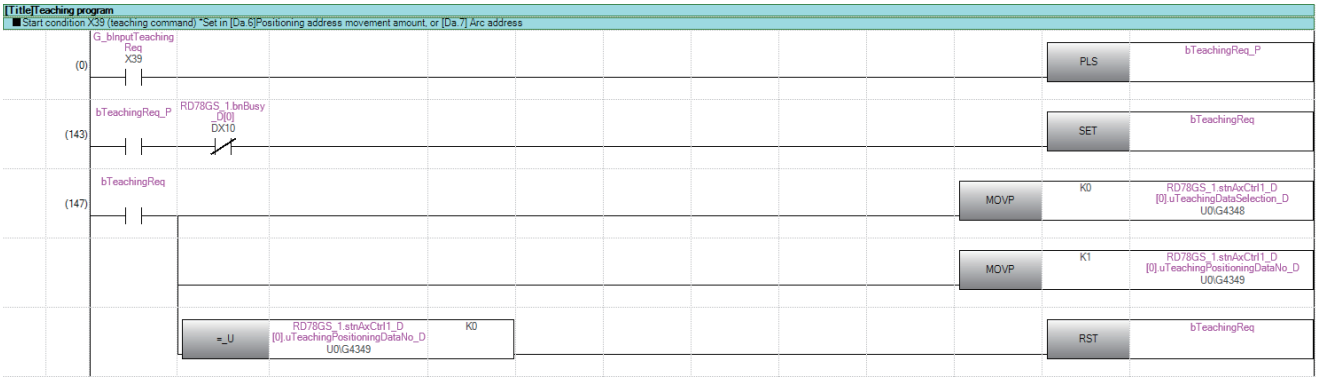
	Label Name	Data Type		Class
1	bSkipReq_P	Bit	...	VAR
2	bSkipReq	Bit	...	VAR
3			...	



Teaching program

Set the local labels as follows.

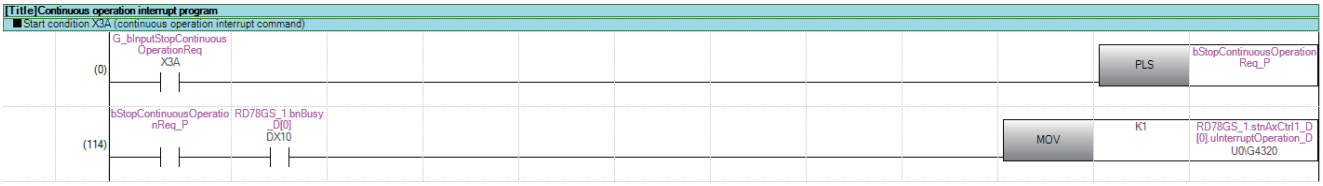
	Label Name	Data Type		Class
1	bTeachingReq_P	Bit	...	VAR
2	bTeachingReq	Bit	...	VAR
3			...	



Continuous operation interrupt program

Set the local labels as follows.

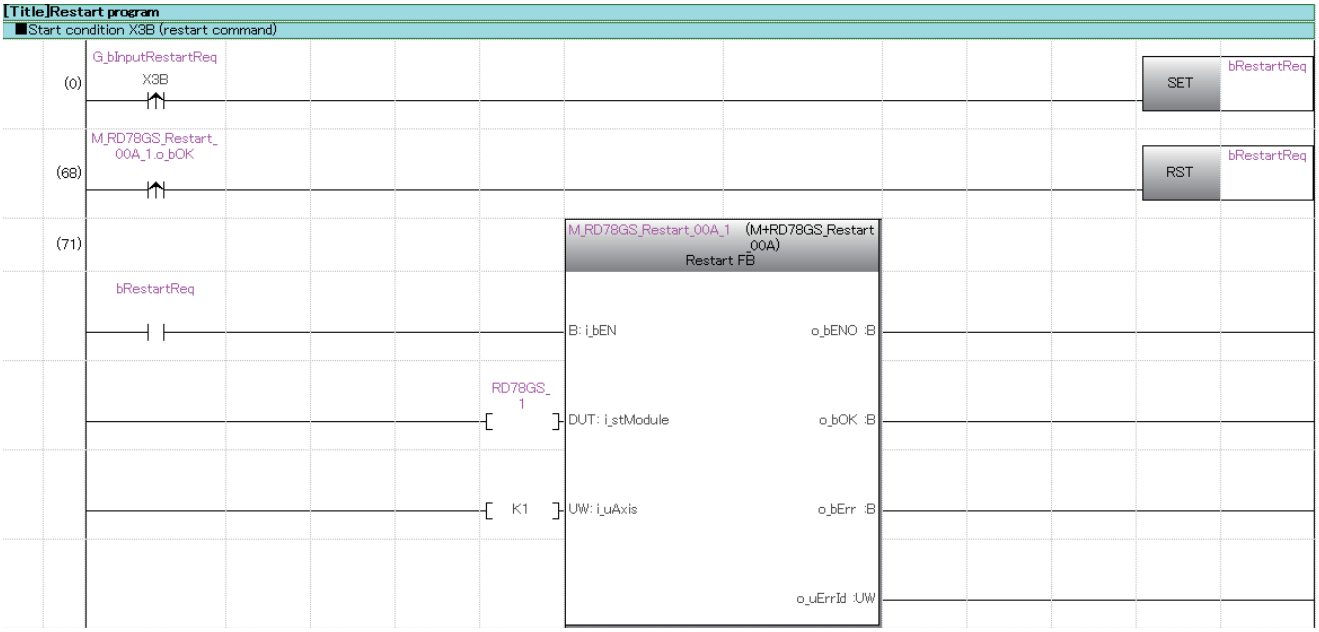
	Label Name	Data Type		Class
1	bStopContinuousOperationReq_P	Bit	...	VAR
2			...	



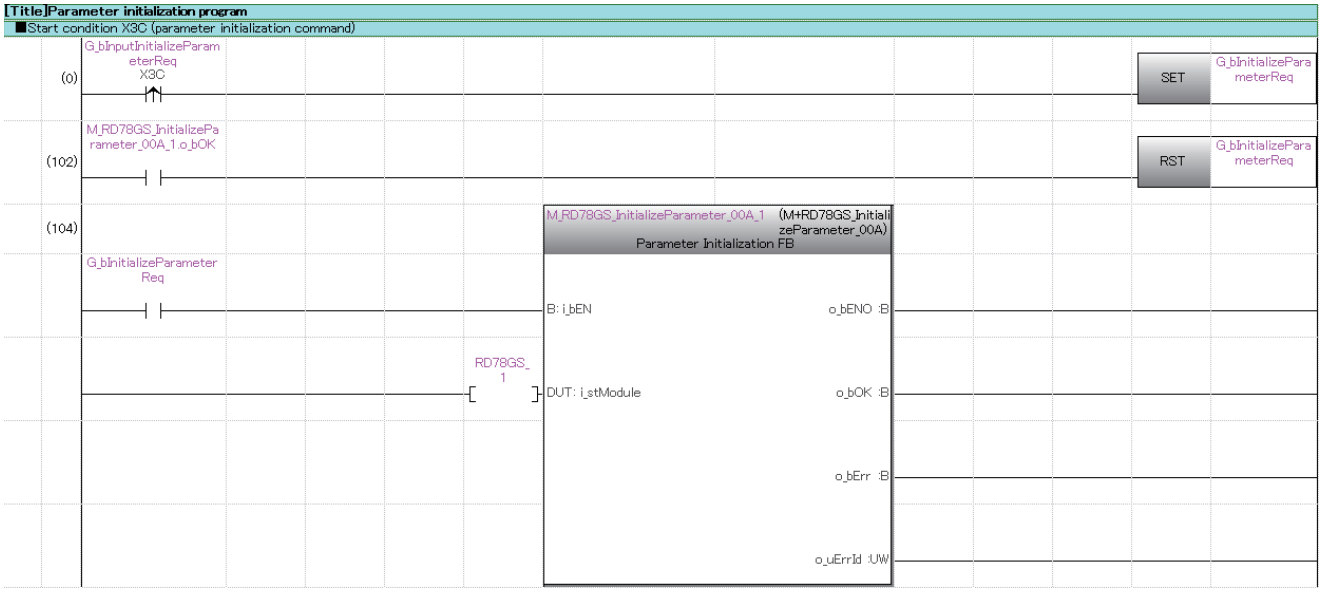
Restart program

Set the local labels as follows.

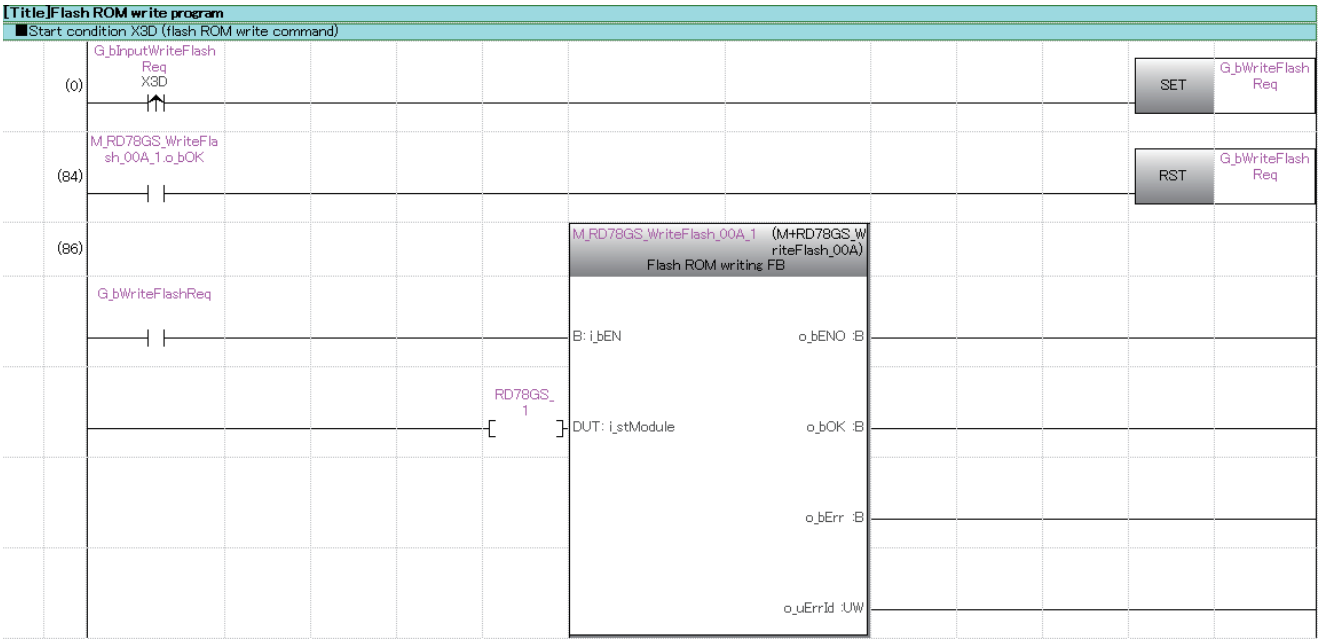
	Label Name	Data Type		Class
1	bRestartReq	Bit	...	VAR
2			...	



Parameter initialization program



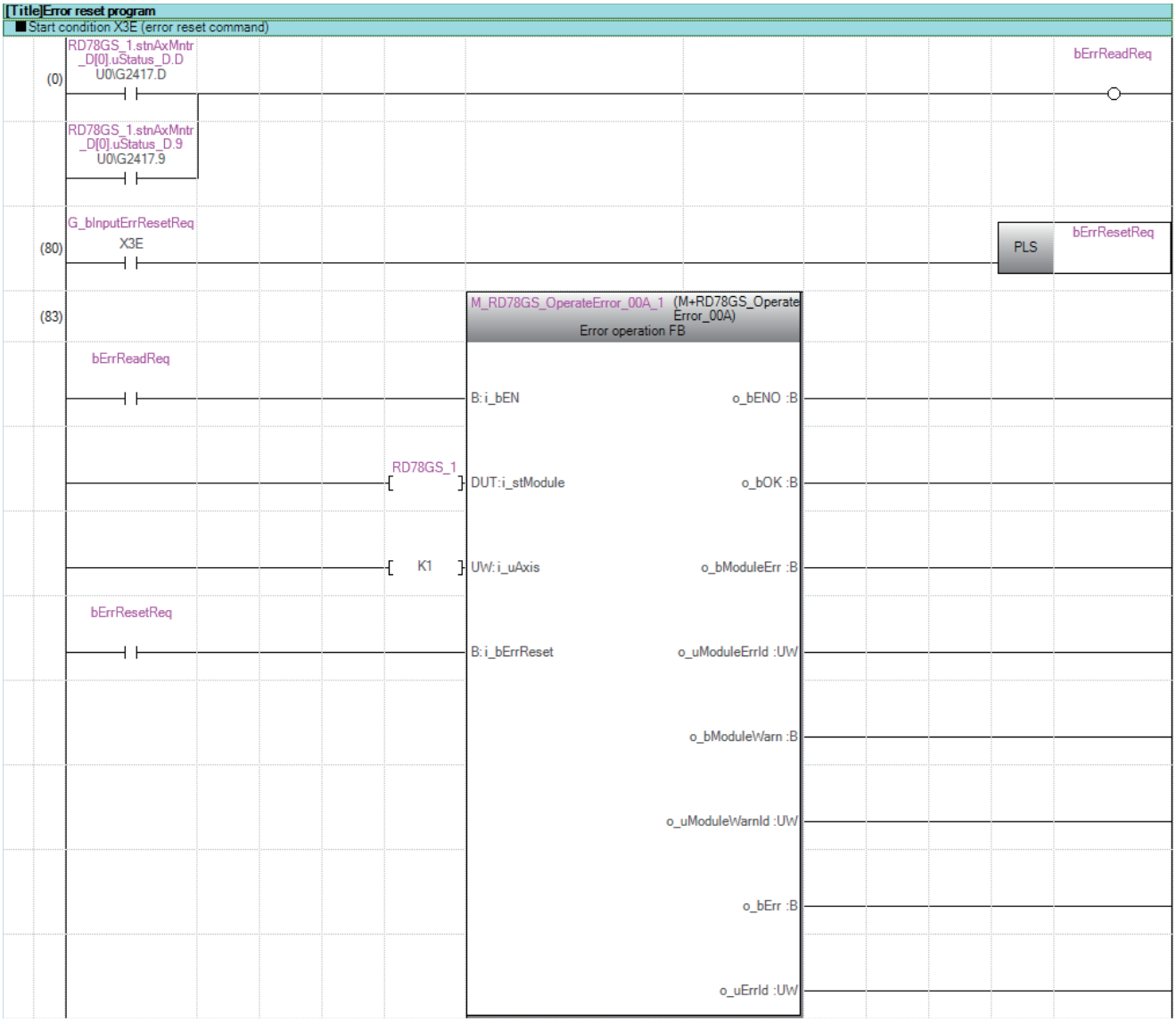
Flash ROM write program



Error reset program

Set the local labels as follows.

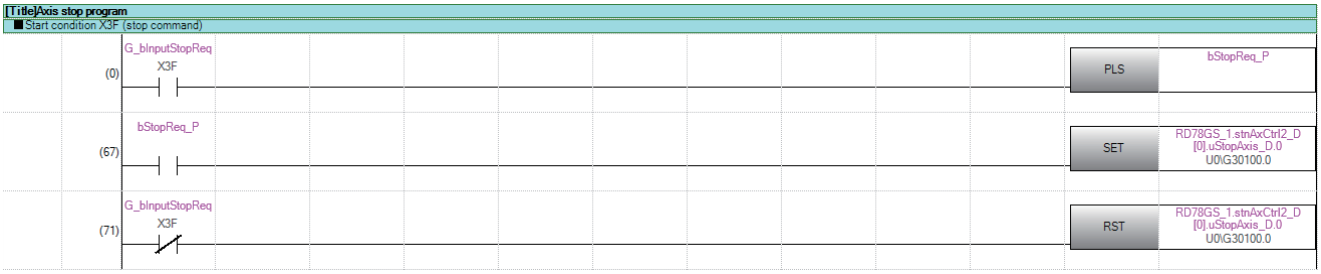
	Label Name	Data Type		Class
1	bErrReadReq	Bit	...	VAR
2	bErrResetReq	Bit	...	VAR
3			...	



Axis stop program

Set the local labels as follows.

	Label Name	Data Type		Class
1	bStopReq_P	Bit	...	VAR
2			...	



14 TROUBLESHOOTING

This chapter describes details of error occurred by using the Motion module and troubleshooting.

14.1 Troubleshooting Procedure

When a trouble occurs, execute the troubleshooting in the order shown below.

1. Check that each module is mounted correctly.
(MELSEC iQ-R Module Configuration Manual)

2. Check the LEDs of the power supply module and CPU module.
(MELSEC iQ-R CPU Module User's Manual (Startup))

3. Check the LED status of each module to confirm whether an error does not occur in a module. (☞ Page 640 Troubleshooting using the LEDs)

4. Check whether an error does not occur in a module using the module diagnostics of an engineering tool. (☞ Page 642 Troubleshooting using the module status)

Troubleshooting using the LEDs

Primary diagnostics can be executed without the engineering tool by checking the status of the LED display, so that the range of the trouble cause can be reduced.
The following shows the correspondence relation between each LED and status of the Motion module.

LED display

☐: OFF, ■: ON, ●: Flashing

Name	Description	LED display		Status
RUN LED	Displays the operation status.*1	RUN LED■		Normal operation
		RUN LED☐		Error occurring, initializing
ERR LED	Displays the error status.	ERR LED■		Error occurring
		ERR LED●		200ms interval: Error occurring 500ms interval: Data link error station detected
		ERR LED☐		Normal operation
PROGRAM RUN LED	Displays the PLC READY status.*1	PROGRAM RUN LED■		PLC READY [Y0] ON
		PROGRAM RUN LED☐		PLC READY [Y0] OFF
D LINK LED	Displays the data link status.	D LINK LED■		Data link (cyclic transmission being performed)
		D LINK LED●		Data link (cyclic transmission stopped)
		D LINK LED☐		Data link not performed (disconnection)
SD/RD LED	Displays the data transmit status.	SD/RD LED■		Data*2 transmission in progress
		SD/RD LED☐		Data*2 transmission not in progress
CARD READY LED	Displays the SD memory card status.	CARD READY LED■		SD memory card usable
		CARD READY LED●		Preparing
		CARD READY LED☐		Not inserted
CARD ACCESS LED	Displays the access status of the SD memory card.	CARD ACCESS LED■		SD memory card being accessed
		CARD ACCESS LED☐		SD memory card not accessed
L ER LED	Displays the port status.	P1	L ER LED■	Abnormal data received
			L ER LED☐	Normal data received
LINK LED	Displays the link status.	P1	LINK LED■	Link-up
			LINK LED☐	Link-down

*1 The LED display differs during software installation. For details, refer to the following.
☞ Page 389 Software Installation to the Own Module

*2 Includes cyclic transmission and transient transmission data for CC-Link IE TSN.

The error status can be identified by the lighting status of the RUN LED and ERR LED as follows.

RUN LED	ERR LED	Error status	Description
OFF	ON or flashing	Major error	An error in which the module stops operation because of a hardware error or memory error, etc.
ON	Flashing	Moderate error	An error related to module operation in which the module stops operation because of a parameter error, etc.
ON	ON	Minor error	An error, such as a communication, positioning control, or program error, in which the module continues operation.

When multiple errors occur, the error status is displayed in the order of Major error > Moderate error > Minor error.

When the RUN LED turns off

Check item	Action
Is the power supplied for the power supply module?	Check that the voltage supplied to the power supply module is within the rated range.
Is the LED of the power supply module turned on?	If the LED is not turned on, refer to the following. MELSEC iQ-R CPU Module User's Manual (Application)
Is the power supply capacity sufficient?	Calculate the total current consumption of the modules connected with the base unit (CPU module, I/O modules, and intelligent function modules) and check that the power supply capacity is not insufficient.
Is the module connected with the base unit correctly?	Check the state of connection with the module.

If there is no problem on the above check items, a hardware failure may have occurred. Reset the CPU module and check that the RUN LED turns on.
If not, the possible cause is a hardware failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

When the ERR LED flashes

Check item	Action
Is there a moderate error?	• An error may have occurred in the CPU module. Check the error occurred in the CPU module and take a corrective action. • A hardware failure may have occurred. Reset the CPU module and check that the RUN LED turns on. If not, the possible cause is a hardware failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

When the ERR LED turns on

Check item	Action
Is there a synchronous encoder axis error?	Check the error code and take a corrective action.
Is there a minor error?	Check the error code and take a corrective action.
Is there a command generation axis error?	Check the error code and take a corrective action.

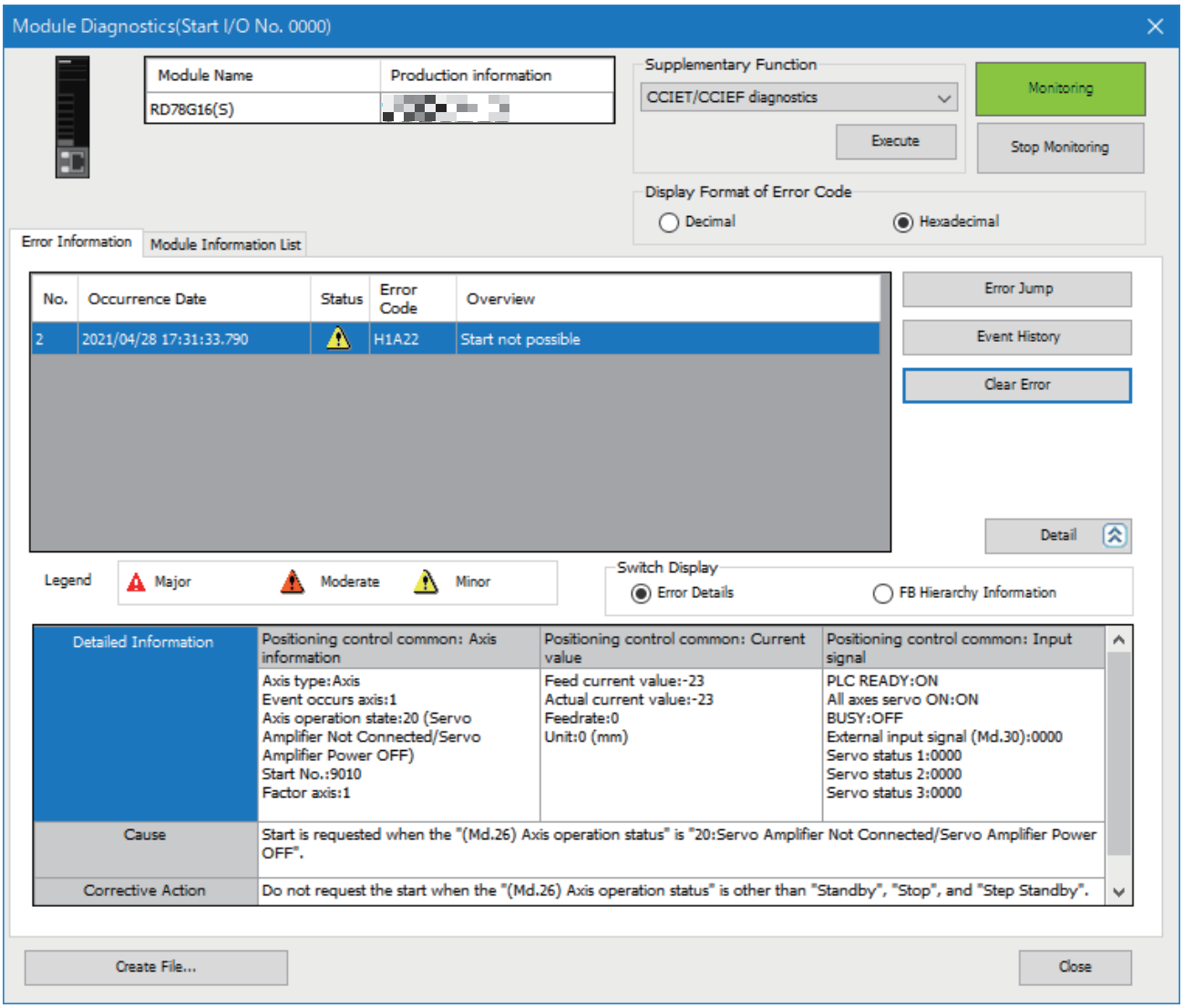
The ERR LED may not correspond to the axis operation status. To check the latest operation status, refer to the error detection signal ([Md.31] Status: b13).

Other than those above

Reset the CPU module and check that the module is in the normal status.
If the status is not changed, the possible cause is a hardware failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

Troubleshooting using the module status

Error codes (warning codes) and error history occurred in the Motion module can be checked on the module diagnostics display of the engineering tool.



14.2 Troubleshooting by Symptom

Troubleshooting when a motor does not rotate

Check items and corrective actions for troubleshooting when a motor does not rotate are described below.

Check item	Action
Is PLC READY [Y0] ON?	Review the program to turn ON PLC READY [Y0].
Is the servo amplifier powered ON?	Power on the servo amplifier.
Is there an error in the servo amplifier?	Check the error code of the servo amplifier and take a corrective action.
Is the wiring between the Motion module and servo amplifier correct?	Check the wiring between the Motion module and servo amplifier, and correct it.
Is the wiring between the servo amplifier and motor correct?	Check the wiring between the servo amplifier and motor, and correct it.
Is the wiring of the limit signal correct?	Check the wiring and logic setting of the limit signal, and correct the wiring.
Is there an error in the Motion module? (The ERR LED is ON or flashing.)	Check the error code and take a corrective action.
Isn't the value in "[Md.26] Axis operation status" "1: stopped"?	• Review the stop program. • Review whether the stop signal (STOP) is not input erroneously.
Is the value in "[Md.20] Command position value" changed after positioning control is performed?	Review the start program.
Is the cumulative pulse of servo amplifier changed after positioning control is performed?	Refer to the manual of each servo amplifier and check if any function that suppress the motor rotation is activated.
Is the speed change 0 flag ([Md.31] Status: b10) turned ON?	When the speed is changed to zero by the speed change function, review the speed to be changed. When "[Cd.13] Positioning operation speed override" is set to "0 (%)", review the set value.

If a motor does not rotate even after the above items are checked, the possible cause is a hardware failure.
Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

Troubleshooting when a motor does not rotate as intended

Check items and corrective actions for troubleshooting when a motor does not rotate as intended are described below.

■When a motor rotates only in the opposite direction

Check item	Action
Is the setting of "Travel direction selection (PA14)" correct?	Check the setting of "Travel direction selection (PA14)" to see if the intended rotation direction has been set. Once "Travel direction selection (PA14)" is changed, power OFF and ON the servo amplifier or reset the controller to return to the home position.

■When a motor does not rotate at the set speed

Check item	Action
Does the value in "[Md.28] Axis speed command"*1 indicate the set speed?	[When "[Md.28] Axis speed command"*1 indicates the set speed] • Check that the values in "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)", and "[Pr.4] Unit magnification (AM)" meet the system. • When the servo amplifier has the electronic gear function, check that the settings meet the system.
	[When "[Md.28] Axis speed command"*1 does not indicate the set speed] • Check that the speed is not limited by the value in "[Pr.8] Speed limit value". • In the JOG operation, check that the speed is not limited by the value in "[Pr.31] JOG speed limit value". • In the JOG operation, check that Forward run JOG start signal [Cd.181] and Reverse run JOG start signal [Cd.182] do not repeatedly turn ON and OFF.

*1 Speed control mode and continuous operation to torque control mode: "[Md.122] Speed during command"

■When the set position is not reached

Check item	Action
Does the value in "[Md.20] Command position value" indicate the intended position when the motor stops?	[When the position set in "[Md.20] Command position value" is reached] • Check that the values in "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)", and "[Pr.4] Unit magnification (AM)" meet the system. • When the servo amplifier has the electronic gear function, check that the settings meet the system.
	[When the position set in "[Md.20] Command position value" is not reached] • Check that the motor is not stopped by Axis stop signal [Cd.180]. If a motor is stopped by the stop command, the value "1: stopped" is stored in "[Md.26] Axis operation status".

When a communication time-out occurs on the engineering tool

Check items and corrective actions for when a communication time-out occurs on the engineering tool are described below.

Check item	Action
Is the communication cycle set for the operation cycle time sufficiently long?	Check the positioning details, or change the setting of the network parameter "Communication cycle interval setting"*1 to a longer value. In addition, when a communication time-out occurs when performing flash ROM writing or parameter initialization from the engineering tool, perform communication load reduction by turning OFF the power supply of the connected servo amplifier, etc., to shorten the operation processing time.

*1 For the communication cycle interval, refer to "Processing Time" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Network)

When parameters are not applied

Check the fetch timing of each parameter. For details, check the description of each function or the following.

☞ Page 587 Details of areas

If parameters are not applied after restarting the module, check if the execution data backup has been performed. For details of the execution data backup, refer to the following.

☞ Page 315 Execution Data Backup Function

14.3 Error and Warning Details

Error type

There are the following errors: Parameter setting range errors and errors at operation start or during operation detected by the Motion module and errors detected by the servo amplifier.

Motion module detection parameter setting range errors

The parameters are checked when the power is turned ON and at the rising edge (OFF to ON) of PLC READY [Y0]. An error will occur if there is a mistake in the parameter setting details at that time.
When this kind of error occurs, the READY signal [X0] does not turn ON.
To cancel this kind of error, set the correct value in the parameter for which the error occurred, and then turn ON PLC READY [Y0].

Motion module detection errors at operation start or during operation

The errors that occur at operation start or during operation such as the positioning control, JOG operation, or manual pulse generator operation. If an axis error occurs during interpolation operation, the error code will be stored in both the reference axis and the interpolation axis.
Note that the axis error No. will be stored only in the reference axis during analysis of the positioning data set in each point of the positioning start data table in the following cases.

- When the interpolation axis is BUSY.
- When the error occurs in positioning data or parameters unrelated to interpolation control.

If the error occurs at the simultaneous start of a positioning operation, the axis error storage details will differ depending on whether the error occurred before or after the simultaneous start.

- If the error (illegal axis No., other axis BUSY, etc.) occurs before the simultaneous start, "Error before simultaneous start" (error code: 1A90H to 1A91H) will occur for the start axis.
- If the error (positioning data error, software stroke limit error, etc.) occurs after the simultaneous start, an error code corresponding to the axis in which the error occurred will be stored. Because a simultaneous start cannot be carried out due to this, "Simultaneous start not possible" (error code: 1A9EH) will be stored in all axes in which an error has not occurred.

The axis operation status will be displayed as "error occurring" for axes in which an error occurred.
If an error occurs during operation, any moving axes will deceleration stop, and their operation status will be displayed as "error occurring".
All axes will decelerate to a stop during interpolation operations, even if the error occurs in only one axis.

Servo amplifier detection errors

The errors that occur when the hardware error of the servo amplifier or servo motor or the servo parameter error occurs.
The servo is turned off at the error occurrence and the axis stops.
Remove the error factor and reset the error, reset the controller, or turn the servo amplifier power supply ON again from OFF.

Error code classification

Item	Error code	Classification of errors
Minor errors	1080H	Life detection error
	1A00H to 1A3FH	Positioning control common errors
	1A40H to 1A7FH	Home position return errors
	1A80H to 1A8FH	JOG, inching and manual pulse generator operation errors
	1A90H to 1AEFH	Positioning operation errors
	1AF0H to 1AFFH	Block start data errors
	1B00H to 1B0FH	Condition data errors
	1B10H to 1B5FH	Positioning data errors
	1B60H to 1B9FH	Basic parameter errors
	1BA0H to 1BFFH	Detailed parameter errors
	1C10H to 1C2FH	Home position return parameter errors
	1D90H to 1DEFH	Extended/Common parameter errors
	1DF0H to 1E2FH	Synchronous control input axis errors
	1E30H to 1E8FH	Synchronous control output axis errors
	1ED0H to 1F0FH	Errors for servo amplifier, inverter, amplifier manufactured by other companies, and head module
	1F10H to 1F1FH	Link device external signal assignment error
Moderate errors	3300H to 337FH	Initial process errors
Major error	3C00H to 3DFFH	Hardware failures (common)

Error storage

When an error occurs, the error detection signal turns ON, and the error code corresponding to the error details is stored in "[Md.23] Axis error No.". Note that there is a delay of up to operation cycle after the error detection signal turns ON until the error code is stored.

There are system errors that do not depend on the axis. If a system error occurs, an error code is stored in "[Md.23] Axis error No." of the axis 1. For the error codes of system errors, refer to the following.

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When an alarm occurs on the servo amplifier, the alarm No. displayed in the LED of the servo amplifier is stored in "[Md.114] Servo alarm" and "[Md.115] Servo alarm detail number". Check the error details and remedies with "[Md.114] Servo alarm" and "[Md.115] Servo alarm detail number".

Error detection signal	Error code	Servo alarm
[Md.31] Status: b13	[Md.23] Axis error No.*1	[Md.114] Servo alarm [Md.115] Servo alarm detail number

*1 A new error code is stored in "[Md.23] Axis error No." every time an error occurs.

The following table shows the specifications of the alarm on the drive unit.

[Md.23] Axis error No.	[Md.108] Servo status1	[Md.114] Servo alarm [Md.115] Servo alarm detail number
1ED0H	"b7: Servo alarm" becomes ON.	The error code read from the drive unit is stored.

The following table shows the specifications of communication errors on the drive unit detected by the Motion module.

Error status	[Md.23] Axis error No.	[Md.108] Servo status1	[Md.114] Servo alarm [Md.115] Servo alarm detail number
WDT error	1ED2H	"b7: Servo alarm" remains OFF.	Not updated.

Point

When any error that is independent of an axis is detected, it is stored in the axis error No. of axis 1.
(These errors are stored in the axis error No. of axis 1 for the system which does not use the axis 1.)

For the synchronous encoder axis, "b4: Error detection flag" of "[Md.325] Synchronous encoder axis status" for target axis turns ON, and the input axis error No. is stored in "[Md.326] Synchronous encoder axis error No.".

Warning type

There are the following warnings: System warnings and axis warnings detected by the Motion module and warnings detected by the servo amplifier.

Motion module detection system warnings

- System control data setting warnings: An axis warning for axis 1 will occur.
- Positioning data setting warnings: An axis warning for each axis will occur. Note that a warning will occur for the reference axis when an interpolation designation or axis setting warning occurs.

Motion module detection axis warnings

- Axis warnings that occur at operation start or during operation such as the positioning operation, JOG operation or manual pulse generator operation.
- Axis warnings that occur due to system warnings: The axis operation status does not change even though an axis warning occurs.

Servo amplifier detection warnings

The warnings that occur when the hardware error of the servo amplifier or servo motor occurs or the servo parameter is inapplicable.

The servo may not be turned off depending on the warning. However, an error occurs or the operation cannot be executed normally if the warning is remained.

Once the warning cause is removed, the warning on the servo amplifier will be automatically cleared, however, the Motion module will remain in the warning state.

Reset it as necessary.

Warning code classification

Item	Warning code	Classification of warnings
Warnings	0D00H to 0D3FH	Positioning control common warnings
	0D40H to 0D4FH	JOG, inching and manual pulse generator operation warnings
	0D50H to 0DAFH	Positioning operation warnings
	0DB0H to 0DBFH	Block start data warnings
	0DC0H to 0E0FH	Positioning data warnings
	0E10H to 0E4FH	Synchronous control input axis warnings
	0E50H to 0E8FH	Synchronous control output axis warnings
	0E90H to 0EBFH	Cam data operation warnings
	0EC0H to 0EDFH	Warnings for servo amplifier, inverter, amplifier manufactured by other companies, and head module
	0F0EH	System error warning

Warning storage

When an axis warning occurs, the warning code corresponding to the warning details is stored in "[Md.24] Axis warning No.". When an axis warning occurs in a positioning operation, etc., axis warning detection ([Md.31] Status: b9) for axis status storage turns ON.

There are system warnings that do not depend on the axis. If a system warning occurs, a warning code is stored in "[Md.24] Axis warning No." of the axis 1. For the warning codes of system warnings, refer to the following.

☞ Page 650 List of Warning Codes

When a warning occurs on the servo amplifier, the warning No. displayed in the LED of the servo amplifier is stored in "[Md.114] Servo alarm" and "[Md.115] Servo alarm detail number". Check the warning details and remedies with "[Md.114] Servo alarm" and "[Md.115] Servo alarm detail number".

Warning detection signal	Warning code	Servo alarm
[Md.31] Status: b9	[Md.24] Axis warning No.*1	[Md.114] Servo alarm [Md.115] Servo alarm detail number

*1 A new warning code is stored in "[Md.24] Axis warning No." every time a warning occurs.

The following table shows the specifications of the warning on the drive unit.

[Md.23] Axis error No.	[Md.108] Servo status1	[Md.114] Servo alarm [Md.115] Servo alarm detail number
0EC0H	"b9: Servo warning" becomes ON.	The warning code read from the drive unit is stored.

For the synchronous encoder axis, "b5: Warning detection flag" of "[Md.325] Synchronous encoder axis status" for target axis turns ON, and the input axis warning No. is stored in "[Md.327] Synchronous encoder axis warning No.".

Clearing errors and warnings

Remove the cause of error or warning following the actions described in the sections below before canceling an error or warning state by resetting the error.

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How to clear errors or warnings

■When clearing errors for an individual axis

An error or warning state is canceled after the following processing is carried out by setting "1" in "[Cd.5] Axis error reset".

- Axis error detection signal is turned OFF.
- "[Md.23] Axis error No." is cleared.
- "[Md.24] Axis warning No." is cleared.
- "[Md.26] Axis operation status" is changed from "Error" to "Standby".
- "Axis warning detection ([Md.31] Status: b9)" is turned OFF.

Point

When servo amplifier alarms cannot be reset even if error reset is requested, "0" is not stored in "[Cd.5] Axis error reset" by the Motion module. It remains "1". Set "0" in "[Cd.5] Axis error reset" and then set "1" to execute the error reset again by user side.

For the synchronous encoder axis, an error or warning state is canceled after the following processing is carried out by setting "1" in "[Cd.323] Synchronous encoder axis error reset" for target axis.

- "b4: Error detection flag" of "[Md.325] Synchronous encoder axis status" is turned OFF.
- "[Md.326] Synchronous encoder axis error No." is cleared.
- "b5: Warning detection flag" of "[Md.325] Synchronous encoder axis status" is turned OFF.
- "[Md.327] Synchronous encoder axis warning No." is cleared.

■When clearing errors for all axes

The errors/warnings of the network and all axes are cleared at once by clicking the [Clear Error] button on the "Module Diagnostics" window of GX Works3. The details of processing are the same as those for clearing errors for an individual axis.

14.4 List of Warning Codes

Motion module detection warnings

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0D00H	Start during operation	• The start request is issued while the axis is BUSY. • Positioning was started during speed control mode/torque control mode. [Operation status at warning occurrence] Position control mode: The operation continues. Speed control mode/torque control mode: The operation continues. (Positioning start is not executed.)	• Normalize the start request ON timing. • When in speed control mode/torque control mode, start positioning after switching to the position control mode.
0D02H	Restart not possible	The restart command is issued when "[Md.26] Axis operation status" is not "1: Stopped". [Operation status at warning occurrence] Continues the operation.	Normalize the start request ON timing. (Do not issue the restart command when "[Md.26] Axis operation status" is not "1: Stopped".)
0D03H	Teaching in BUSY	The teaching request is issued while the axis is BUSY. [Operation status at warning occurrence] The warning is issued for the axis designated at the time of the teaching request.	Carry out the teaching request when the axis is not BUSY.
0D04H	Less than minimum speed	The overridden speed becomes "0". [Operation status at warning occurrence] The system is controlled with the currently executing unit of 1.	Prevent the overridden speed from being reduced to 0.
0D05H	In PLC READY[*1]	The request for writing to the flash ROM has been issued during PLC READY [Y0] was ON. [Operation status at warning occurrence] The warning for axis 1 is issued.	Request to write when the PLC READY signal [Y0] is OFF.
0D06H	Illegal override value	A value other than 0 to 300 is set for the override value. [Operation status at warning occurrence] When a setting value is 301 or more: Controlled at 300.	Set a value within the setting range.
0D07H	Outside new torque value range/outside forward new torque value range	"[Cd.22] New torque value/forward new torque value" exceeds "[Pr.17] Torque limit setting value".[*2] [Operation status at warning occurrence] The torque change is not carried out.	Set "[Cd.22] New torque value/forward new torque value" to a value equal to or less than "[Pr.17] Torque limit setting value".
0D08H	Below bias speed	The command speed is below "[Pr.7] Bias speed at start". [Operation status at warning occurrence] Operation is performed at "[Pr.7] Bias speed at start".	Set the command speed/bias speed at start again so that (command speed) is equal to or larger than ("[Pr.7] Bias speed at start").
0D2EH	Mark detection link device start No. specification	The mark detection link device start No. is outside the setting range. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is outside the setting range is invalid.	Review the mark detection signal link device start No. setting.
0D2FH	Mark detection link device bit specification	Bit other than 0 to F has been specified in mark detection signal link device. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is out of the setting range is invalid.	Review the mark detection signal link device start No. setting.
0D32H	Outside new reverse torque value range	"[Cd.113] New reverse torque value" exceeds "[Pr.17] Torque limit setting value". [Operation status at warning occurrence] The torque change is not carried out.	Set "[Cd.113] New reverse torque value" to a value equal to or less than "[Pr.17] Torque limit setting value".
0D36H	Outside mark detection signal setting range[*1]	• The setting value of "[Pr.800] Mark detection signal setting" is outside the setting range. • An axis that TPR1 is specified in "[Pr.800] Mark detection signal setting" is not set or set as a virtual servo amplifier axis. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is outside the range is invalid.	• Set a value within the setting range. • Set the axis specified in "[Pr.800] Mark detection signal setting", or change "[Pr.101] Virtual servo amplifier setting" to "0: Use real servo amplifier".

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0D37H	Outside mark detection data type setting range[*1]	The setting value of "[Pr.802] Mark detection data type" is outside the setting range. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is outside the range is invalid.	Set a value within the setting range.
0D38H	Outside mark detection data axis No. setting range[*1]	When "[Pr.802] Mark detection data type" is not "Optional 2 word buffer memory", the setting value of "[Pr.802] Mark detection data type" is outside the setting range. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is outside the range is invalid.	Set a value within the setting range.
0D39H	Outside mark detection data buffer memory No. setting range[*1]	When "[Pr.802] Mark detection data type" is "Optional 2 word buffer memory", the setting value of "[Pr.804] Mark detection data buffer memory No." is outside the setting range or an odd number. [Operation status at warning occurrence] The setting No. of which the mark detection setting parameter is outside the range is invalid.	Set a value with an even number within the setting range.
0D3AH	Outside maximum number of control axes	The common parameter "[Pr.152] Maximum number of control axes" exceeds the maximum number of control axes of Motion module. [Operation status at warning occurrence] Controlled as "0: No setting".	Set the maximum number of control axes to the maximum number of control axes for the Motion module or less.
0D3BH	Outside control axis setting	"[Pr.141] IP address" or "[Pr.101] Virtual servo amplifier setting" has been set for the axis that exceeds "[Pr.152] Maximum number of control axes". [Operation status at warning occurrence] The communication with the connected device is not executed.	For the axes which are out of the maximum number of control axes, set the servo network configuration parameter "[Pr.141] IP address" to "0: No setting" and "[Pr.101] Virtual servo amplifier setting" to "0: Use real servo amplifier".
0D3CH	Home position return data incorrect	• The backup data for absolute position restoration is illegal. • The home position return has never been executed after the system start. • The home position return is started, but not completed correctly. • "Absolute position erased" in the driver is detected. • "Rotation direction selection (PA14)" of the servo parameter has been changed. • The electronic gear of the Motion module or drive module is changed. [Operation status at warning occurrence] The operation continues.	Execute home position return.
0D3DH	Invalid absolute position system setting	The slave axis of driver communication is set to absolute position system enabled. [Operation status at warning occurrence] The absolute position system is disabled.	Review the absolute position system setting.
0D3FH	Mark detection driver touch probe function disabled	One of the following has occurred in an axis set to use TPR1 in "[Pr.800] Mark detection signal setting". • The specified axis does not support the servo amplifier touch probe function. • An object for touch probe is not set for the optional data monitor when a multi-axis servo amplifier is used. [Operation status at warning occurrence] The setting No. for which the corresponding axis is specified in "[Pr.800] Mark detection signal setting" becomes invalid.	• Check the model and version of the connected servo amplifier, and check if they support the touch probe function. • Set an object for the touch probe to the optional data monitor when using a multi-axis servo amplifier.
0D40H	Speed change during deceleration	The speed change request is issued during deceleration stop with JOG start signal OFF. [Operation status at warning occurrence] The speed change is not carried out.	Do not carry out the JOG speed change during deceleration with the JOG start signal OFF.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0D41H	JOG speed limit value	"[Cd.17] JOG speed[*3]" exceeds "[Pr.31] JOG speed limit value" at JOG start. [Operation status at warning occurrence] • When the speed exceeds "[Pr.31] JOG speed limit value", the JOG operation is carried out with "[Pr.31] JOG speed limit value". • While the speed is limited by the JOG speed limit value, "[Md.39] In speed limit flag" is turned ON.	Set a value within the setting range.
0D42H	JOG speed limit value	The new speed value[*3] exceeds "[Pr.31] JOG speed limit value" when the speed is changed during JOG operation. [Operation status at warning occurrence] • When the speed exceeds "[Pr.31] JOG speed limit value", the JOG operation is carried out with "[Pr.31] JOG speed limit value". • While the speed is limited by the JOG speed limit value, "[Md.39] In speed limit flag" is turned ON.	Set a value within the setting range.
0D48H	Outside manual pulse generator input magnification range	"[Cd.20] Manual pulse generator 1 pulse input magnification" is set to 0, 10001 or more, or a negative value. [Operation status at warning occurrence] • When input magnification is set at 10001 or more, or negative value: Re-set to 10000. • When input magnification is set at 0: Re-set to 1.	Set "[Cd.20] Manual pulse generator 1 pulse input magnification" within the setting range.
0D49H	Outside manual pulse generator speed limit value	The manual pulse generator speed exceeds "[Pr.123] Manual pulse generator speed limit value". [Operation status at warning occurrence] • When the speed exceeds the detailed parameter 2 "[Pr.123] Manual pulse generator speed limit value", the manual pulse generator operation is executed following the detailed parameter 2 "[Pr.122] Manual pulse generator speed limit mode". • "[Md.39] In speed limit flag" is turned ON while the speed is controlled with the detailed parameter 2 "[Pr.123] Manual pulse generator speed limit value".	Adjust speed of manual pulse generator or "[Cd.20] Manual pulse generator 1 pulse input magnification" not to exceed the speed limit value.
0D50H	Deceleration/stop speed change	The speed change request is issued during deceleration stop. [Operation status at warning occurrence] The speed change is not carried out.	Do not carry out the speed change during deceleration with a stop command, during stoppage, or during automatic deceleration with position control.
0D51H	Speed limit value over	• Setting speeds[*3] exceed "[Pr.8] Speed limit value" when starting/restarting the positioning or when changing the speed at the positioning[*4]. (At the interpolation control, any of reference axes or interpolation axes exceeds "[Pr.8] Speed limit value".) • "[Cd.140] Command speed at speed control mode" exceeds "[Pr.8] Speed limit value" during the speed control mode. • "[Cd.146] Speed limit value at torque control mode" exceeds "[Pr.8] Speed limit value" during the torque control mode. • "[Cd.147] Speed limit value at continuous operation to torque control mode" exceeds "[Pr.8] Speed limit value" during the continuous operation to torque control mode. [Operation status at warning occurrence] [Position control mode] • The speed is controlled with "[Pr.8] Speed limit value". • "[Md.39] In speed limit flag" is turned ON. [Speed control mode/Torque control mode/Continuous operation to torque control mode] The speed is controlled with "[Pr.8] Speed limit value".	Review each speed so that setting speeds do not exceed "[Pr.8] Speed limit value".
0D52H	M code ON signal ON	The M code ON signal ([Md.31] Status: b12) is turned ON when the positioning data is executed. [Operation status at warning occurrence] Continues executing the positioning data.	Normalize the ON and OFF timings of the "[Cd.7] M code OFF request".

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0D53H	Speed-position switching (during acceleration) signal ON	The switching signal for speed-position switching control (INC mode) is turned ON during acceleration. [Operation status at warning occurrence] The operation is continued.	Turn ON the speed-position switching signal in the speed stabilization region (constant speed status).
0D54H	Insufficient remaining distance	At a continuous operation interrupt request, the distance required deceleration stop is not long enough. [Operation status at warning occurrence] • When a command speed is changed: Change to a value as close as possible to "[Cd.14] New speed value". • When a target position is changed: Adjust the speed to a value as close as possible to "[Da.8] Command speed", and then change to a target position. (When "[Da.1] Operation pattern" is continuous path control, ignore the operations stated above.)	Give a request at the position where there is an enough remaining distance.
0D55H	Insufficient remaining distance	At a speed change request, the remaining distance is shorter than the distance required for speed change. [Operation status at warning occurrence] • When a command speed is changed: Change to a value as close as possible to "[Cd.14] New speed value". • When a target position is changed: Adjust the speed to a value as close as possible to "[Da.8] Command speed", and then change to a target position. (When "[Da.1] Operation pattern" is continuous path control, ignore the operations stated above.)	Give a request at the position where there is an enough remaining distance.
0D56H	Step not possible	Code 1 is set for "[Cd.36] Step start information" when the axis operation status is not step standby. [Operation status at warning occurrence] The step will not start.	Do not set a "1" to the "[Cd.36] Step start information" when the axis operation status is not step standby.
0D57H	Illegal external command function	The setting value of the detailed parameter 2 "[Pr.42] External command function selection" exceeds the setting range. [Operation status at warning occurrence] Even if the external command signal is turned ON, the system will not perform anything.	Set the detailed parameter 2 "[Pr.42] External command function selection" within the setting range.
0D58H	Insufficient movement amount	The movement amount is not large enough for automatic deceleration. [Operation status at warning occurrence] The system stops immediately after it reaches the positioning address.	Set a decelerating address or a movement amount to the positioning data.
0D59H	Illegal teaching data No.	The positioning data No. is set outside the setting range. [Operation status at warning occurrence] Teaching is not carried out when the setting value is 0 or 601 or more. (The setting value is automatically reset to "0" by the Motion module even when a "0" or "601" or more is set.)	Set the positioning data No. to within the setting range.
0D5AH	Illegal teaching data selection	The setting value of "[Cd.38] Teaching data selection" is outside the range. [Operation status at warning occurrence] Teaching is not carried out.	Set the value of "[Cd.38] Teaching data selection" within the setting range.
0D5BH	Target position change not possible	• A target position change request was given for the control method other than ABS1 and INC1. • A target position change request was given during speed control mode, torque control mode or continuous operation to torque control mode. [Operation status at warning occurrence] The target position change is not carried out.	Do not turn ON the target position change request in the following cases. • A control method other than ABS1 and INC1 is used. • During speed control mode • During torque control mode • During continuous operation to torque control mode
0D5CH	Target position change not possible	A target position change request is turned ON during continuous path control. [Operation status at warning occurrence] The target position change is not carried out.	Do not turn ON the target position change request when an operating pattern "continuous path control" is used.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0D5DH	Target position change not possible	A target position change request was given during deceleration to a stop. [Operation status at warning occurrence] The target position change is not carried out.	Do not turn ON the target position change request during deceleration stop.
0D5EH	Target position change not possible	A target position change request was issued when speed change 0 flag ([Md.31] Status: b10) was ON. [Operation status at warning occurrence] The target position change is not carried out.	Do not turn ON the target position change request when speed change 0 flag ([Md.31] Status: b10) is ON.
0D5FH	Target position change not possible	"[Cd.27] Target position change value (New address)" is outside the software stroke limit range (+). [Operation status at warning occurrence] The target position change is not carried out.	Correct the setting value.
0D60H	Target position change not possible	"[Cd.27] Target position change value (New address)" is outside the software stroke limit range (-). [Operation status at warning occurrence] The target position change is not carried out.	Correct the setting value.
0D61H	Target position change not possible	"[Cd.27] Target position change value (New address)" is out of range (0 to 359.99999 [degree]). [Operation status at warning occurrence] The target position change is not carried out.	Correct the setting value.
0DA4H	Torque limit value over	• A value exceeding "[Pr.17] Torque limit setting value" is set to "[Cd.143] Command torque at torque control mode" at torque control mode. • A value exceeding "[Pr.17] Torque limit setting value" is set to "[Cd.150] Target torque at continuous operation to torque control mode" at continuous operation to torque control mode. [Operation status at warning occurrence] The torque is controlled with "[Pr.17] Torque limit setting value".	Review the setting so that the setting torque does not exceed "[Pr.17] Torque limit setting value".
0DA5H	Torque initial value selection invalid	At switching the control mode, the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is "0: Enabled" on the axis that set feedback torque into the torque initial value selection. [Operation status at warning occurrence] The initial value selection is controlled as the command torque.	• Use a servo amplifier which supports the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" and set (PC29) to "1: Disabled". • At switching the control mode, set the torque initial value selection to command torque.
0DA6H	Control mode switching during BUSY	Control mode switching was executed from the position control mode to the speed control mode/ torque control mode while BUSY was turned ON. [Operation status at warning occurrence] The control mode is not switched. (Positioning during operation continues.)	Switch the control mode after turning BUSY OFF.
0DA7H	Control mode switching during zero speed OFF	Control mode was changed when Zero speed ([Md.119] Servo status2: b3) was turned OFF. [Operation status at warning occurrence] The control mode is not switched. (Current operation continues.)	Switch the control mode after turning Zero speed ([Md.119] Servo status2: b3) ON.
0DA8H	Outside control mode range	Control mode switching request was performed by specifying a value outside the range for "[Cd.139] Control mode setting". [Operation status at warning occurrence] The control mode is not switched. (Current operation continues.)	Switch the control mode after setting a value within the range for "[Cd.139] Control mode setting".
0DA9H	Control mode switching	Control mode switching request was performed during the control mode switching. [Operation status at warning occurrence] Control mode switching request is not accepted.	Carry out the control mode switching request after completing the control mode switching.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0DAAH	Illegal control mode switching	• Switching to the speed/torque control mode is requested to the axis which does not support the control mode switching. • Switching to the continuous operation to torque control mode is requested to the axis which does not support the control mode switching. [Operation status at warning occurrence] Control mode switching request is not accepted.	• Do not use the speed/torque control to the axis which does not support the control mode switching. • Do not use the continuous operation to torque control to the axis which does not support the control mode switching.
0DABH	Control mode switching not possible	Control mode switching was performed in one of the following ways when the servo is ON. • Position control mode → Continuous operation to torque control mode → Speed control mode • Speed control mode → Continuous operation to torque control mode → Position control mode • Torque control mode ⇔ Continuous operation to torque control mode Control mode switching was performed in one of the following ways when "[Pr.112] Servo OFF command valid/invalid setting" is set to "1: Servo OFF command valid during speed-torque control" and the servo is OFF. • Mode other than position control mode → Position control mode • Speed control mode ⇔ Torque control mode [Version 30 or earlier] • Speed control mode ⇔ Continuous operation to torque control mode • Torque control mode ⇔ Continuous operation to torque control mode [Operation status at warning occurrence] The control mode is not switched. (Current operation continues.)	Review so that control mode switching is performed between the position control mode and continuous operation to torque control mode or between the speed control mode and continuous operation to torque control mode when the servo is ON. Review so that any of the following control mode is performed when the setting value of "[Pr.112] Servo OFF command valid/invalid setting" is "1: Servo OFF command valid during speed-torque control" and the servo is OFF. • Position control mode → Speed control mode • Position control mode → Torque control mode • Position control mode → Continuous operation to torque control mode • Speed control mode ⇔ Torque control mode [Version 30 or later]
0DB0H	No operation termination setting	In the positioning by block starting, the 50th point of the positioning start data is set to CONTINUE. [Operation status at warning occurrence] The operation is terminated.	Set the operation termination to the 50th point.
0DB1H	FOR to NEXT nest construction	FOR to NEXT is nested. [Operation status at warning occurrence] The operation is continued.	Make 1 nest construction for FOR to NEXT.
0DC0H	Outside command speed range	• The speed change value is outside the setting range when changing the speed during operation[*5] • "[Cd.140] Command speed at speed control mode" is outside the setting range during the speed control mode. • "[Cd.146] Speed limit value at torque control mode" is outside the setting range during the torque control mode. [Operation status at warning occurrence] • The speed change value is controlled as the "maximum value within the setting range". • "[Md.39] In speed limit flag" is turned ON.	• Set the speed change value to within the setting range. • Set "[Cd.140] Command speed at speed control mode" to within the setting range during the speed control mode. • Set "[Cd.146] Speed limit value at torque control mode" to within the setting range during the torque control mode.
0E06H	Speed limit value outside range at switching control mode	The value set "[Pr.8] Speed limit value" is outside the range when switching the control mode. [Operation status at warning occurrence] The previous speed limit value is continued.	Set the speed limit value within the range.
0EC0H	Driver warning	Warnings occur in the driver. [Operation status at warning occurrence] The operation continues.	Check the contents of the warning and take actions according to "[Md.114] Servo alarm" and "[Md.115] Servo alarm detail number". (For the details of "[Md.114] Servo alarm" and "[Md.115] Servo alarm detail number", refer to the manual of each driver.)
0EC1H	Incompatible device	Incompatible device is connected. [Operation status at warning occurrence] The operation continues.	Please contact with our sales representative.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0F0EH	Module extended parameter storage location warning	The written module extended parameter is not enabled. [Operation status at warning occurrence] The written module extended parameter is not enabled.	Review the setting of module extended parameter storage location.

*1 System warnings that do not depend on the axis

*2 When the torque change function is used with the individual setting for new torque value and new reverse torque value, it indicates outside forward new torque value.

*3 This speed is a value in which override value is considered when override function is used. ("[Cd.13] Positioning operation speed override" is set other than 100 [%].)

*4 The speed change by position-speed switching control, target position change function, or override function is contained.

*5 The speed change by position-speed switching control or target position change function is contained.

Warnings related to synchronous control are described below.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0E40H	Input axis phase compensation amount over	Phase compensation amount of input axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647). [Operation status at warning occurrence] The input axis operation continues. It is controlled with the minimum or maximum value.	• Set a smaller phase compensation advance time. • Decrease the input axis speed.
0E41H	Input axis rotation direction restriction amount over	Rotation direction restriction amount of input axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647). [Operation status at warning occurrence] The input axis operation continues. It is controlled with the minimum or maximum value.	• Confirm the enabled direction of the rotation direction restriction setting. (The setting may be reversed.) • Check if the input axis moves to the reverse direction of the enabled direction.
0E42H	Input axis speed display over	Monitor speed display of input axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647). [Operation status at warning occurrence] The input axis operation continues. The minimum or maximum value is displayed as the speed display of monitor data.	• Set a lower value if the number of decimal places for speed command setting is available in the input axis setting. • Switch the units from minute to second if the speed command time unit setting is available in the input axis setting. • Decrease the input axis speed.
0E43H	Synchronous encoder via servo amplifier battery warning	Voltage of the servo amplifier battery connected with a synchronous encoder decreased to 3.2 V or less. [Operation status at warning occurrence] The synchronous encoder control continues.	Replace the battery.
0E54H	Outside main shaft clutch control setting range	• The synchronous parameter "[Pr.405] Main shaft clutch control setting" was set to outside the setting range during synchronous control. • The synchronous parameter "[Pr.405] Main shaft clutch control setting" was changed from a setting other than "No Clutch" to "No Clutch" during synchronous control. • When the detailed parameter 2 "[Pr.95] External command signal selection" is set to "900: Link device", the synchronous parameter "[Pr.405] Main shaft clutch control setting" is set to "5: High-speed input request" during synchronous control. [Operation status at warning occurrence] Synchronous control continues by the previous main shaft clutch control setting.	• Set a value within the range. • Do not change the settings other than "No Clutch" to "No Clutch". • When the detailed parameter 2 "[Pr.95] External command signal selection" is set to "900: Link device", do not set the synchronous parameter "[Pr.405] Main shaft clutch control setting" to "5: High-speed input request".
0E55H	Main shaft clutch control request (ON control mode) link device incorrect configuration	During synchronous control, when the set value of the ON control mode of the synchronous parameter "[Pr.405] Main shaft clutch control setting" is "6: Link device signal", link device of link device external signal allocation parameter "Main shaft clutch control request (ON control mode)" is not set. [Operation status at warning occurrence] Synchronous control continues by the previous main shaft clutch control setting.	• When using link device as main shaft clutch control request (ON control mode), set "[Pr.990] Main shaft clutch control request (ON control mode): Link device type" within the range. • When link device is not used as main shaft clutch control request (ON control mode), do not set "6: Link device signal" in the ON control mode of "[Pr.405] Main shaft clutch control setting".
0E56H	Main shaft clutch control request (OFF control mode) link device incorrect configuration	During synchronous control, when the set value of the OFF control mode of the synchronous parameter "[Pr.405] Main shaft clutch control setting" is "6: Link device signal", link device of link device external signal allocation parameter "Main shaft clutch control request (OFF control mode)" is not set. [Operation status at warning occurrence] Synchronous control continues by the previous main shaft clutch control setting.	• When using link device as main shaft clutch control request (OFF control mode), set "[Pr.995] Main shaft clutch control request (OFF control mode): Link device type)" within the range. • When link device is not used as main shaft clutch control request (OFF control mode), do not set "6: Link device signal" in the OFF control mode of "[Pr.405] Main shaft clutch control setting".
0E57H	Main shaft clutch control operation (ON control mode) overflow	Clutch output overflowed (sign reversal) because the signal delay correction amount of the main shaft clutch was large. [Operation status at warning occurrence] Output axis operation continues with the maximum value/minimum value of the movement amount after the clutch output.	• Decrease "[Pr.994] Main shaft clutch control request (ON control mode): Acquisition delay compensation time". • Decrease the input axis speed.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0E58H	Main shaft clutch control operation (OFF control mode) overflow	Clutch output overflowed (sign reversal) because the signal delay correction amount of the main shaft clutch was large. [Operation status at warning occurrence] Output axis operation continues with the maximum value/minimum value of the movement amount after the clutch output.	• Decrease "[Pr.999] Main shaft clutch control request (OFF control mode): Acquisition delay compensation time". • Decrease the input axis speed.
0E64H	Outside auxiliary shaft clutch control setting range	• The synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" was set to outside the setting range during synchronous control. • The synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" was changed from a setting other than "No Clutch" to "No Clutch" during synchronous control. • When the detailed parameter 2 "[Pr.95] External command signal selection" is set to "900: Link device", the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" is set to "5: High-speed input request" during synchronous control. [Operation status at warning occurrence] Synchronous control continues by the previous auxiliary shaft clutch control setting.	• Set a value within the range. • Do not change the settings other than "No Clutch" to "No Clutch". • When the detailed parameter 2 "[Pr.95] External command signal selection" is set to "900: Link device", do not set the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" to "5: High-speed input request".
0E65H	Auxiliary shaft clutch control request (ON control mode) link device incorrect configuration	During synchronous control, when the set value of the ON control mode of the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" is "6: Link device signal", link device of link device external signal allocation parameter "Auxiliary shaft clutch control request (ON control mode)" is not set. [Operation status at warning occurrence] Synchronous control continues by the previous auxiliary shaft clutch control setting.	• When using link device as auxiliary shaft clutch control request (ON control mode), set "[Pr.1000] Auxiliary shaft clutch control request (ON control mode): Link device type" within the range. • When link device is not used as auxiliary shaft clutch control request (ON control mode), do not set "6: Link device signal" in the ON control mode of "[Pr.422] Auxiliary shaft clutch control setting".
0E66H	Auxiliary shaft clutch control request (OFF control mode) link device incorrect configuration	During synchronous control, when the set value of the OFF control mode of the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" is "6: Link device signal", link device of link device external signal allocation parameter "Auxiliary shaft clutch control request (OFF control mode)" is not set. [Operation status at warning occurrence] Synchronous control continues by the previous auxiliary shaft clutch control setting.	• When using link device as auxiliary shaft clutch control request (OFF control mode), set "[Pr.1005] Auxiliary shaft clutch control request (OFF control mode): Link device type" within the range. • When link device is not used as auxiliary shaft clutch control request (OFF control mode), do not set "6: Link device signal" in the OFF control mode of "[Pr.422] Auxiliary shaft clutch control setting".
0E67H	Auxiliary shaft clutch control operation (ON control mode) overflow	Clutch output overflowed (sign reversal) because the signal delay correction amount of the auxiliary shaft clutch was large. [Operation status at warning occurrence] Output axis operation continues with the maximum value/minimum value of the movement amount after the clutch output.	• Decrease "[Pr.1004] Auxiliary shaft clutch control request (ON control mode): Acquisition delay compensation time." • Decrease the input axis speed.
0E68H	Auxiliary shaft clutch control operation (OFF control mode) overflow	Clutch output overflowed (sign reversal) because the signal delay correction amount of the auxiliary shaft clutch was large. [Operation status at warning occurrence] Output axis operation continues with the maximum value/minimum value of the movement amount after the clutch output.	• Decrease "[Pr.1009] Auxiliary shaft clutch control request (OFF control mode): Acquisition delay compensation time." • Decrease the input axis speed.
0E71H	Outside speed change ratio denominator range	The synchronous parameter "[Pr.437] Speed change ratio: Denominator" is set to 0 or lower during synchronous control. [Operation status at warning occurrence] Synchronous control continues by the previous speed change ratio (Denominator).	Set a value within the range of 1 to 2147483647.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0E80H	Outside cam No. range	The synchronous parameter "[Pr.440] Cam No." is set to a value other than 0 to 256 during synchronous control. [Operation status at warning occurrence] Synchronous control continues by the previous cam No.	Set a value within the range of 0 to 256.
0E81H	Cam not registered	When the synchronous parameter "[Pr.440] Cam No." is changed, the cam data of the changed cam No. does not exist on the Cam open area during synchronous control. [Operation status at warning occurrence] Synchronous control continues by the previous cam No.	Specify the cam No. of an existing cam data.
0E82H	Cam axis length per cycle outside range	The synchronous parameter "[Pr.439] Cam axis length per cycle" is set to 0 or lower. [Operation status at warning occurrence] Synchronous control continues by the previous cam axis length per cycle.	Set a value within the range of 1 to 2147483647.
0E84H	Cam axis phase compensation amount over	Phase compensation amount of cam axis is equal or lower than the minimum value (-2147483648), or exceeding the maximum value (2147483647). [Operation status at warning occurrence] Synchronous control continues. The operation is controlled with the minimum or maximum value.	• Set a smaller cam axis phase compensation advance time. • Decrease the cam axis input value speed.
0E85H	Cam axis length per cycle change invalid	"[Pr.439] Cam axis length per cycle" was changed when the cam data whose cam data starting point is not 0 in the stroke ratio data format is used during synchronous control. [Operation status at warning occurrence] Synchronous control continues by the previous cam axis length per cycle.	Use the cam data which the cam data starting position is 0.
0E90H	Outside operation cam No. range*1	"[Cd.601] Operation cam No." is set to a value other than 1 to 256. [Operation status at warning occurrence] Cam data writing/reading is not executed.	Set a value within the range of 1 to 256.
0E91H	Read cam not registered*1	Cam data of the specified cam No. does not exist on the cam open area during the cam data reading operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Specify the cam No. of an existing cam data. • When writing the cam data from a programming tool, turn the power or the PLC READY signal [Y0] from OFF to ON and open the cam data on the cam open area.
0E92H	Outside cam data first position range*1	• "[Cd.602] Cam data first position" is outside the range of "1 to Cam resolution" for the stroke ratio data format cam. • "[Cd.602] Cam data first position" is outside the range of "0 to (Coordinate number - 1)" for the coordinate data format cam. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Set a value within the range of "1 to Cam resolution" for the stroke ratio data format cam. • Set a value within the range of "0 to (Coordinate number - 1)" for the coordinate data format cam.
0E93H	Outside number of cam data operation points range*1	• "[Cd.603] Number of cam data operation points" is outside the range of 1 to 4096 for the stroke ratio data format cam. • "[Cd.603] Number of cam data operation points" is outside the range of 1 to 2048 for the coordinate data format cam. • First position and number of operation points which exceed the cam resolution or coordinate number are set during the cam data writing operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Set a value within the range of 1 to 4096 for the stroke ratio data format cam. • Set a value within the range of 1 to 2048 for the coordinate data format cam. • Set "Cam data first position + (Number of cam data operation points - 1)" not to exceed the cam resolution. • Set "Cam data first position + Number of cam data operation points" not to exceed the number of coordinates.
0E94H	Outside cam data format range*1	"[Cd.604] Cam data format" is set to a value other than 1 or 2 during the cam data writing operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	Set 1 or 2.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0E95H	Outside cam resolution/ coordinate number range*1	• "[Cd.605] Cam resolution/coordinate number" is other than "256/512/1024/2048/4096/8192/16384/ 32768" for the stroke ratio data format cam during the cam data writing operation. • "[Cd.605] Cam resolution/coordinate number" is outside the range of "2 to 16384" for the coordinate data format cam during the cam data writing operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Set a value within the range of "256/512/1024/ 2048/4096/8192/16384/32768" for the stroke ratio data format cam. • Set a value within the range of 2 to 16384 for the coordinate data format cam.
0E96H	Outside cam data starting position range*1	"[Cd.606] Cam data starting point" is outside the range of "0 to (Cam resolution - 1)" during the cam data writing operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	Set a value within the range of "0 to (Cam resolution - 1)".
0E97H	Cam storage area capacity over*1	• The free area in the cam storage area is insufficient during the cam data writing operation. • The writable area is insufficient due to the decoupling of free area. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Decrease the number of cam data (number of cams, cam resolution, and coordinate number). • Erase the cam data and rewrite it.
0E98H	Cam open area capacity over*1	• The free area in the cam open area is insufficient during the cam data writing operation. • The writable area is insufficient due to the decoupling of free area. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Decrease the number of cam data (number of cams, cam resolution, and coordinate number). • Erase the cam data and rewrite it.
0E99H	Coordinate data error*1	• Input value of coordinate data is a negative value during the cam data writing operation. • Input value of coordinate data is not "$X_n < X_{n+1}$" during the cam data writing operation. [Operation status at warning occurrence] Cam data writing/reading is not executed.	• Set the Input value of coordinate data to 0 or more. • Set the Input value of coordinate data to "$X_n < X_{n+1}$".
0E9AH	Cam data reading operation inhibit*1	Cam data reading operation is executed with the cam data read password set. [Operation status at warning occurrence] Cam data writing/reading is not executed.	Delete the cam data read password with a programming tool.
0E9BH	Cam data writing operation inhibit*1	Cam data writing operation is executed with the cam data write password set. [Operation status at warning occurrence] Cam data writing/reading is not executed.	Delete the cam data write password with a programming tool.
0EA0H	Outside cam auto-generation cam No. range*1	"[Cd.609] Cam auto-generation cam No." is outside the range of 1 to 256. [Operation status at warning occurrence] Cam auto-generation is not executed.	Set a value within the range of 1 to 256.
0EA1H	Outside cam auto-generation type range*1	"[Cd.610] Cam auto-generation type" is set to a value other than 1. [Operation status at warning occurrence] Cam auto-generation is not executed.	Set 1.
0EA2H	Cam auto-generation cam storage area capacity over*1	• The free area in the cam storage area is insufficient. • The writable area is insufficient due to the decoupling of free area. [Operation status at warning occurrence] Cam auto-generation is not executed.	• Decrease the number of cam data (number of cams, cam resolution, and coordinate number). • Erase the cam data and rewrite it.
0EA3H	Cam auto-generation cam open area capacity over*1	• The free area in the cam open area is insufficient. • The writable area is insufficient due to the decoupling of free area. [Operation status at warning occurrence] Cam auto-generation is not executed.	• Decrease the number of cam data (number of cams, cam resolution, and coordinate number). • Erase the cam data and rewrite it.
0EA4H	Outside cam auto-generation value range*1	"[Cd.611] Cam auto-generation data" is outside the setting range. [Operation status at warning occurrence] Cam auto-generation is not executed.	Set a value within the setting range for the cam auto-generation.

Warning code (Hexadecimal)	Warning name	Error details and causes	Remedy
0EA5H	Cam auto-generation calculation disable*1	"[Cd.611] Cam auto-generation data" is set to a value invalid for cam pattern generation. (Such as when the sheet synchronization width is larger than the sheet length in the cam for a rotary cutter) [Operation status at warning occurrence] Cam auto-generation is not executed.	Review the setting value of the cam auto-generation data.
0EA6H	Cam auto-generation data write inhibit*1	Cam auto-generation is executed with the cam data write password set. [Operation status at warning occurrence] Cam auto-generation is not executed.	Delete the cam data write password with a programming tool.
0EB0H	Outside cam position calculation cam No. range*1	"[Cd.613] Cam position calculation: Cam No." is outside the range of 0 to 256. [Operation status at warning occurrence] Cam position calculation is not executed.	Set a value within the range of 0 to 256.
0EB1H	Cam position calculation cam not registered*1	Cam data of the specified cam No. does not exist on the cam open area during the cam position calculation. [Operation status at warning occurrence] Cam position calculation is not executed.	• Specify the cam No. of an existing cam data. • When cam data is written from a programming tool, turn PLC READY [Y0] from OFF to ON and share the cam data on the cam open area.
0EB2H	Outside cam position calculation cam axis length per cycle range*1	"[Cd.615] Cam position calculation: Cam axis length per cycle" is set to 0 or lower. [Operation status at warning occurrence] Cam position calculation is not executed.	Set a value within the range of 1 to 2147483647.
0EB3H	Outside cam position calculation cam axis position value per cycle range*1	"[Cd.617] Cam position calculation: Cam axis position value per cycle" is outside the range of 0 to "Cam axis length per cycle". [Operation status at warning occurrence] Cam position calculation is not executed.	Set a value within the range of 0 to "Cam axis length per cycle".
0EB4H	Cam position calculation cam axis 1 cycle position value calculation disable*1	Corresponding cam axis position value per cycle could not be calculated during cam axis position value per cycle calculation. (Occurs in reciprocated cam pattern) [Operation status at warning occurrence] Cam position calculation is not executed.	Set "[Cd.614] Cam position calculation: Stroke amount", "[Cd.616] Cam position calculation: Cam reference position", and "[Cd.618] Cam position calculation: Cam axis command position value" within the range of reciprocated cam pattern stroke.

*1 System warnings that do not depend on the axis

Servo amplifier detection warning

For details of servo amplifier detection warnings, refer to the manual of each servo amplifier.

14.5 List of Error Codes

Motion module detection error

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
0000H	Normal	—	—
1080H	Flash ROM write number error[*1]	Data is written to the flash ROM continuously 25 times or more from the program. Or the cumulative number of write accesses to flash ROM exceeds 100,000. [Operation status at error occurrence] The system does not write data to the flash ROM.	Review the program so that data is not written continuously to the flash ROM. (Using "[Md.19]", the number of flash ROM write times can be monitored.) (If this error has occurred in a proper using method, writing is enabled by resetting the error, switching power OFF, then ON, or resetting the CPU module.) If the same error occurs repeatedly, please consult your local Mitsubishi representative.
1800H	SDO communication error	• An error occurred in the SDO communication. • Issued a large quantity of SLMP requests at a time. • Issued an SLMP request for a virtual servo amplifier axis. [Operation status at error occurrence] Error of the function block turns ON, and the error code of SDO is output to SDOErrorID.	• Remove the error cause according to the SDO error code. • Reduce the number of SLMPs to be issued, or modify the program to issue the next request after the response is received. • Modify the program not to issue the SLMP request for the virtual servo amplifier axis.
1A00H	PLC READY OFF during operation	PLC READY [Y0] was turned OFF during operation. [Operation status at error occurrence] The system stops with the setting (deceleration stop/ rapid stop) of the detailed parameter 2 "[Pr.38] Stop group 2 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Review the program which turns ON/OFF PLC READY [Y0].
1A02H	Servo READY signal OFF during operation	The servo READY signal is turned OFF during operation. [Operation status at error occurrence] During operation: The system stops immediately.	Check the servo amplifier power, wiring with the servo amplifier, and connection of connectors.
1A03H	Test mode faults during operation[*1]	The personal computer cannot communicate with the CPU module. [Operation status at error occurrence] The system stops with the setting (deceleration stop/ rapid stop) of the detailed parameter 2 "[Pr.38] Stop group 2 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Check that there is no error on the personal computer side I/F to which a cable is connected.
1A04H	Hardware stroke limit (+)	Start is requested when the hardware stroke limit (upper limit signal (FLS)) is turned OFF. [Operation status at error occurrence] The system does not start.	• Check the wiring of upper limit signal FLS. • Check if the specification of the limit switch and the setting of "[Pr.22] Input signal logic selection" match. • For systems that do not require the installation of a hardware stroke limit (limit switch), wiring should be done so that the upper limit signal (FLS) input of the Motion module is always ON.
1A05H	Hardware stroke limit (+)	The hardware stroke limit (upper limit signal (FLS)) is turned OFF during operation. [Operation status at error occurrence] The system stops with the setting (deceleration stop/ rapid stop) of the detailed parameter 2 "[Pr.37] Stop group 1 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	After making an axis error reset, perform manual control operation to move the axis to the other position in order that the upper limit signal (FLS) will not turn OFF.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A06H	Hardware stroke limit (-)	Start is requested when the hardware stroke limit (lower limit signal (RLS)) is turned OFF. [Operation status at error occurrence] At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.37] Stop group 1 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	• Check the wiring of lower limit signal RLS. • Check if the specification of the limit switch and the setting of "[Pr.22] Input signal logic selection" match. • For systems that do not require the installation of a hardware stroke limit (limit switch), wiring should be done so that the lower limit signal (RLS) input of the Motion module is always ON.
1A07H	Hardware stroke limit (-)	The hardware stroke limit (lower limit signal (RLS)) is turned OFF during operation. [Operation status at error occurrence] The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.37] Stop group 1 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	After making an axis error reset, perform manual control operation to move the axis to the other position in order that the lower limit signal (RLS) will not turn OFF.
1A08H	Stop signal ON at start	Start is requested when a stop signal is turned ON. [Operation status at error occurrence] The system does not start.	After clearing the stop command status, then review the timing of start.
1A09H	Stop signal ON at start	Start is requested when an external stop is turned ON. [Operation status at error occurrence] The system does not start.	After clearing the external stop status, then review the timing of start.
1A0AH	READY OFF → ON during BUSY[*1]	PLC READY [Y0] was turned OFF and ON with the BUSY signal ON. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Turn ON PLC READY [Y0] with the BUSY signals of all axes OFF.
1A20H	Start not possible	Start is requested when start is not possible in the axis operation state. [Operation status at error occurrence] The system does not start positioning.	Do not issue a start request when "[Md.26] Axis operation status" is other than "0: Standby", "1: Stopped", or "-2: Step standby".
1A21H	Start not possible	Start is requested when "[Md.26] Axis operation status" is "-1: Error". [Operation status at error occurrence] The system does not start positioning.	Do not issue a start request when "[Md.26] Axis operation status" is other than "0: Standby", "1: Stopped", or "-2: Step standby".
1A22H	Start not possible	Start is requested when "[Md.26] Axis operation status" is "20: Servo amplifier has not been connected/servo amplifier power OFF". [Operation status at error occurrence] The system does not start positioning.	Do not issue a start request when "[Md.26] Axis operation status" is other than "0: Standby", "1: Stopped", or "-2: Step standby".
1A23H	Start not possible	Start is requested when "[Md.26] Axis operation status" is "21: Servo OFF". [Operation status at error occurrence] The system does not start positioning.	Do not issue a start request when "[Md.26] Axis operation status" is other than "0: Standby", "1: Stopped", or "-2: Step standby".
1A24H	Start not possible	Start is requested when communication with servo amplifier is error. [Operation status at error occurrence] The system does not start positioning.	Check the wiring with the servo amplifier and connection of connectors.
1A25H	Start not possible	Start is requested when "[Md.26] Axis operation status" in the axis to be interpolated is "-1: Error", "20: Servo amplifier has not been connected/servo amplifier power OFF", and "21: Servo OFF". [Operation status at error occurrence] The system does not start positioning.	Do not issue a start request when "[Md.26] Axis operation status" of the axis to be interpolated is other than "0: Standby", "1: Stopped", or "-2: Step standby".
1A26H	Start not possible	Start is requested when "[Cd.100] Servo OFF command" is turned ON. [Operation status at error occurrence] The system does not start positioning.	Set "0: Servo ON" in "[Cd.100] Servo OFF command".
1A27H	Start not possible	Start is requested when the servo alarm occurs. [Operation status at error occurrence] The system does not start positioning.	Reset the error after removing the servo alarm referring to the manual of the servo amplifier.
1A29H	Start not possible	Start is requested when the servo READY signal is turned OFF. [Operation status at error occurrence] The system does not start positioning.	Do not request the start when the servo READY signal is turned OFF.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A30H	Hold error	In the CPU module parameter "Output at error stop", the setting for the Simple Motion module is "Hold". [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Clear the setting of the CPU module parameter "Output at error stop".
1A31H	Flash ROM write error*1	• Data is not written to the flash ROM. • Backup data saving is failure due to a drive error. • The backup data is accessed externally. [Operation status at error occurrence] At start: The system does not operate.	Initialize the Motion module or write the parameter again. If the same error reappears, the flash ROM may have reached the end of its writable life.
1A32H	Flash ROM sum check error*1	• While data is written to the flash ROM, the power is turned OFF. • The backup data is corrupted. [Operation status at error occurrence] At start: The system does not operate.	Reset the parameter and write it to a Flash ROM again.
1A33H	Flash ROM sum check error	• While data is written to the flash ROM in the synchronous control area, the power is turned OFF. • The backup data is corrupted. [Operation status at error occurrence] At start: The system does not operate.	Reset the parameter and write it to a Flash ROM again.
1A34H	Synchronous restoration data sum check error	Synchronous restoration data reading is failure. [Operation status at error occurrence] The synchronous control initial value cannot be restored.	The internal memory (nonvolatile) is expected to be at the end of its writable life. Exchange the module.
1A3FH	Operation cycle time over error*1	The calculation process time of the positioning etc. exceeds the operation cycle. [Operation status at error occurrence] The operation continues.	Review the content of the positioning or change the operation cycle setting longer than the current setting.
1A45H	Home position return request ON	The home position return request flag ([Md.31] Status: b3) is turned ON when a fast-home position return is started (positioning start No.9002). [Operation status at error occurrence] The fast-home position return does not start.	Execute the machine home position return (positioning start No.9001).
1A46H	Home position return restart not possible	The restart command is turned ON after the machine home position return is stopped using a stop signal. [Operation status at error occurrence] The restart is not carried out.	Start the machine home position return (positioning start No.9001) again.
1A74H	ZCT read error	The data is not loaded from the servo amplifier properly upon the home position return. [Operation status at error occurrence] The home position return does not complete.	• Execute home position return again.
1A75H	ABS reference point read error	• The data is not loaded from the servo amplifier properly upon the home position return. • The in-position signal is not turned ON within 1.5 seconds after moving an axis to the home position. [Operation status at error occurrence] The home position return does not complete.	• Execute home position return again. • Adjust the servo gain and in-position range, and execute home position return again.
1A79H	Home position return method invalid	Home position return is started with the home position return method which is not supported by the connected device. [Operation status at error occurrence] The home position return does not start.	Correct to the available home position return method.
1A7EH	Encoder initial communication error at turning on servo amplifier power supply	A communication error occurred between the servo amplifier and encoder when the servo amplifier was powered ON. [Operation status at error occurrence] Current value restoration is not performed.	Check the motors and encoder cables.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A80H	Outside JOG speed range	"[Cd.17] JOG speed" is out of the setting range at JOG start. [Operation status at error occurrence] The JOG operation is not carried out when the JOG speed is outside the setting range at the time of JOG start.	Set "[Cd.17] JOG speed" within the setting range.
1A81H	Inching movement amount error	"[Cd.16] Inching movement amount" does not satisfy the setting condition*2. (The setting value is large.) [Operation status at error occurrence] Inching operation is not performed.	Reduce "[Cd.16] Inching movement amount" to satisfy the setting condition.
1A82H	Overcarrying movement amount overflow in manual pulse generator	The movement amount has continuously exceeded the detailed parameter 2 "[Pr.123] Manual pulse generator speed limit value" and exceeded the maximum value (2147483647) or minimum value (-2147483648) of "[Md.62] Amount of the manual pulser driving carrying over movement". [Operation status at error occurrence] The system decelerates to a stop.	• Adjust input pulses so that the movement amount does not continuously exceed the detailed parameter 2 "[Pr.123] Manual pulse generator speed limit value". • Change the detailed parameter 2 "[Pr.122] Manual pulse generator speed limit mode" to a value other than "2: Output over value of speed limit later".
1A90H	Error before simultaneous start	<When multiple axes are started and controlled simultaneously> • The partner axis for simultaneous start is BUSY. • The partner axis for simultaneous start is not present. [Operation status at error occurrence] At start: The system does not operate. During operation: The operation is terminated.	Normalize the simultaneous start axis.
1A91H	Error before simultaneous start	<When multiple axes are started and controlled simultaneously> • The same axis No. is set to multiple simultaneous start axes. • The own axis No. is set to a simultaneous start axis. • "[Da.23] Number of simultaneous starting axes" was set to a value other than 2 to 4. • The "Simultaneous starting axis start data No." of the start axis is 0 or is outside the setting range. • The "Simultaneous starting axis start data No." of the start axis and the partner axis for simultaneous start is 0 or is outside the setting range. [Operation status at error occurrence] At start: The system does not operate. During operation: The operation is terminated.	Normalize the simultaneous starting own axis start data No. and the simultaneous starting axis start data No. (1 to 3).
1A93H	Software stroke limit +	The command position exceeds the upper limit of the software stroke limit. [Operation status at error occurrence] At operation start: The system does not operate. In the analysis of new current value: Current value is not changed. During operation: • The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range. • In the analysis of new current value: Current value is not changed. • During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of "[Pr.39] Stop group 3 rapid stop selection" in the detailed parameter 2 when the command position value or machine feed value during manual control is outside the software stroke limit range. At speed control mode/torque control mode/continuous operation to torque control mode: The system switches to the position control mode and stops immediately when the command position value is outside the software stroke limit range.	At operation start: Set the command position value within the software stroke limit by the manual control operation. At speed control mode/torque control mode/ continuous operation to torque control mode: Review the operation so that the command position value does not exceed the software stroke limit.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A94H	Software stroke limit +	"[Cd.9] New position value" exceeds the upper limit of the software stroke limit. [Operation status at error occurrence] In the analysis of new current value: Current value is not changed.	Set "[Cd.9] New position value" within the software stroke limit.
1A95H	Software stroke limit -	The command position exceeds the lower limit of the software stroke limit. [Operation status at error occurrence] At operation start: The system does not operate. In the analysis of new current value: Current value is not changed. During operation: • The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range. • During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of "[Pr.39] Stop group 3 rapid stop selection" in the detailed parameter 2 when the command position value or machine feed value during manual control is outside the software stroke limit range. At speed control mode/torque control mode/continuous operation to torque control mode: The system switches to the position control mode and stops immediately when the command position value is outside the software stroke limit range.	At operation start: Set the command position value within the software stroke limit by the manual control operation. At speed control mode/torque control mode/ continuous operation to torque control mode: Review the operation so that the command position value does not exceed the software stroke limit.
1A96H	Software stroke limit -	"[Cd.9] New position value" exceeds the lower limit of the software stroke limit. [Operation status at error occurrence] In the analysis of new current value: Current value is not changed.	Set "[Cd.9] New position value" within the software stroke limit.
1A97H	Outside new current value range	The new current address is outside the ranges of 0 to 359.99999, where the control unit is set to "degree". [Operation status at error occurrence] Current value is not changed.	Set "[Cd.9] New position value" within the setting range.
1A98H	Interpolation while interpolation axis BUSY	Interpolation is started during the operation of the interpolation axis. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection".	Correct "[Da.2] Control method".
1A99H	Unit group unmatched	The unit is different between the reference axis and interpolation axis for "Composite speed" setting in the parameter "[Pr.20] Interpolation speed designation method". [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the positioning data or change the parameter "[Pr.1] Unit setting" of the axis to be interpolated.
1A9AH	Interpolation mode error	For starting, a composite speed is designated in the reference axis parameter "[Pr.20] Interpolation speed designation method" using the speed interpolation control or 4-axis linear interpolation control. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Set "[Pr.20] Interpolation speed designation method" correctly.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1A9BH	Interpolation mode error	For starting, a reference axis speed is designated in the reference axis parameter "[Pr.20] Interpolation speed designation method" using the circular interpolation control or helical interpolation control. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Set "[Pr.20] Interpolation speed designation method" correctly.
1A9CH	Control method setting error	• The setting value of "[Da.2] Control method" is outside the setting range. • The number of control axes or the axis to be interpolated differs from the previous data when continuous positioning control or continuous path control is to be exercised for continuously. • The NOP instruction was set to the control method of positioning data No.600. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct "[Da.2] Control method", axis to be interpolated, or parameter.
1A9EH	Simultaneous start not possible	Among the axes to be started simultaneously, there is an axis on which an error other than this error occurs. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	In the error history, check the axis where the error other than this error occurred, and remove the error factor. Correct the block start data and positioning data.
1A9FH	Circular interpolation not possible	Circular interpolation or helical interpolation is carried out on an axis in the unit of degree. [Operation status at error occurrence] The operation is terminated.	Correct "[Da.2] Control method".
1AA0H	M code ON signal start	The positioning start is carried out when an M code ON signal ([Md.31] Status: b12) is turned ON. [Operation status at error occurrence] The system does not operate at start.	After turning OFF the M code ON signal ([Md.31] Status: b12), start the system.
1AA1H	PLC READY OFF start	The positioning start is carried out when PLC READY [Y0] is turned OFF. [Operation status at error occurrence] The system does not operate at start.	Check the program which turns ON/OFF PLC READY [Y0], and turn ON PLC READY [Y0]. Then start the system.
1AA2H	READY OFF start	The positioning start is carried out when the READY signal [X0] is turned OFF. [Operation status at error occurrence] The system does not operate at start.	Check the READY ON signal [X0], and then start the system.
1AA3H	Outside start No. range	• At the start of positioning, the setting value of "[Cd.3] Positioning start No." of the axis control data is other than 1 to 600, 7000 to 7004, or 9001 to 9004. • At the start of pre-reading, the setting value of "[Cd.3] Positioning start No." is other than 1 to 600. [Operation status at error occurrence] The system does not operate at start.	Normalize "[Cd.3] Positioning start No.".

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1AA4H	Illegal setting of ABS direction in unit of degree	The setting value of "[Cd.40] ABS direction in degrees" is outside the setting range when the software stroke limit is invalid. [Operation status at error occurrence] At start: The system does not operate. During operation: The system decelerates to a stop. (Note that, in the continuous positioning control and continuous path control, the system continues operating with the setting set at the time of start even if the setting is changed during the operation.)	Set "[Cd.40] ABS direction in degrees" within the setting range.
1AA5H	Illegal setting of ABS direction in unit of degree	The setting value of "[Cd.40] ABS direction in degrees" is other than 0 when the software stroke limit is valid. [Operation status at error occurrence] At start: The system does not operate. During operation: The system decelerates to a stop. (Note that, in the continuous positioning control and continuous path control, the system continues operating with the setting set at the time of start even if the setting is changed during the operation.)	• Set "0" when the software stroke limits are valid. • Invalidate the software stroke limit. ("It is disabled when [Pr.12] Software stroke limit upper limit value" = "[Pr.13] Software stroke limit lower limit value".)
1AA6H	Start at home position return incomplete	• When executing operation setting at home position return incomplete, positioning was started at home position return request ON. • When executing operation setting at home position return incomplete, control mode switching was executed at home position return request ON. [Operation status at error occurrence] At start: The system does not operate. At control mode switching: The mode is not changed.	• Start after the home position return is executed. • Switch the control mode after the home position return is executed. • For systems which can operate the positioning control and speed-torque control though the home position return request is ON, set "[Pr.55] Operation setting for incompletion of home position return" to "1".
1AE4H	Outside control mode auto-shift switching parameter range	When "[Cd.153] Control mode auto-shift selection" is set, "[Cd.154] Control mode auto-shift parameter" is outside the range. [Operation status at error occurrence] During positioning control: The system stops with the setting of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". During speed control mode: The mode is switched to position control mode, and the system stops immediately.	Set "[Cd.154] Control mode auto-shift parameter" within the setting range and switch to the continuous operation to torque control mode.
1AE7H	Driver control not supported	The driver performed switching to an unsupported driver control mode. [Operation status at error occurrence] During positioning control: The system stops with the setting of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". During speed control mode: The mode is switched to position control mode, and the system stops immediately.	Connect a driver which supports the switching driver control mode.
1AF0H	Illegal condition data No.	The condition data No. is outside the setting range when a block using the condition data is started by a special starting (conditional start, wait start, simultaneous start, FOR (condition)). (1 ≤ Condition data No. ≤ 10) [Operation status at error occurrence] The operation is terminated.	Review the condition data No.
1AF1H	Error before simultaneous start	<When blocks are started simultaneously> The partner axis for simultaneous start is BUSY. [Operation status at error occurrence] At start: The system does not operate. During operation: The operation is terminated.	Normalize the simultaneous start axis.
1AF2H	Special start instruction error	No applicable special start instruction is present. [Operation status at error occurrence] The operation is terminated.	Correct the instruction code of the special start.
1B00H	Condition data error	The setting values of "[Da.15] Condition target" are not set or outside the setting range. [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1B01H	Condition data error	The setting values of "[Da.16] Condition operator" are not set or outside the setting range. [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1B02H	Condition data error	"[Da.16] Condition operator" is a bit operator, and "[Da.18] Parameter 1" is 32 or more. [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1B03H	Condition data error	"[Da.16] Condition operator" that cannot be used for the set "[Da.15] Condition target" is set. [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1B04H	Condition data error	• "[Da.16] Condition operator" is 05H (P1 ≤ ** ≤ P2) and "[Da.18] Parameter 1" > "[Da.19] Parameter 2". • "[Da.16] Condition operator" is 06H (** ≤ P1 P2 ≤ **) and "[Da.18] Parameter 1" > "[Da.19] Parameter 2". [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1B05H	Condition data error	The setting value of "[Da.17] Address" is outside the setting range when "[Da.15] Condition target" is set to "Buffer memory (1-word/2-word)". (1-word: 0 to 16777215, 2-word: 0 to 16777214) [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1B0CH	Condition data error	The same axis No. is set in "[Da.24] Simultaneous starting axis No.1", [Da.25] Simultaneous starting axis No.2" and [Da.26] Simultaneous starting axis No.3". [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1B0DH	Condition data error	The axis No. is set in "[Da.24] Simultaneous starting axis No.1", [Da.25] Simultaneous starting axis No.2" and [Da.26] Simultaneous starting axis No.3", that is larger than the common parameter "[Pr.152] Maximum number of control axes". [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1B0EH	Condition data error	The self axis is set in "[Da.24] Simultaneous starting axis No.1", [Da.25] Simultaneous starting axis No.2" and [Da.26] Simultaneous starting axis No.3". [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1B0FH	Condition data error	"[Da.23] Number of simultaneous starting axes" is outside the setting range, or "[Da.23] Number of simultaneous starting axes" is larger than "[Pr.152] Maximum number of control axes". [Operation status at error occurrence] The operation is terminated.	Normalize the block start data.
1B10H	Illegal data No.	The designation of a JUMP destination is executed currently. [Operation status at error occurrence] The positioning data is not executed.	Normalize the positioning data.
1B11H	Illegal data No.	• The positioning data No. tried to be executed is outside the ranges of 1 to 600, 7000 to 7004, and 9001 to 9004. • The designation of a JUMP destination is outside the ranges of 1 to 600. [Operation status at error occurrence] The positioning data is not executed.	Normalize the positioning data.
1B12H	No command speed	At the start of positioning, a current speed (-1) is set for the command speed of the positioning data to be initially executed. [Operation status at error occurrence] The operation does not start at positioning start.	Normalize the positioning data.
1B13H	No command speed	The current speed is set by speed control. [Operation status at error occurrence] The operation does not start at positioning start.	Normalize the positioning data.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1B14H	No command speed	The current speed is set for speed-position or position-speed switching control. [Operation status at error occurrence] The operation does not start at positioning start.	Normalize the positioning data.
1B15H	Outside linear movement amount range	When "[Pr.20] Interpolation speed designation method" performs a linear interpolation in setting a "composite speed", the axis movement amount for each positioning data exceeds 1073741824(2^{30}). [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Review the positioning address.
1B16H	Outside linear movement amount range	The positioning address is -360.00000 or less or 360.00000 or more using INC instruction, where the control unit is set to "degree" and "[Pr.12] Software stroke limit upper limit value" is not equal to "[Pr.13] Software stroke limit lower limit value". [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Review the positioning address.
1B17H	Large arc error deviation	When circular interpolation or helical interpolation with center point designation is performed, the difference between the radius from the start point to the center and radius from the end point to the center exceeds the parameter "[Pr.41] Allowable circular interpolation error width". [Operation status at error occurrence] At start: The circular interpolation control by center point designation is not executed. During operation: The system stops immediately.	• Correct the center point address (arc address) • Correct the end address (positioning address) • Correct the value of "[Pr.41] Allowable circular interpolation error width".
1B18H	Software stroke limit +	The setting value of "[Da.6] Positioning address/movement amount" exceeds "[Pr.12] Software stroke limit upper limit value". [Operation status at error occurrence] At operation start: The system does not operate. In the analysis of new current value: Current value is not changed. During operation: • The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range. • During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of "[Pr.39] Stop group 3 rapid stop selection" in the detailed parameter 2 when the command position value or machine feed value during manual control is outside the software stroke limit range. At speed control mode/torque control mode/continuous operation to torque control mode: The system switches to the position control mode and stops immediately when the command position value is outside the software stroke limit range.	At operation start, during operation: Correct "[Da.6] Positioning address/movement amount". At operation start: Set the command position value within the software stroke limit by the manual control operation.
1B19H	Software stroke limit +	In the circular interpolation or helical interpolation with sub points designated, the sub point exceeds "[Pr.12] Software stroke limit upper limit value". [Operation status at error occurrence] At operation start: The system does not operate.	At operation start, during operation: Correct "[Da.6] Positioning address/movement amount" and "[Da.7] Arc address". At operation start: Set the command position value within the software stroke limit by the manual control operation.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1B1AH	Software stroke limit -	The setting value of "[Da.6] Positioning address/ movement amount" exceeds "[Pr.13] Software stroke limit lower limit value". [Operation status at error occurrence] At operation start: The system does not operate. In the analysis of new current value: Current value is not changed. During operation: • The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range. • During speed control (including speed control in speed-position switching control or position-speed switching control), the system stops at the setting (normal deceleration stop only) of "[Pr.39] Stop group 3 rapid stop selection" in the detailed parameter 2 when the command position value or machine feed value during manual control is outside the software stroke limit range. At speed control mode/torque control mode/continuous operation to torque control mode: The system switches to the position control mode and stops immediately when the command position value is outside the software stroke limit range.	At operation start, during operation: Correct "[Da.6] Positioning address/movement amount". At operation start: Set the command position value within the software stroke limit by the manual control operation.
1B1BH	Software stroke limit -	In the circular interpolation or helical interpolation with sub points designated, the sub point exceeds "[Pr.13] Software stroke limit lower limit value". [Operation status at error occurrence] At operation start: The system does not operate.	At operation start, during operation: Correct "[Da.6] Positioning address/movement amount" and "[Da.7] Arc address". At operation start: Set the command position value within the software stroke limit by the manual control operation.
1B1CH	New current value not possible	"[Da.1] Operation pattern" is set to "continuous path control" for the positioning data whose "[Da.2] Control method" is current value changing. [Operation status at error occurrence] Current value is not changed.	• Do not designate a current value changing using the positioning data following the continuous path control. • Do not designate positioning data following continuous path control using a "current value changing".
1B1DH	New current value not possible	"[Da.2] Control method" is set to "current value changing" for the data following the positioning data whose "[Da.1] Operation pattern" is "continuous path control". [Operation status at error occurrence] Current value is not changed.	• Do not designate a current value changing using the positioning data following the continuous path control. • Do not designate positioning data following continuous path control using a "current value changing".
1B1EH	Continuous path control not possible	"[Da.1] Operation pattern" is "Continuous positioning control" or "Continuous path control" when "[Da.2] Control method" is "Speed control" or "Position-speed switching control". [Operation status at error occurrence] The system does not operate at start.	Correct "[Da.1] Operation pattern" or "[Da.2] Control method".
1B1FH	Continuous path control not possible	"[Da.1] Operation pattern" is "Continuous path control" when "[Da.2] Control method" is "Fixed-feed" or "Speed-position switching control". [Operation status at error occurrence] The system does not operate at start.	Correct "[Da.1] Operation pattern" or "[Da.2] Control method".
1B20H	Continuous path control not possible	"[Da.1] Operation pattern" is "Continuous path control" when "[Da.2] Control method" is "Speed control", "Fixed-feed", "Position-speed switching control" or "Speed-position switching control". [Operation status at error occurrence] The system does not operate at start.	Correct "[Da.1] Operation pattern" or "[Da.2] Control method".

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1B21H	Outside operation pattern range	The setting value of "[Da.1] Operation pattern" is 2. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct "[Da.1] Operation pattern".
1B22H	Illegal interpolation description command	In the interpolation control, the axis to be interpolated is set as follows: • The self axis • Not present axis • The axis No. exceeds the maximum number of control axes. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	• Correct "[Da.2] Control method". • Correct the axis to be interpolated. • Correct the maximum number of control axes.
1B23H	Command speed setting error	The command speed is outside the setting range. Linear interpolation, circular interpolation, helical interpolation: Reference axis is outside the setting range. Speed control interpolation: Either of reference axis and interpolation axis is outside the speed range. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the command speed.
1B24H	Control method setting error	The setting value of "[Da.2] Control method" is outside the setting range. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct "[Da.2] Control method", axis to be interpolated, or parameter.
1B25H	Control method setting error	The number of control axes or the axis to be interpolated differs from the previous data when continuous positioning control or continuous path control is to be exercised for continuously. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct "[Da.2] Control method", axis to be interpolated, or parameter.
1B26H	Control method setting error	The NOP instruction was set to the control method of positioning data No.600. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct "[Da.2] Control method", axis to be interpolated, or parameter.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1B27H	Sub point setting error	Start point is equal to sub point in the circular interpolation or helical interpolation with sub points designated. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the sub address (arc address).
1B28H	Sub point setting error	End point is equal to sub point in the circular interpolation or helical interpolation with sub points designated. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the sub address (arc address).
1B29H	Sub point setting error	Start point, end point, and sub point are in line with each other in the circular interpolation or helical interpolation with sub points designated. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the sub address (arc address).
1B2AH	Sub point setting error	Sub point address is outside the range of -2147483648 to 2147483647 in the circular interpolation or helical interpolation with sub points designated. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the sub address (arc address).
1B2BH	End point setting error	Start point is equal to end point in the circular interpolation or helical interpolation with sub points designated. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the end address (positioning address)
1B2CH	End point setting error	End point address is outside the range of -2147483648 to 2147483647 in the circular interpolation or helical interpolation with auxiliary point designation and center point designation. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the end address (positioning address)
1B2DH	Center point setting error	Start point is equal to center point in the circular interpolation or helical interpolation with center point designation. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the center point address (arc address)
1B2EH	Center point setting error	End point is equal to center point in the circular interpolation or helical interpolation with center point designation. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the center point address (arc address)
1B2FH	Center point setting error	Center point address is outside the range of -2147483648 to 2147483647 in the circular interpolation or helical interpolation with center point designation. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the center point address (arc address)
1B30H	Outside address range	In the speed-position switching control and the position-speed switching control, the setting value of a positioning address is negative. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the positioning address.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1B31H	Outside address range	In ABS1, ABS2, ABS3 and ABS4, the setting value of a positioning address is outside the range of 0 to 359.99999degrees. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the positioning address.
1B32H	Outside radius range	The arc radius exceeds 536870912. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the positioning data.
1B33H	Control method LOOP setting error	The number of repetitions is set to "0" for "[Da.2] Control method" "LOOP". [Operation status at error occurrence] The operation is terminated.	Set 1 to 65535 in the repeating time of LOOP.
1B34H	M code ON timing error	The setting value of the positioning data "[Da.27] M code ON signal output timing" is outside the setting range. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection".	Correct the setting range of "[Da.27] M code ON signal output timing" within "0 to 2".
1B35H	Interpolation speed designation method error	The setting value of the positioning data "[Da.29] Interpolation speed designation method" is outside the setting range. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection".	Correct the setting range of "[Da.29] Interpolation speed designation method" within "0 to 2".
1B36H	Outside number of pitch	The number of pitches set in "[Da.10] M code/ Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear axis is outside the setting range when the helical interpolation control has been performed. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection".	Correct the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear axis within "0 to 999".
1B37H	Sub point setting error	The sub point address is outside the range of -2147483648 to 2147483647 when the circular interpolation control or helical interpolation control has been performed with the sub point being specified. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Correct the sub address (arc address).
1B60H	Outside unit setting range	The setting value of the basic parameter 1 "[Pr.1] Unit setting" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1B61H	Outside pulse number per rotation range	The setting value of the basic parameter 1 "[Pr.2] Number of pulses per rotation (AP)" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1B62H	Outside movement amount per rotation range	The setting value of the basic parameter 1 "[Pr.3] Movement amount per rotation (AL)" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1B63H	Outside unit magnification range	• The setting value of the basic parameter 1 "[Pr.4] Unit magnification (AM)" is outside the setting range. • "[Pr.3] Movement amount per rotation (AL)" × "[Pr.4] Unit magnification (AM)" exceeds 2147483648. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• Set AL and AM values which make "[Pr.3] Movement amount per rotation (AL)" × "[Pr.4] Unit magnification (AM)" within 2147483647, and then turn the PLC READY [Y0] from OFF to ON. • Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1B66H	Outside bias speed range	The setting value of the basic parameter 1 "[Pr.7] Bias speed at start" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1B67H	Outside bias speed range	The bias speed exceeds "[Pr.8] Speed limit value". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Set the bias speed equal to or less than "[Pr.8] Speed limit value" and turn PLC READY [Y0] from OFF to ON.
1B69H	Outside speed limit value range	The setting value of the basic parameter 2 "[Pr.8] Speed limit value" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not operate.	When PLC READY [Y0] is not turned ON even if the setting is within the setting range, turn PLC READY [Y0] from OFF to ON.
1B6AH	Outside speed limit value range	The setting value of the basic parameter 2 "[Pr.8] Speed limit value" exceeds the command speed limit value. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not operate.	Make sure that "[Pr.8] Speed limit value" will not exceed the command speed limit value, and then turn PLC READY [Y0] from OFF to ON.
1B6BH	Outside acceleration time 0 range	The setting value of the basic parameter 2 "[Pr.9] Acceleration time 0" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not operate.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1B6CH	Outside deceleration time 0 range	The setting value of the basic parameter 2 "[Pr.10] Deceleration time 0" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not operate.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1B94H	Station address duplication error	There is an axis where "[Pr.141] IP address" and "[Pr.142] Multidrop number" overlap. [Operation status at error occurrence] Connection with the driver is not possible.	Set each axis so that "[Pr.141] IP address" and "[Pr.142] Multidrop number" do not overlap.
1B95H	Connected device setting invalid	• For a real servo amplifier axis that does not use the virtual servo amplifier function, the specified "[Pr.141] IP address" is not set in the Network Configuration Settings or connected device does not exist. • The real servo amplifier axis specified for "[Pr.141] IP address" and "[Pr.142] Multidrop number" is not set as the Motion control station in the network configuration settings. • A station specified with "[Pr.141] IP address" does not support CANopen communication. • The electronic gear is 0. • A moderate error has occurred in the Motion module. [Operation status at error occurrence] Connection with the driver is not possible.	• If the virtual servo amplifier function is not used, specify the IP address set in the Network Configuration Settings for "(Pr.141) IP address" and "(Pr.142) Multidrop number". • Check that the real servo amplifier axis specified for "[Pr.141] IP address" and "[Pr.142] Multidrop number" is set as the Motion control station in the network configuration settings. • Set the IP address of the station that supports CANopen communication to "[Pr.141] IP address". • Review "[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)", and "[Pr.4] Unit magnification (AM)". • Refer to the remedy for the moderate error occurred in the Motion module.
1BA0H	Backlash compensation amount error	The calculation result of the following equation is smaller than 0 or larger than 4194304. $0 \leq \frac{[Pr.11] \times [Pr.2]}{[Pr.3] \times [Pr.4]} \leq 4194303$ [Operation status at error occurrence] The READY signal [X0] is not turned ON.	"[Pr.2] Number of pulses per rotation (AP)", "[Pr.3] Movement amount per rotation (AL)", "[Pr.4] Unit magnification (AM)", "[Pr.11] Backlash compensation amount" Review the items above.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1BA1H	Software stroke limit upper limit	In the unit of "degree", the setting value of the detailed parameter 1 "[Pr.12] Software stroke limit upper limit value" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BA2H	Software stroke limit upper limit	In a unit other than "degree", "[Pr.12] Software stroke limit upper limit value" is smaller than "[Pr.13] Software stroke limit lower limit value". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	In a unit other than "degree", configure the setting so that "[Pr.13] Software stroke limit lower limit value" is smaller than "[Pr.12] Software stroke limit upper limit value", turn PLC READY [Y0] from OFF to ON.
1BA3H	Software stroke limit lower limit	In the unit of "degree", the setting value of the detailed parameter 1 "[Pr.13] Software stroke limit lower limit value" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BA4H	Software stroke limit lower limit	In a unit other than "degree", "[Pr.12] Software stroke limit upper limit value" is smaller than "[Pr.13] Software stroke limit lower limit value". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	In a unit other than "degree", configure the setting so that "[Pr.13] Software stroke limit lower limit value" is smaller than "[Pr.12] Software stroke limit upper limit value", turn PLC READY [Y0] from OFF to ON.
1BA5H	Software stroke limit selection	• The setting value of the detailed parameter 1 "[Pr.14] Software stroke limit selection" is outside the setting range. • In the unit of "degree", "1: Apply software stroke limit on machine feed value" is set. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• Bring the setting into the setting range. • In the unit of "degree", set "0: Apply software stroke limit on command position value".
1BA6H	Software stroke limit valid/invalid setting	The setting value of the detailed parameter 1 "[Pr.15] Software stroke limit valid/invalid setting" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BA7H	Command in-position width	The setting value of the detailed parameter 1 "[Pr.16] Command in-position width" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BA8H	Illegal torque limit setting value	The setting value of the detailed parameter 1 "[Pr.17] Torque limit setting value" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BA9H	M code ON timing error	The setting value of the detailed parameter 1 "[Pr.18] M code ON signal output timing" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BAAH	Speed switching mode error	The setting value of the detailed parameter 1 "[Pr.19] Speed switching mode" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BABH	Interpolation speed designation method error	The setting value of the detailed parameter 1 "[Pr.20] Interpolation speed designation method" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BACH	Current value update request error	The setting value of the detailed parameter 1 "[Pr.21] Command position value during speed control" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1BAEH	Speed-position function selection error	The detailed parameter 1 "[Pr.81] Speed-position function selection" is preset to 2 and the following three conditions are not satisfied: • Unit is "degree". • Software stroke limits are invalid. • Update command position value. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• Speed-position switching control (ABS mode) should satisfy the conditions given on the left. • When speed-position switching control (ABS mode) is not to be exercised, set "[Pr.81] Speed-position function selection" to 0 and turn PLC READY [Y0] from OFF to ON.
1BB1H	Acceleration time 1 setting error	The setting value of the detailed parameter 2 "[Pr.25] Acceleration time 1" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BB2H	Acceleration time 2 setting error	The setting value of the detailed parameter 2 "[Pr.26] Acceleration time 2" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BB3H	Acceleration time 3 setting error	The setting value of the detailed parameter 2 "[Pr.27] Acceleration time 3" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BB4H	Deceleration time 1 setting error	The setting value of the detailed parameter 2 "[Pr.28] Deceleration time 1" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BB5H	Deceleration time 2 setting error	The setting value of the detailed parameter 2 "[Pr.29] Deceleration time 2" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1BB6H	Deceleration time 3 setting error	The setting value of the detailed parameter 2 "[Pr.30] Deceleration time 3" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BB7H	JOG speed limit value error	The setting value of the detailed parameter 2 "[Pr.31] JOG speed limit value" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start.	When PLC READY [Y0] is not turned ON even if the setting is within the setting range, turn PLC READY [Y0] from OFF to ON.
1BB8H	JOG speed limit value error	The setting value of the detailed parameter 2 "[Pr.31] JOG speed limit value" exceeds "[Pr.8] Speed limit value". [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start.	When PLC READY [Y0] is not turned ON even if the setting value is set to equal to or less than "[Pr.8] Speed limit value", turn PLC READY [Y0] from OFF to ON.
1BB9H	JOG speed limit value error	The setting value of the detailed parameter 2 "[Pr.31] JOG speed limit value" is smaller than "[Pr.7] Bias speed at start". [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start.	When PLC READY [Y0] is not turned ON after the setting value is set to equal to or more than "[Pr.7] Bias speed at start", turn PLC READY [Y0] from OFF to ON.
1BBAH	Manual pulse generator speed limit value error	The setting value of the detailed parameter 2 "[Pr.123] Manual pulse generator speed limit value" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not operate.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BBBH	Manual pulse generator speed limit value error	The setting value of the detailed parameter 2 "[Pr.123] Manual pulse generator speed limit value" exceeds "[Pr.8] Speed limit value". [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not operate.	Set a value equal to or less than "[Pr.8] Speed limit value".
1BBCH	JOG acceleration time selection setting error	The setting value of the detailed parameter 2 "[Pr.32] JOG operation acceleration time selection" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1BBDH	JOG deceleration time selection setting error	The setting value of the detailed parameter 2 "[Pr.33] JOG operation deceleration time selection" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection".(Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BBEH	Acceleration/deceleration process selection setting error	The setting value of the detailed parameter 2 "[Pr.34] Acceleration/deceleration process selection" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BBFH	S-curve ratio setting error	The setting value of the detailed parameter 2 "[Pr.35] S-curve ratio" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BC0H	Illegal rapid stop deceleration time	The setting value of the detailed parameter 2 "[Pr.36] Rapid stop deceleration time" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BC1H	Stop group 1 rapid stop selection error	The setting value of the detailed parameter 2 "[Pr.37] Stop group 1 rapid stop selection" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1BC2H	Stop group 2 rapid stop selection error	The setting value of the detailed parameter 2 "[Pr.38] Stop group 2 rapid stop selection" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BC3H	Stop group 3 rapid stop selection error	The setting value of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BC4H	Outside allowance circular interpolation error width	The setting value of the detailed parameter 2 "[Pr.41] Allowable circular interpolation error width" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BC5H	External command function selection error	The setting value of the detailed parameter 2 "[Pr.42] External command function selection" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BC6H	Manual pulse generator speed limit mode error	The setting value of the detailed parameter 2 "[Pr.122] Manual pulse generator speed limit mode" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BCBH	Input signal logic selection setting error	The setting values of the detailed parameter 1 "[Pr.22] Input signal logic selection" are different in the axis that uses the same input signal. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1BCCH	Restart allowable range error	The setting value of the detailed parameter 2 "[Pr.84] Restart allowable range when servo OFF to ON" is outside the setting range. [Operation status at error occurrence] PLC READY [Y0] OFF to ON: READY signal [X0] is not turned ON. At start: The system does not start. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.39] Stop group 3 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BCDH	Speed control 10 × multiplier setting for degree axis error	The setting value of the detailed parameter 2 "[Pr.83] Speed control 10 × multiplier setting for degree axis" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BCEH	Operation setting for speed-torque control mode error	The setting value of the detailed parameter 2 "[Pr.90] Operation setting for speed-torque control mode" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BCFH	External command signal selection error	• The setting value of the detailed parameter 2 "[Pr.95] External command signal selection" is outside the setting range. • When the set value of the detailed parameter 2 "External command signal selection" is "900: Link device", there is no external command signal for which the link device external signal allocation parameter is valid. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• Correct the setting value, turn PLC READY [Y0] from OFF to ON. • When a link device is not used as an external command signal, a setting other than "900: Link device" is set, and the PLC READY signal is turned OFF to ON. • When a link device is used as an external command signal, the link device external signal allocation parameter for the external command signal to be used is set within the set range, and turn on the power again or reset the sequencer.
1BD0H	FLS signal selection error	The setting value of the detailed parameter 1 "[Pr.116] FLS signal selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BD1H	RLS signal selection error	The setting value of the detailed parameter 1 "[Pr.117] RLS signal selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BD2H	DOG signal selection error	The setting value of the detailed parameter 1 "[Pr.118] DOG signal selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BD3H	STOP signal selection error	The setting value of the detailed parameter 1 "[Pr.119] STOP signal selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1BE6H	Driver command discard detection	The command discard (Statusword bit12 OFF) of the servo amplifier was detected during operation. [Operation status at error occurrence] The operation is stopped.	Clear forced stop input or emergency stop input of servo amplifier. When the servo amplifier uses the limit signal, move the command by using the JOG command or others to the position where the limit signal was detected. (For the details of Statusword, refer to the manual of the servo amplifier.)
1BE7H	Driver execution control mode invalid	The control mode of the connected driver device switched to an unsupported mode by the Motion module during operation. [Operation status at error occurrence] The system stops immediately.	Switch the driver control mode to a control mode that is supported by the Motion module.
1C10H	Home position return method error	The setting value of the home position return basic parameter "[Pr.43] Home position return method" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1C11H	Home position return direction error	The setting value of the home position return basic parameter "[Pr.44] Home position return direction" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1C12H	Home position address setting error	The setting value of the home position return basic parameter "[Pr.45] Home position address" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1C13H	Home position return speed error	The setting value of the home position return basic parameter "[Pr.46] Home position return speed" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1C14H	Home position return speed error	The setting value of the home position return basic parameter "[Pr.46] Home position return speed" exceeds "[Pr.8] Speed limit value". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	After the setting value is set to equal to or less than "[Pr.8] Speed limit value", turn PLC READY [Y0] from OFF to ON.
1C15H	Home position return speed error	The setting value of the home position return basic parameter "[Pr.46] Home position return speed" is smaller than "[Pr.7] Bias speed at start". [Operation status at error occurrence] The READY signal [X0] is not turned ON.	After the setting value is set to equal to or more than "[Pr.7] Bias speed at start", turn PLC READY [Y0] from OFF to ON.
1C1BH	Home position return acceleration time selection error	The setting value of the home position return detailed parameter "[Pr.51] Home position return acceleration time selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1C1CH	Home position return deceleration time selection error	The setting value of the home position return detailed parameter "[Pr.52] Home position return deceleration time selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1C21H	Home position return torque limit value error	The setting value of the home position return detailed parameter "[Pr.55] Operation setting for incompletion of home position return" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1C41H	WDT error	A WDT error of the driver was detected. [Operation status at error occurrence] The system stops immediately.	• When a stop error of the CPU module is detected, check the details of the CPU module error and take actions. • Review the communication cycle. • Check for abnormalities in the surrounding environment, such as noise, and remove the cause. • After taking the above measures, switch the power on again or reset the CPU module.
1C42H	Unsupported driver connection	An unsupported driver was connected. [Operation status at error occurrence] Instance creation of the driver fails.	Connect a supported driver.
1C43H	SLMP communication error	An error occurred in SLMP communication. [Operation status at error occurrence] During communication initialization • Communication with the driver is not possible.	• Review the device object setting. • Check the manual of the driver.
1C45H	SLMP communication error (timeout)	Response timeout was detected in SLMP communication. [Operation status at error occurrence] SLMP communication is not established.	Review the transient transmission time. It is obtained by the following equation. (Transient transmission time = Communication period interval setting - Cyclic transmission time - System reservation time)

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1C46H	Time synchronization error	There is a station that has disconnected due to incomplete time synchronization. [Operation status at error occurrence] The target station cannot be connected to the drive unit.	• Shorten the communication cycle. • Check for abnormalities in the surrounding environment, such as noise, and remove the cause. • Connect only to the stations for which the network configuration has been set.
1C47H	Communication cycle unsupported driver connection	The MR-J5(W)-G series which does not support the communication cycle of 31.25/62.5μs was connected. [Operation status at error occurrence] The target station cannot be connected to the drive unit.	Check the version of the MR-J5(W)-G series and apply the latest version.
1C48H	PDO mapping setting error	Abnormal response for PDO mapping setting was received from a device station. [Operation status at error occurrence] The target station cannot be connected to the drive unit.	• Check the error details according to the error code (SDO Abort Code) and review the PDO mapping setting. • Check if the CiA402 objects that can be monitored have been set in "[Pr.91] Optional data monitor: Data type setting 1" to [Pr.94] Optional data monitor: Data type setting 4" and "[Pr.591] Optional data monitor: Data type expansion setting 1" to "[Pr.594] Optional data monitor: Data type expansion setting 4".
1C49H	Configuration mismatch on reconnection	A model name mismatch was detected on reconnection of device station. [Operation status at error occurrence] The target station cannot be connected to the drive unit.	Connect a device station with the same name as the disconnected one.
1C4AH	Unsupported device station connection	Connection with a device that does not support the Motion control station was detected. [Operation status at error occurrence] The target station cannot be connected to the drive unit.	Connect a device that supports the Motion control station. For the connectable devices, refer to the following. ☞ Page 702 Devices Compatible with CC-Link IE TSN
1C4BH	Motion control station setting error	A Motion control station setting error was detected. [Operation status at error occurrence] The target station cannot be connected to the drive unit.	• Check that the Motion control station has been set in "[Pr.141] IP address". • Check if "[Pr.141] IP address" has been set for the axis that exceeds "[Pr.152] Maximum number of control axes".
1DC1H	Forced stop valid/invalid setting error	The setting value of the detailed parameter 1 "[Pr.82] Forced stop valid/invalid selection" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.
1DC3H	Operation cycle setting error[*1]	The setting value of "Communication Period Interval Setting" in the module parameter (network) is out of the range of the operation cycle supported by the Motion module. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Change the setting value of "Communication Period Interval Setting" in the module parameter (network) to a value within the range of the operation cycle supported by the Motion module, write parameters, and power on or reset the PLC.
1DC6H	Outside manual pulse generator smoothing time constant range error	The set value of the common parameter "(Pr.156) Manual pulse generator smoothing time constant" is outside the setting range. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Correct the setting value, turn PLC READY [Y0] from OFF to ON.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1DC8H	Servo parameter invalid	Servo parameters are not set as the following. • Electrical gear numerator (PA06) When the servo motor resolution is 26 bits: 16 (such as the rotary servo motor HK series), When the servo motor resolution is other than 26 bits: 1 • PA07 (Electronic gear - Denominator): 1 • PC79.0 (DI status read selection): Eh • PD41.2 (Limit switch enabled status selection): 1h • PD41.3 (Sensor input method selection): 1h • PD60 (DI pin polarity selection): 00000000h • PT01.1 (Speed/acceleration/deceleration unit selection): 0h • PT08 (Homing position data): 0 • PT15 (Software position limit +): 0 • PT17 (Software position limit -): 0 • PT29.0 (Device input polarity 1): 1h [Operation status at error occurrence] Current value restoration is not performed for the relevant servo amplifier.	The servo parameter is automatically overwritten. After powering OFF and ON the servo amplifier, check that this error no longer occurs.
1ED0H	Driver error	Errors occur in the driver. [Operation status at error occurrence] The motor stops. (The stop method follows the specifications of the driver.)	Check the contents of the error and take actions according to "[Md.114] Servo alarm" and "[Md.115] Servo alarm detail number". (For the details of "[Md.114] Servo alarm" and "[Md.115] Servo alarm detail number", refer to the manual of each driver.)
1ED2H	WDT error	The Motion module detects the WDT error of the driver. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops immediately.	Replace the driver in which the WDT occurred.
1EE0H	Number of master axis error	In "Driver communication setting (PD15.0)" of the device station parameter automatic setting, the number of master axes exceeds the number of axes that can be set. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	In "Driver communication setting (PD15.0)" of the device station parameter automatic setting, set the number of master axes less than or equal to the number of axes that can be set.
1EE1H	Master axis No. error	In "Master axis 1 station No. setting when driver communication slave is set (PD22)" of the device station parameter automatic setting, the station number of own axis is set. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	In "Master axis 1 station No. setting when driver communication slave is set (PD22)" of the device station parameter automatic setting, review the set number of the master axis.
1EE2H	Master axis setting error	In "Master axis 1 station No. setting when driver communication slave is set (PD22)" of the device station parameter automatic setting, the station number of own axis is not set. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	In "Master axis 1 station No. setting when driver communication slave is set (PD22)" of the device station parameter automatic setting, review the set number of the master axis.
1EE3H	Driver communication setting error	• Driver communication is set for the servo amplifier that does not support driver communication. • The driver communication setting differs between the Motion module and servo amplifier. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• Check the driver communication setting and actually connected servo amplifier. • After setting "Driver communication setting (PD15.0), (PD15.1)", "Master axis 1 station No. setting when the slave for driver communication is set (PD22)", and "Master axis 1 control slave axis No. setting when the slave for driver communication is set (PD23.1)" of Simple Motion module setting and device station parameter automatic setting, write it to the flash ROM and switch the power ON again or reset the PLC.
1EE4H	Power not turned on after parameter distribution	After driver communication was enabled, the device station automatic setting was performed. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	Power on the Motion module and servo amplifier again.

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1F04H	Control mode switching error	Driver control mode switching did not complete within 1 second after control mode switching command had been issued. [Operation status at error occurrence] The system stops. Communication with the driver is not possible.	• Check whether an error occurred in the driver or whether the setting is incorrect, and take necessary actions. • When the MR-J5(W)-G series is connected: To switch the driver control mode while the motor is operating, set the servo parameter "ZSP disabled selection at control switching (PC76.1)" to "1: Disabled". • To change the current value or switch the fixed-feed control or speed control to continuous operation to torque control mode using "[Cd.153] Control mode auto-shift selection", set "1: Switching request" in "[Cd.138] Control mode switching request" not to satisfy the switching condition while "[Md.26] Axis operation status" is "5: Analyzing".
1F05H	Servo parameter communication error	A communication error was detected when the servo amplifier was connected. [Operation status at error occurrence] The system stops. Communication with the driver is not possible.	After checking the cable connecting the servo amplifier, switch the power off and then on, or reset the PLC.
1F10H	Outside the link device start No. range	•The link device start No. is outside the setting range. • When specifying 1-word/2-words size of the bit device, the start number which is not a multiple of 16 is set. [Operation status at error occurrence] The relevant link device external signal cannot be used.	Review the link device start No. setting.
1F11H	Outside the link device bit specification range	Bit other than 0 to F is specified. [Operation status at error occurrence] The relevant link device external signal cannot be used.	Review the setting of link device bit specification.
1F12H	Outside the link device maximum/minimum value specification range	The maximum value in the ring counter range is set smaller than the minimum value. [Operation status at error occurrence] The relevant link device external signal cannot be used.	Review the maximum value/minimum value of ring counter.
1F13H	Forced stop signal link device incorrect configuration	When the set value of the common parameter "[Pr.82] Forced stop valid/invalid selection" is "3: Enable (link device)", link device of forced stop signal is not set in link device external signal allocation parameter. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• When using link device as forced stop signal, set "[Pr.900] Forced stop signal(EMI): Link device type" within the range. • If you do not use link device as forced stop signal, do not set 3: Enable (link device) for "[Pr.82] Forced stop valid/invalid selection".
1F14H	FLS signal link device incorrect configuration	When the detailed parameter 1 "[Pr. 116] FLS signal selection: Input type" set to "3: Link device", link device of upper limit signal is not set in link device external signal allocation parameter. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• When using link device as upper limit signal, set "[Pr.910] Upper limit signal: Link device type" within the range. • If you do not us e link device as upper limit signal, do not set "3: Link device" for "[Pr. 116] FLS signal selection: Input type".
1F15H	RLS signal link device incorrect configuration	When the detailed parameter 1 "[Pr. 117] RLS signal selection: Input type" set to "3: Link device", link device of lower limit signal is not set in link device external signal allocation parameter. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• When using link device as lower limit signal, set "[Pr.920] Lower limit signal: Link device type" within the range. • If you do not use link device as lower limit signal, do not set "3: Link device" for "[Pr. 117] RLS signal selection: Input type".
1F16H	DOG signal link device incorrect configuration	When the detailed parameter 1 "[Pr. 118] DOG signal selection: Input type" set to "3: Link device", link device of proximity dog signal is not set in link device external signal allocation parameter. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• When using link device as proximity dog signal, set "[Pr.930] Proximity dog signal: Link device type" within the range. • If you do not use link device as proximity dog signal, do not set "3: Link device" for "[Pr. 118] DOG signal selection: Input type".

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
1F17H	STOP signal link device incorrect configuration	When the detailed parameter 1 "[Pr. 119] STOP signal selection: Input type" set to "3: Link device", link device of stop signal is not set in link device external signal allocation parameter. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	• When using link device as stop signal, set "[Pr.940] Stop signal: Link device type" within the range. • If you do not use link device as stop signal, do not set "3: Link device" for "[Pr. 119] STOP signal selection: Input type".
1F18H	Speed-position switching request link device incorrect configuration	• At the time of speed/position changeover control start, when the set value of axis control data "[Cd.45] Speed-position switching device select on" is "0: External command signal is used for switching from speed control to position control" and the set value of detailed parameter 2 "[Pr.95] External command signal selection" is "900: Link device", link device of link device external signal allocation parameter "Speed-position switching request" is not set. • At the time of position/speed switching control start, when the set value of axis control data "[Cd.45] Speed-position switching device selection" is "0: External command signal is used for switching from position control to speed control" and the set value of detailed parameter 2 "[Pr.95] External command signal selection" is "900: Link device", link device of link device external signal allocation parameter "Speed-position switching request" is not set. [Operation status at error occurrence] The system does not operate at start.	• When using link device as a Speed-position switching request, set "[Pr.980] Speed-position switching request: Link device type" within the range. • When link device is not used as a speed/position switching request, do not set the set value of "[Cd.45] Speed-position switching device selection" to "0: External command signal is used for switching from speed control to position control" and the set value of "[Pr.95] External command signal selection" to "900: Link device". • When link device is not used as a position/speed switching request, do not set the set value of "[Cd.45] Speed-position switching device selection" to "0: External command signal is used for switching from position control to speed control" and the set value of "[Pr.95] External command signal selection" to "900: Link device".
1F19H	Main shaft clutch control request (ON control mode) link device incorrect configuration	When the ON control mode of the synchronous parameter "[Pr.405] Main shaft clutch control setting" is set to "6: Link device signal", link device of link device external signal allocation parameter "Main shaft clutch control request (ON control mode)" is not set. [Operation status at error occurrence] Synchronous control does not start.	• When using link device as a main shaft clutch control request (ON control mode), set "[Pr.990] Main shaft clutch control request (ON control mode): Link device type" within the range. • When link device is not used as a main shaft clutch control request (ON control mode), do not set "6: Link device signal" in the ON control mode of "[Pr.405] Main shaft clutch control setting".
1F1AH	Main shaft clutch control request (OFF control mode) link device incorrect configuration	When the OFF control mode of the synchronous parameter "[Pr.405] Main shaft clutch control setting" is set to "6: Link device signal", link device of link device external signal allocation parameter "Main shaft clutch control request (OFF control mode)" is not set. [Operation status at error occurrence] Synchronous control does not start.	• When using link device as a main shaft clutch control request (OFF control mode), set "[Pr.995] Main shaft clutch control request (OFF control mode): Link device type" within the range. • When link device is not used as a main shaft clutch control request (OFF control mode), do not set "6: Link device signal" in the OFF control mode of "[Pr.405] Main shaft clutch control setting".
1F1BH	Auxiliary shaft clutch control request (ON control mode) link device incorrect configuration	When the ON control mode of the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" is set to "6: Link device signal", link device of link device external signal allocation parameter "Auxiliary shaft clutch control request (ON control mode)" is not set. [Operation status at error occurrence] Synchronous control does not start.	• When using link device as an auxiliary shaft clutch control request (ON control mode), set "[Pr.1000] Auxiliary shaft clutch control request (ON control mode): Link device type" within the range. • When link device is not used as an auxiliary shaft clutch control request (ON control mode), do not set "6: Link device signal" in the ON control mode of "[Pr.422] Auxiliary shaft clutch control setting".
1F1CH	Auxiliary shaft clutch control request (OFF control mode) link device incorrect configuration	When the OFF control mode of the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" is set to "6: Link device signal", link device of link device external signal allocation parameter "Auxiliary shaft clutch control request (OFF control mode)" is not set. [Operation status at error occurrence] Synchronous control does not start.	• When using link device as an auxiliary shaft clutch control request (OFF control mode), set "[Pr.1005] Auxiliary shaft clutch control request (OFF control mode): Link device type" within the range. • When link device is not used as an auxiliary shaft clutch control request (OFF control mode), do not set "6: Link device signal" in the OFF control mode of "[Pr.422] Auxiliary shaft clutch control setting".

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
3205H	Add-on library load error	• The add-on file is corrupted. Alternatively, an error occurred during initialization processing. (detail code: 0001H) • Dependent add-ons are not installed or enabled. Or, there is a version mismatch. (detail code: 0002H). • An add-on that cannot be combined is installed or enabled. Or, there is a version mismatch. (detail code: 0002H). • An add-on with the same name is installed or enabled. (detail code: 0004H). [Operation status at error occurrence] The motion system does not start.	• Install the software again. (detail code: 0001H) • Install or enable add-ons with dependencies. Or, install the correct version of the add-on. (detail code: 0002H). • Remove or disable add-ons that cannot be combined. Or, install the correct version of the add-on. (detail code: 0003H). • Remove or disable an add-on with the same name.
3207H	Drive error	The drive has failed. [Operation status at error occurrence] The target drive cannot be accessed.	Format the drive. Refer to the following for instructions on how to format the drive. ☞ Page 394 Formatting a drive
320DH	Base system error	• The label construction failed. • The initial process failed. • The backup data is being accessed externally. [Operation status at error occurrence] The motion system does not start.	• Install the software again. • Write the program again. • Stop the access to the backup data.
320EH	Network driver error	• The communication between the motion and the network failed. [Operation status at error occurrence] • The motion system does not start. • The axis in operation stops immediately.	• Install the software again. • Write the program again.
320FH	Servo driver error	• The initialization of the servo driver failed. [Operation status at error occurrence] • The motion system does not start. • The instance creation of the driver fails.	• Install the software again.
3217H	Add-on SimpleMotion acquisition error	The acquisition of the add-on SimpleMotion failed. [Operation status at error occurrence] The motion system does not start.	Install the software again.
3218H	Add-on SimpleMotion internal error	The initial process of the add-on SimpleMotion failed. [Operation status at error occurrence] The motion system does not start.	Install the software again.
3219H	Insufficient add-on SimpleMotion memory	The system memory of the add-on SimpleMotion is insufficient. [Operation status at error occurrence] The motion system does not start.	Install the software again.
322BH	Motion Control Station Setting Error	Any of the items in "Network Configuration Settings" under "Basic Settings" are set as follows. • A local station was set as the motion control station. • The communication period of the remote station designated as the motion control station was set to other than "Basic Period". [Operation status at error occurrence] • Data link does not start. • The READY signal [X0] does not turn ON.	Correct the parameters shown in the cause.
322CH	Link device setting error	The following settings were made while the start/end of the link device for the device station which was set as the motion control station in "Network Configuration Settings" had not been set. • A local station was set in "Network Configuration Settings". • "Multicast" was set to "Communication Mode". [Operation status at error occurrence] • Data link does not start. • The READY signal [X0] does not turn ON.	Through GX Works3 version 1.085P or later, set the start/end of the link device for the station which is set as the motion control station in network configuration settings, or make the following settings. • Change the device station set as the motion control station in "Network Configuration Settings" to be a standard station. • Remove local stations form "Network Configuration Settings". • Set "Unicast" to "Communication Mode".

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
322DH	Number of motion control station device points error	The following settings were made while there is a local station in "Network Configuration Settings", or "Multicast" was set to "Communication Mode". • The RWw/RWr number of points of the device station set as the motion control station in "Network Configuration Settings" is less than PDO size. [Operation status at error occurrence] • Data link does not start. • The READY signal [X0] does not turn ON.	Take any of the following settings. • Remove the local stations set in "Network Configuration Settings" and set "Unicast" to "Communication Mode". • Set RWw/RWr points of the device station designated as the motion control station in "Network Configuration Settings" as the following or more: RWw: 40 points (24 points when the extension module is mounted) RWr: 40 points (28 points when the extension module is mounted)
3230H	Driver communication setting error 1	• There is an abnormal value for the driver communication setting in the servo parameter of the device station parameter automatic setting. • The setting for servo network configuration parameter is incorrect. • There are errors in "Network Configuration Settings". [Operation status at error occurrence] The Motion system is not started.	• Check the driver communication setting in the servo parameter of the device station parameter automatic setting. • Do not set the virtual servo amplifier for the axis where driver communication is enabled. • Set the number of slave axes operated by the master axis within the range of 1 to 8. • Do not enable driver communication for the multi-axis servo amplifier. • Do not set overlapping slave axis control numbers for the slave axes belonging to the same master axis. • Set the servo parameter "Driver communication setting - Slave - Master axis 1 - Control slave axis No. setting (PD23.1)" of each slave axis belonging to the same master axis avoiding duplication. • Do not enable driver communication for stations for which "Station-specific mode setting" in "Network Configuration Settings" has been set to "Motion Mode (Safety)".
3231H	Driver communication setting error 2	The setting of the communication period or speed does not support driver communication. [Operation status at error occurrence] The Motion system is not started.	[Add-on baseSystem version "Ver. 1.30" or later] • Set the factor of "Low-Speed" in "Multiple Period Setting" to be 128 times or less after multiplying by the driver communication factor (basic). • Please set the communication speed to 1Gbps. • Please invalidate the inter-module synchronization. • To connect CC-Link IE TSN Class A device station, please set the "TSN HUB Setting" to "Use TSN HUB". [Add-on baseSystem version "Ver. 1.28" or earlier] • The following condition must be satisfied if there is a device station for which "Communication Period Setting" is set to "Low-Speed". A × B / C ≤ 128 A: "Communication Period Interval Setting" in "Basic Period Interval Setting" B: "Low-Sped" in "Multiple Period Setting" C: Driver communication period (SW04C0) • Set the communication speed to 1Gbps. • Disable inter-module synchronization. • In order to enable driver communication, calculate and set the communication period interval and cyclic transmission time using the formula for computing the communication period interval setting of the driver communication function. • To connect CC-Link IE TSN Class A device station, set the "TSN HUB setting" to "Use TSN HUB".

Error code (Hexadecimal)	Error name	Error details and causes	Remedy
3235H	Driver Communication Cyclic Transmission Time Setting Error	The cyclic transmission time setting does not support driver communication function. [Operation status at error occurrence] The Motion system is not started.	Set the value of "Cyclic Transmission Time" in "Communication Period Setting" in "Basic Settings" of the master station to not less than Cyclic transmission time of detailed information and not more than 216μs. If the cyclic transmission time of detailed information exceeds 216μs, reduce the number of stations connected to the master station and the number of link devices allocated to each device in "Network Configuration Settings".
3236H	Driver Communication Period Interval Setting Error	"Communication Period Interval Setting" does not support Driver communication function. [Operation status at error occurrence] The Motion system is not started.	In "Communication cycle setting" of "Basic settings" of the master station, set the value of "Communication cycle Period interval" to be equal to or greater than the communication cycle interval in the detailed information and one of the following. • 250μs • 500μs • 1000μs • 2000μs • 4000μs If the communication cycle interval for detailed information exceeds 4000μs, do one of the following. • Decrease the "Cyclic Transmission Time" setting. • Reduce the number of devices connected to the master station and the number of link devices allocated to each unit in "Network Configuration Settings".
3237H	PDO Size Over	The size of the PDO exceeds the configurable range when the CANopen device station is set to motion control station. [Operation status at error occurrence] • Data link does not start. • The READY signal [X0] is not turned ON.	Among CANopen supported device station, set the station as motion control station as follows. • Set the RWr and RWw settings within 40 points from "Network Configuration" in the module parameters (network).
3301H	Faults*1	Hardware is faulty. [Operation status at error occurrence] The system stops.	Check that there is no influence from noise.
3302H	Internal circuit fault	Hardware is faulty. [Operation status at error occurrence] The system stops.	• Take measures against noise. • After the Motion module is reset, switch to RUN. If the same error is displayed again, the hardware fault might occur in the CPU module, base unit, extension cable, or module. Please consult your sales representative.
3320H	CPU module error*1	An error is detected in the CPU module. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.38] Stop group 2 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Check the error of the CPU module and take corrective action using the module diagnostics.
3321H	CPU module error	An error is detected in the CPU module. [Operation status at error occurrence] At start: The system does not operate. During operation: The system stops with the setting (deceleration stop/rapid stop) of the detailed parameter 2 "[Pr.38] Stop group 2 rapid stop selection". (Note that the deceleration stop only occurs during the manual pulse generator operation.)	Check the error of the CPU module and take corrective action using the module diagnostics.
342FH	SD memory card removed	The SD memory card was removed without setting it to the use stop state. [Operation status at error occurrence] -	Set the SD memory card to the use stop state before removing it.

*1 Errors that do not depend on the axis

*2 Setting condition: "[Cd.16] Inching movement amount × (A) ≤ [Pr.31] JOG speed limit value". Use the following values for (A).

Unit setting	Operation cycle				
	0.25ms	0.50ms	1.00ms	2.00ms	4.00ms
When unit is set to pulse	4000	2000	1000	500	250
When unit is set to degree and "[Pr.83] Speed control 10 × multiplier setting for degree axis" is valid	240	120	60	30	15
When the unit setting is other than the above	2400	1200	600	300	150

Errors related to synchronous control are described below.

Error code	Error name	Error details and causes	Remedy
1A28H	Start not possible	Start is requested during the forced stop of controller. [Operation status at error occurrence] The system does not start positioning.	Remove the cause of forced stop.
1DF0H	Outside input axis type setting range	The setting values of the input axis parameters "[Pr.300] Servo input axis type" and "[Pr.320] Synchronous encoder axis type" are outside the setting range. [Operation status at error occurrence] The setting becomes invalid for input axis.	Bring the setting into the setting range.
1DF1H	Outside input axis unit setting range	The setting value of the input axis parameter "[Pr.321] Synchronous encoder axis unit setting" is outside the setting range. [Operation status at error occurrence] The setting becomes invalid for input axis.	Bring the setting into the setting range.
1DF2H	Outside input axis unit conversion denominator range	The input axis parameter "[Pr.323] Synchronous encoder axis unit conversion: Denominator" is set to 0 or lower. [Operation status at error occurrence] The setting becomes invalid for input axis.	Set a value within the range of 1 to 2147483647.
1DF3H	Outside input axis length per cycle range	The input axis parameter "[Pr.324] Synchronous encoder axis length per cycle" is set to 0 or lower. [Operation status at error occurrence] The setting becomes invalid for input axis.	Set a value within the range of 1 to 2147483647.
1DF4H	Outside input axis smoothing time constant range	The input axis parameters "[Pr.301] Servo input axis smoothing time constant" and "[Pr.325] Synchronous encoder axis smoothing time constant" are outside the range of 0 to 5000. [Operation status at error occurrence] The setting becomes invalid for input axis.	Set a value within the range of 0 to 5000.
1DF5H	Outside input axis rotation direction restriction setting range	The input axis parameters "[Pr.304] Servo input axis rotation direction restriction" and "[Pr.328] Synchronous encoder axis rotation direction restriction" are outside the range of 0 to 2. [Operation status at error occurrence] The setting becomes invalid for input axis.	Set a value within the range of 0 to 2.
1DF6H	Input axis unit conversion overflow	Internal operation overflow occurred because the unit conversion ratio (unit conversion: Numerator/unit conversion: Denominator) of the input axis is too large. [Operation status at error occurrence] The input axis operation is immediately stopped, and a connection becomes invalid.	• Set a smaller unit conversion ratio (unit conversion: Numerator/unit conversion: Denominator) of the input axis. • Decrease the input axis speed.
1DF7H	Speed-position switching control start in servo input axis not possible	When the input axis parameter "[Pr.300] Servo input axis type" is command position value or actual position value, the speed-position switching control is started with the detailed parameter 1 "[Pr.21] Command position value during speed control" set to other than "1: Update of command position value". [Operation status at error occurrence] The speed-position switching control does not start.	• Set "[Pr.300] Servo input axis type" to the servo command value or feedback value. • Set "[Pr.21] Command position value during speed control" to "1: Update command position value".
1DF8H	Synchronous encoder via servo amplifier communication error	• The hardware of the synchronous encoder or the servo amplifier is faulty. • The synchronous encoder cable is disconnected. • Communication to the synchronous encoder cannot be established. [Operation status at error occurrence] The connection of synchronous encoder axis becomes invalid.	• Replace the synchronous encoder or the servo amplifier. • Check the synchronous encoder cable. • Check the connected synchronous encoder. • Check whether the synchronous encoder cable is faulty.
1DF9H	Synchronous encoder via servo amplifier battery error	The battery which the servo amplifier connected synchronous encoder is empty or the battery is disconnected. [Operation status at error occurrence] The synchronous encoder control continues.	Replace the battery or check the battery connection of the servo amplifier.

Error code	Error name	Error details and causes	Remedy
1DFAH	Synchronous encoder via servo amplifier invalid error	• "[Pr.141] IP address" of the axis No. selected as "Synchronous encoder via servo amplifier" in "[Pr.320] Synchronous encoder axis type" is not set or it is set as the virtual servo amplifier axis. • The servo amplifier axis set as synchronous encoder via servo amplifier is not supported with scale measurement mode. [Add-on baseSystem version "Ver.1.31" or earlier] • Linear scale is connected. [Add-on baseSystem version "Ver.1.32" or later] • Linear encoder (absolute position type) is connected. [Operation status at error occurrence] The READY signal [X0] is not turned ON.	After you solve the problem, switch the power off and then on, or reset the PLC.
1DFDH	Outside command generation axis length per cycle setting error	A value other than 0 to 2147483647 was input for "[Pr.346] Command generation axis length per cycle". [Operation status at error occurrence] The system operates as "[Pr.346] Command generation axis length per cycle" is 0.	Set a value within the range from 0 to 2147483647 for "[Pr.346] Command generation axis length per cycle".
1DFEH	Synchronous encoder via link device communication error	The link device set as the synchronous encoder axis input is unconnected with the corresponding station or disconnected. [Operation status at error occurrence] The synchronous encoder axis start is not executed.	Check the connection status of the target station.
1E30H	Outside main input axis No. range	• The setting value of the synchronous parameter "[Pr.400] Main input axis No." is outside the setting range. • The same servo input axis No. as the output axis has been set for "[Pr.400] Main input axis No.". [Operation status at error occurrence] Synchronous control does not start.	• Set within the range. • Do not set up the same servo input axis No. as the output axis.
1E31H	Outside sub input axis No. range	• The setting value of the synchronous parameter "[Pr.401] Sub input axis No." is outside the setting range. • The same servo input axis No. as the output axis is set for "[Pr.401] Sub input axis No.". [Operation status at error occurrence] Synchronous control does not start.	• Set within the range. • Do not set up the same servo input axis No. as the output axis.
1E32H	Outside main shaft gear: denominator range	The synchronous parameter "[Pr.404] Main shaft gear: Denominator" is set to 0 or lower. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 1 to 2147483647.
1E33H	Main shaft gear operation overflow	Overflow (sign reversion) occurred in input values, because the main shaft gear ratio is too large. [Operation status at error occurrence] Synchronous control is immediately stopped.	• Set a smaller absolute value for the synchronous parameter "[Pr.403] Main shaft gear: Numerator". • Set a larger value for the synchronous parameter "[Pr.404] Main shaft gear: Denominator". • Decrease the input axis speed.
1E34H	Outside main shaft clutch control setting range	• The setting value of the synchronous parameter "[Pr.405] Main shaft clutch control setting" is outside the setting range. • The detailed parameter 2 "[Pr.95] External command signal selection" is set to "900: Link device" and the synchronous parameter "[Pr.405] Main shaft clutch control setting" is set to "5: High-speed input request". [Operation status at error occurrence] Synchronous control does not start.	• Set within the range. • To use the high-speed input request as the main shaft clutch control request, select axis DOG signal to be used in the detailed parameter 2 "[Pr.95] External command signal selection", and select "5: High-speed input request" in the synchronous parameter "[Pr.405] Main shaft clutch control setting". • When link device is used as the main shaft clutch control request, select "6: Link device signal" in the synchronous parameter "[Pr.405] Main shaft clutch control setting".
1E35H	Outside main shaft clutch reference address setting range	The setting value of the synchronous parameter "[Pr.406] Main shaft clutch reference address setting" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.

Error code	Error name	Error details and causes	Remedy
1E36H	Outside main shaft clutch smoothing method range	The setting value of the synchronous parameter "[Pr.411] Main shaft clutch smoothing method" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1E37H	Outside main shaft clutch smoothing time constant range	The setting value of the synchronous parameter "[Pr.412] Main shaft clutch smoothing time constant" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1E38H	Composite main shaft gear operation overflow	The composite value is overflowed (sign reverse) because the input values of main input axis and sub input axis are large. [Operation status at error occurrence] Synchronous control is immediately stopped.	Lower the input values of main input axis and sub input axis.
1E40H	Outside auxiliary shaft No. range	• The setting value of the synchronous parameter "[Pr.418] Auxiliary shaft axis No." is outside the setting range. • The same servo input axis No. as the output axis is set for "[Pr.418] Auxiliary shaft axis No.". [Operation status at error occurrence] Synchronous control does not start.	• Set within the range. • Do not set up the same servo input axis No. as the output axis.
1E42H	Outside auxiliary shaft gear: denominator range	The synchronous parameter "[Pr.421] Auxiliary shaft gear: Denominator" is set to 0 or lower. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 1 to 2147483647.
1E43H	Auxiliary shaft gear operation overflow	Overflow (sign reversion) occurred in input values, because the auxiliary shaft gear ratio is too large. [Operation status at error occurrence] Synchronous control is immediately stopped.	• Set a smaller absolute value for the synchronous parameter "[Pr.420] Auxiliary shaft gear: Numerator". • Set a larger value for the synchronous parameter "[Pr.421] Auxiliary shaft gear: Denominator". • Decrease the input axis speed.
1E44H	Outside auxiliary shaft clutch control setting range	• The setting value of the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" is outside the setting range. • The detailed parameter 2 "[Pr.95] External command signal selection" is set to "900: Link device" and the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting" is set to "5: High-speed input request". [Operation status at error occurrence] Synchronous control does not start.	• Set within the range. • To use the high-speed input request as the auxiliary shaft clutch control request, select axis DOG signal to be used in the detailed parameter 2 "[Pr.95] External command signal selection", and select "5: High-speed input request" in the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting". • When link device is used as the auxiliary shaft clutch control request, select "6: Link device signal" in the synchronous parameter "[Pr.422] Auxiliary shaft clutch control setting".
1E45H	Outside auxiliary shaft clutch reference address setting range	The setting value of the synchronous parameter "[Pr.423] Auxiliary shaft clutch reference address setting" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1E46H	Outside auxiliary shaft clutch smoothing method range	The setting value of the synchronous parameter "[Pr.428] Auxiliary shaft clutch smoothing method" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1E47H	Outside auxiliary shaft clutch smoothing time constant range	The setting value of the synchronous parameter "[Pr.429] Auxiliary shaft clutch smoothing time constant" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1E48H	Composite auxiliary shaft gear operation overflow	The composite value is overflowed (sign reverse) because the input values of main shaft and auxiliary shaft are large. [Operation status at error occurrence] Synchronous control is immediately stopped.	Lower the input values of main shaft and auxiliary shaft.

Error code	Error name	Error details and causes	Remedy
1E50H	Outside speed change gear range	The setting value of the synchronous parameter "[Pr.434] Speed change gear arrangement" is outside the setting range. [Operation status at error occurrence] Synchronous control does not start.	Set within the range.
1E51H	Outside speed change ratio: denominator range	The synchronous parameter "[Pr.437] Speed change ratio: Denominator" is set to 0 or lower. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 1 to 2147483647.
1E52H	Outside speed change gear smoothing time constant range	The synchronous parameter "[Pr.435] Speed change gear smoothing time constant" is set to a value other than 0 to 5000. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 5000.
1E53H	Speed change gear overflow	Overflow (sign reversion) occurred in input values, because the speed change ratio of speed change gear is too large. [Operation status at error occurrence] Synchronous control is immediately stopped.	• Set a smaller absolute value for the synchronous parameter "[Pr.436] Speed change ratio: Numerator". • Set a larger value for the synchronous parameter "[Pr.437] Speed change ratio: Denominator". • Decrease the input axis speed.
1E60H	Outside cam No. range	The synchronous parameter "[Pr.440] Cam No." is set to a value other than 0 to 256. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 256.
1E61H	Cam not registered	The cam data of the cam No. specified in the synchronous parameter "[Pr.440] Cam No." does not exist on the Cam open area. [Operation status at error occurrence] Synchronous control does not start.	Specify the cam No. of an existing cam data.
1E62H	Cam axis length per cycle outside range	The synchronous parameter "[Pr.439] Cam axis length per cycle" is set to 0 or lower. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 1 to 2147483647.
1E63H	Outside output axis smoothing time constant range	The synchronous parameter "[Pr.447] Output axis smoothing time constant" is set to a value other than 0 to 5000. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 5000.
1E70H	Outside setting method of position value per cycle after main shaft gear range	The synchronous parameter "[Pr.460] Setting method of position value per cycle after main shaft gear" is set to a value other than 0 to 2. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 2.
1E71H	Outside position value per cycle after main shaft gear (Initial setting) range	The synchronous parameter "[Pr.465] Position value per cycle after main shaft gear (Initial setting)" is set to a value other than 0 to (Cam axis length per cycle - 1). [Operation status at error occurrence] Synchronous control does not start.	Set within the range of 0 to (Cam axis length per cycle - 1).
1E72H	Outside setting method of position value per cycle after auxiliary shaft gear range	The synchronous parameter "[Pr.461] Setting method of position value per cycle after auxiliary shaft gear" is set to a value other than 0 to 2. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 2.
1E73H	Outside position value per cycle after auxiliary shaft gear (Initial setting) range	The synchronous parameter "[Pr.466] Position value per cycle after auxiliary shaft gear (Initial setting)" is set to a value other than 0 to (Cam axis length per cycle - 1). [Operation status at error occurrence] Synchronous control does not start.	Set within the range of 0 to (Cam axis length per cycle - 1).
1E74H	Outside cam axis position restoration object range	The synchronous parameter "[Pr.462] Cam axis position restoration object" is set to other than 0 to 2. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 2.

Error code	Error name	Error details and causes	Remedy
1E75H	Outside setting method of cam reference position range	The synchronous parameter "[Pr.463] Setting method of cam reference position" is set to a value other than 0 to 2. [Operation status at error occurrence] Synchronous control does not start.	Set a value within the range of 0 to 2.
1E76H	Outside setting method of cam axis position value per cycle range	• The synchronous parameter "[Pr.464] Setting method of cam axis position value per cycle" is set to a value other than 0 to 3. • "3: Position value per cycle after auxiliary shaft gear" is established when the auxiliary shaft does not exist. [Operation status at error occurrence] Synchronous control does not start.	• Set a value within the range of 0 to 3. • Set other than "3: Position value per cycle after auxiliary shaft gear" when the auxiliary shaft does not exist.
1E77H	Outside cam axis position value per cycle (Initial setting) range	The synchronous parameter "[Pr.468] Cam axis position value per cycle (Initial setting)" is set to a value other than 0 to (Cam axis length per cycle - 1). [Operation status at error occurrence] Synchronous control does not start.	Set within the range of 0 to (Cam axis length per cycle - 1).
1E78H	Cam axis position value per cycle restoration disable	Cam axis position value per cycle corresponding to the command position value at synchronous control start could not be restored when the synchronous parameter "[Pr.462] Cam axis position restoration object" was "0: Cam axis position value per cycle restoration". (Occurs in reciprocated cam pattern) [Operation status at error occurrence] Synchronous control does not start.	• Start synchronous control after moving the command position value as to fit within the stroke of two-way operation cam pattern. • Set the cam reference position as to fit within the stroke of two-way operation cam pattern.
1E79H	Cam axis command position value restoration disable	Restoration could not be completed when the synchronous parameter "[Pr.462] Cam axis position restoration object" was "2: Cam axis command position value restoration", because the difference between the restored cam axis command position value and the command position value at synchronous control start (pulse command unit) was larger than the servo parameter "Inposition range". [Operation status at error occurrence] Synchronous control does not start.	• Start synchronous control after calculating the cam axis command position value to be restored, using the cam position calculation function, and moving the command position value. • Set a larger setting value for the servo parameter "In-position range", if the current value is extremely small (such as 0).

*1 Errors that do not depend on the axis

Servo amplifier detection error

For details of servo amplifier detection errors, refer to the manual of each servo amplifier.

14.6 Event List

This section lists the events which occur in CC-Link IE TSN.

The three event types are system, security, and operation.

System

Event code	Overview	Cause
0100	Link-up	Link-up has occurred when an external device was connected.
06FD	Master-slave Operation - Axes detection started/completed	• The detection of master-slave operation axes was started. (Detail Code: 0000H) • The detection of master-slave operation axes was completed. (Detail Code: 0001H)
06FE	Home position return request ON	The home position return request is turned ON.
07ED	Velocity Override "0"	The velocity override was set to "0".
07EF	Follow-up temporarily invalid cancellation	Follow-up invalid has been canceled.
07F7	Forced stop detection	Forced stop signal is detection status.
07F8	Event history file creation	Event history file was created.
07F9	Home position return request clear	Home position return request clear is ON.
07FA	Current position change	Current position change was executed.
07FB	Follow-up temporarily invalid	Follow-up was switched to invalid.
07FC	Servo ON when follow-up is invalid	Changed it to servo ON in follow-up invalid status during servo OFF.
07FD	Current position restoration completion	Current position restoration was completed.
0800	Link-down	Link-down occurred when an external device was disconnected.
0906	Alive check error	The alive status of an external device could not be checked within the period specified by the response monitoring timer.
0907	Divided messages receive timeout error	• Sufficient data for the data length could not be received. • Could not receive the rest of the divided message.
0908	IP composition timeout error	Because transient transmission load is high or transient transmission time is not long enough, an IP composition timeout error has occurred. (The remaining part of the divided data could not be received and a timeout has occurred.)
0909	TCP-specified port number error	A port number being used for opened connection was set (for TCP/IP).
090A	UDP-specified port number error	A port number being used for opened connection was set (for UDP/IP).

Security

Event code	Overview	Cause
10200	Remote password lock	The lock processing for a remote password was performed.
10201	Remote password unlock successful	The unlock processing of a remote password was succeeded.
10202	Remote password unlock failed	The unlock processing of a remote password has failed.
10300	Access from IP restricted with IP filter setting	Accessed from IP address restricted with the IP filter setting.

Operation

Event code	Overview	Cause
20300	SD memory card usable	The SD memory card was in usable status.
20301	SD memory card forced stop	The SD memory card was in removable (disabled) status due to SD memory card forced stop function.
27FFE	Software reboot execution	The software reboot was executed.
27FFF	Event history clear	The event history was cleared.

APPENDICES

Appendix 1 Module Label

The functions of the Motion module can be set by using module labels.

Default module label

The names of the default module labels are defined with the following configuration.

■Module label of I/O signals

"Module name"_"[x]"."Label name"_"[ax]"

- "Module name": Indicates the character string of a module model name.
- "[x]": A number starting from 1 for identifying modules with the same module name
- "Label name": Unique label name of a module
- "[ax]": Indicates the axis No. corresponding to the module label. A numerical value from 0 to 15 is used for [ax] according to the axes from 1 to 16.

■Module label of buffer memory areas

"Module name"_"[x]"."Data type"_"_D[ax]"."Label name"_"D"

- "Module name": Indicates the character string of a module model name.
- "[x]": A number starting from 1 for identifying modules with the same module name
- "Data type": Indicates the classification of a buffer memory area.
- "[ax]": Indicates the axis No. corresponding to the module label. A numerical value from 0 to 15 is used for [ax] according to the axes from 1 to 16.
- "Label name": Unique label name of a module
- "D": Indicates whether the module label is for auto refresh or direct access. For direct access, "_D" is added after the label name and in the "[ax]" part. The following shows the differences between auto refresh and direct access.

Type	Description	Access timing
Auto refresh	Reading/writing data from/to the module label is reflected to the Motion module at auto refresh. The execution time of a program can be shortened. To use auto refresh, "Refresh Destination" must be set to "Module Label" in "Refresh Setting" of "Module Parameter".	At auto refresh
Direct access	Reading/writing data from/to the module label is reflected to the Motion module immediately. The execution time is longer than the one at auto refresh, however, the responsiveness becomes high.	At reading/writing data from/to the module label

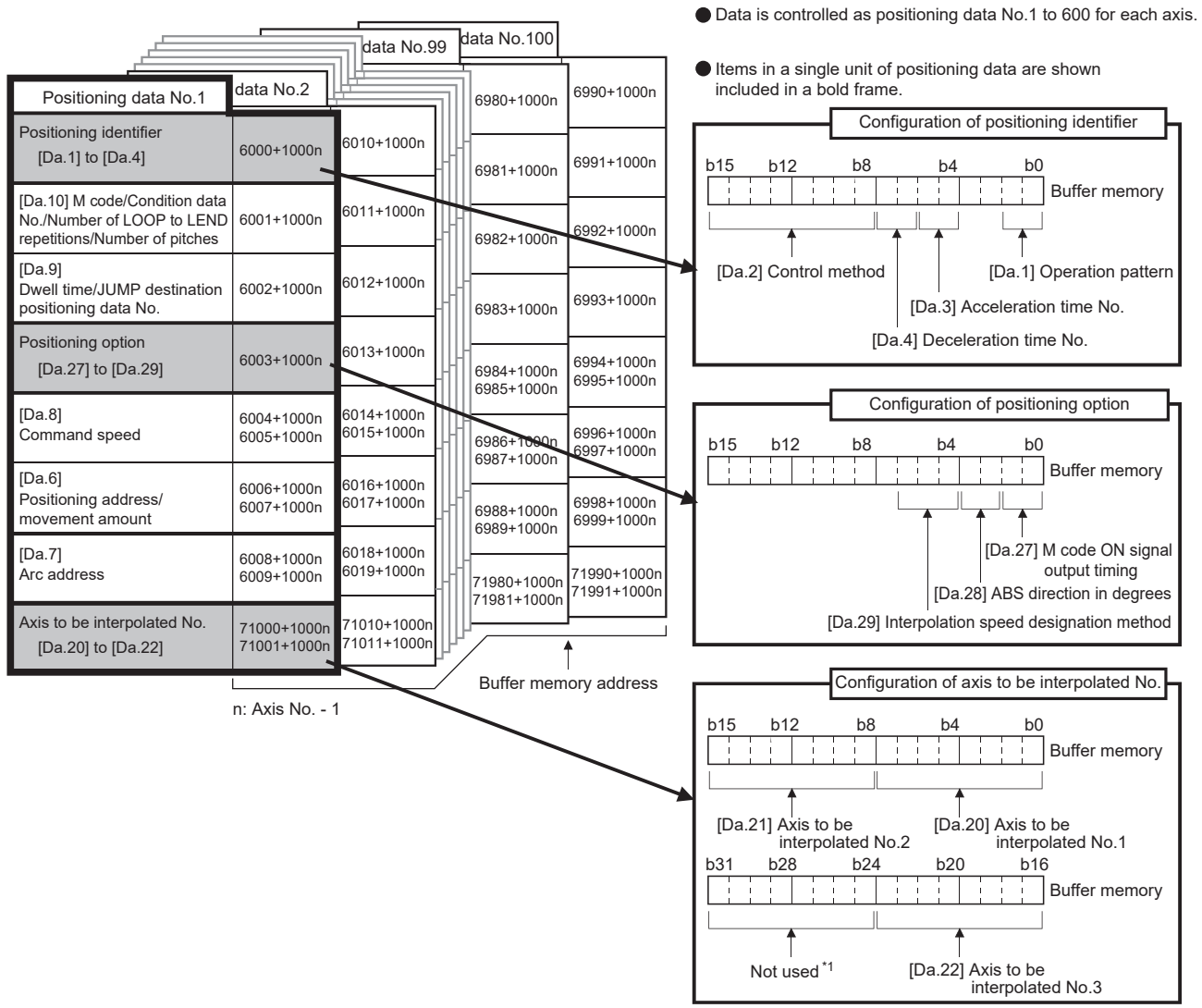
A

Appendix 2 How to Determine Buffer Memory Addresses

This section describes how to determine the buffer memory addresses of positioning data, block start data, and condition data.

Positioning data

Positioning data has the following structure.



*1 Always set "0" to the part not used.

When setting positioning data using a program, determine buffer memory addresses using the following calculation formula and set the addresses.

- $6000^{*1} + (1000 \times (Ax - 1)) + 10 \times (N - 1) + S$

*1 The value is 71000 when setting [Da.20] to [Da.22].

For each variable, substitute a number following the description below.

Variable	Description
Ax	The axis No. of the buffer memory address to be determined. Substitute a number from 1 to 16.
N	The positioning data No. of the buffer memory address to be determined. Substitute a number from 1 to 600.
S	Substitute one of the following numbers according to the buffer memory address to be determined. • Positioning identifier ([Da.1] to [Da.4], [Da.20] to [Da.22]): 0 • [Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches: 1 • [Da.9] Dwell time/JUMP destination positioning data No.: 2 • Positioning option ([Da.27] to [Da.29]): 3 • [Da.8] Command speed (lower 16 bits): 4 • [Da.8] Command speed (upper 16 bits): 5 • [Da.6] Positioning address/movement amount (lower 16 bits): 6 • [Da.6] Positioning address/movement amount (upper 16 bits): 7 • [Da.7] Arc address (lower 16 bits): 8 • [Da.7] Arc address (upper 16 bits): 9

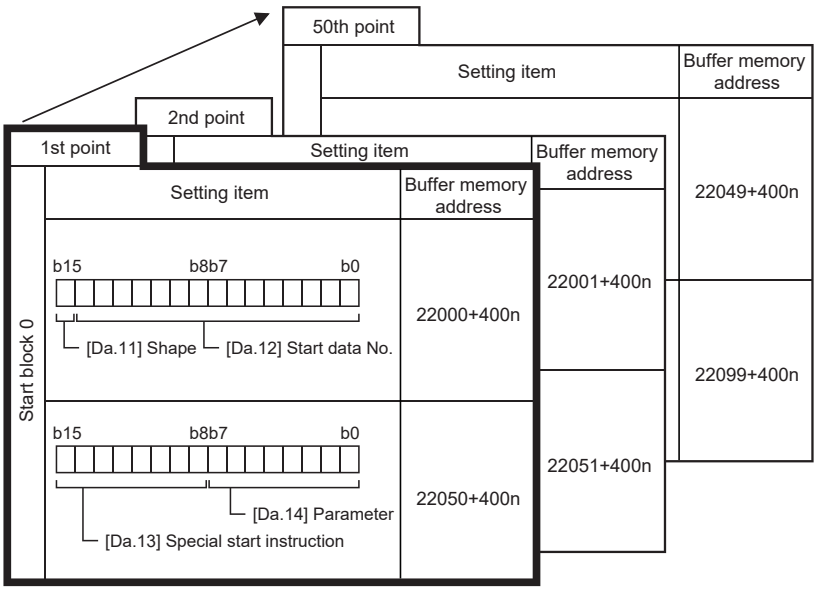
Ex.

When the buffer memory address of "[Da.9] Dwell time/JUMP destination positioning data No." of the positioning data No.1 of axis 2 is determined

6000 + (1000 × (2 - 1)) + 10 × (1 - 1) + 2 = 7002

Block start data

Block start data consists of five start blocks from Start block 0 to 4, and the block start data of 1 to 50 points is assigned to each block. The start blocks are assigned to each axis. Block start data has the following structure.



- Up to 50 block start data points can be set (stored) for each axis in the buffer memory addresses shown on the left.
- Items in a single unit of block start data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).

n: Axis No. - 1

When setting block start data using a program, determine buffer memory addresses using the following calculation formula and set the addresses.

■[Da.11] Shape, [Da.12] Start data No.

Use the following calculation formula.

• 22000 + (400 × (Ax - 1)) + (200 × M) + (P - 1)

For each variable, substitute a number following the description below.

Variable	Description
Ax	The axis No. of the buffer memory address to be determined. Substitute a number from 1 to 16.
M	The start block No. of the buffer memory address to be determined. Substitute a number from 0 to 4.
P	The block start data point of the buffer memory address to be determined. Substitute a number from 1 to 50.

Ex.

When the buffer memory address that satisfies the following conditions is determined

• Axis 3

• Start block No.2

• Block start data point: 40

22000 + (400 × (3 - 1)) + (200 × 2) + (40 - 1) = 23239

■[Da.13] Special start instruction, [Da.14] Parameter

Use the following calculation formula.

• 22050 + (400 × (Ax - 1)) + (200 × M) + (P - 1)

For each variable, substitute a number following the description below.

Variable	Description
Ax	The axis No. of the buffer memory address to be determined. Substitute a number from 1 to 16.
M	The start block No. of the buffer memory address to be determined. Substitute a number from 0 to 4.
P	The block start data point of the buffer memory address to be determined. Substitute a number from 1 to 50.

Ex.

When the buffer memory address that satisfies the following conditions is determined

• Axis 2

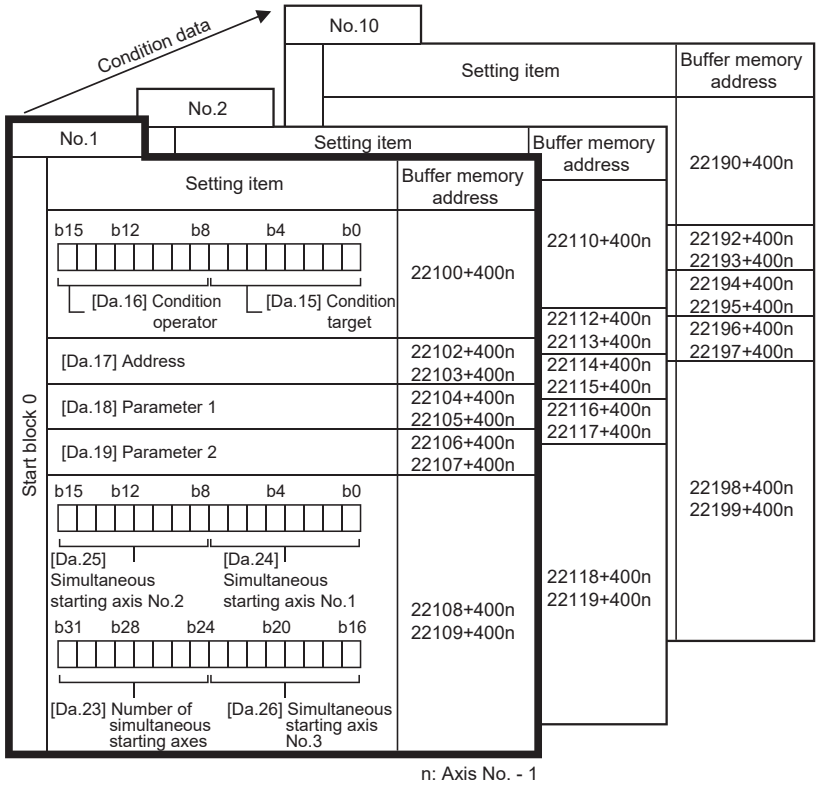
• Start block No.1

• Block start data point: 25

22050 + (400 × (2 - 1)) + (200 × 1) + (25 - 1) = 22674

Condition data

Condition data consists of five start blocks from Start block 0 to 4, and the condition data No.1 to 10 are assigned to each block. The start blocks are assigned to each axis. Condition data has the following structure.



- Up to 10 condition data points can be set (stored) for each block No. in the buffer memory addresses shown on the left.
- Items in a single unit of condition data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).

n: Axis No. - 1

When setting block start data using a program, determine buffer memory addresses using the following calculation formula and set the addresses.

- 22100 + (400 × (Ax - 1)) + (200 × M) + (10 × (Q - 1)) + R

For each variable, substitute a number following the description below.

Variable	Description
Ax	The axis No. of the buffer memory address to be determined. Substitute a number from 1 to 16.
M	The start block No. of the buffer memory address to be determined. Substitute a number from 0 to 4.
Q	The condition data No. of the buffer memory address to be determined. Substitute a number from 1 to 10.
R	Substitute one of the following numbers according to the buffer memory address to be determined. • [Da.15] Condition target: 0 • [Da.16] Condition operator: 0 • [Da.17] Address (lower 16 bits): 2 • [Da.17] Address (upper 16 bits): 3 • [Da.18] Parameter 1 (lower 16 bits): 4 • [Da.18] Parameter 1 (upper 16 bits): 5 • [Da.19] Parameter 2 (lower 16 bits): 6 • [Da.19] Parameter 2 (upper 16 bits): 7 • [Da.23] to [Da.26] Simultaneous starting axis (lower 16 bits): 8 • [Da.23] to [Da.26] Simultaneous starting axis (upper 16 bits): 9

Ex.

When the buffer memory address that satisfies the following conditions is determined

- Axis 4
- Start block No.3
- Condition data No.5
- [Da.19] Parameter 2 (lower 16 bits)

22100 + (400 × (4 - 1)) + (200 × 3) + (10 × (5 - 1)) + 6 = 23946

Appendix 3 Devices Compatible with CC-Link IE TSN

MR-J5(W)-G (cyclic synchronous mode) connection method

This section describes how to configure settings when connecting MR-J5(W)-G in the cyclic synchronous mode (csp, csv, and cst) and use various functions.

For details of wiring and parameters of MR-J5(W)-G, refer to the MR-J5(W)-G manuals.

Setting method

■Parameter setting value for using MR-J5(W)-G

To perform motion control with MR-J5(W)-G, set the parameters of MR-J5(W)-G as shown below.

When the parameters are not set as shown below, "Servo parameter invalid" (error code: 1DC8H) occurs and the values will be overwritten from the controller.

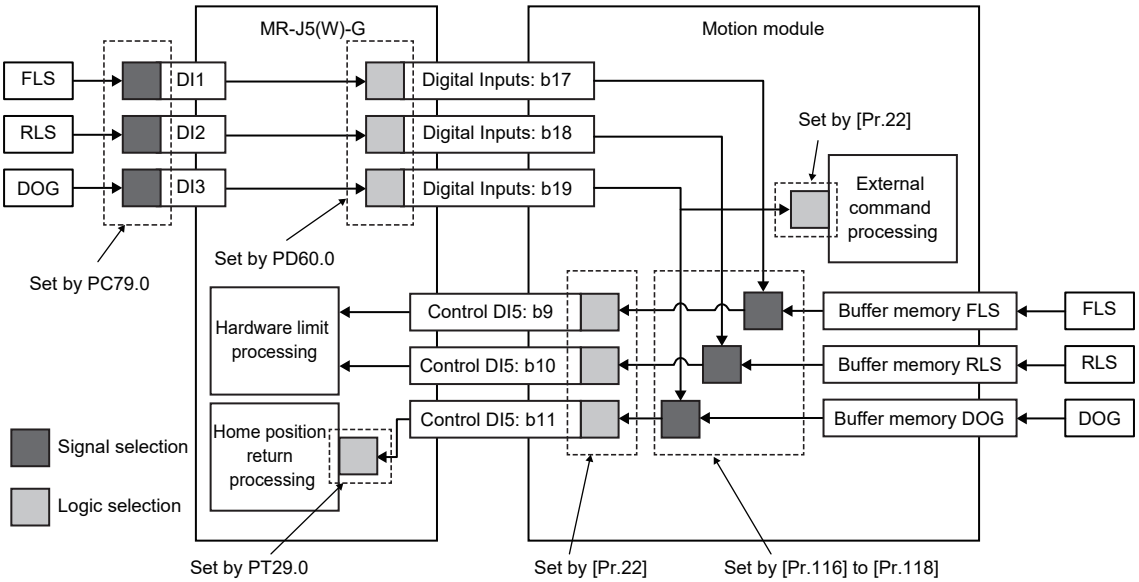
No.	Name	Default value	Setting value
PA06	Electronic gear numerator*1	1	• When the servo motor resolution is 26 bits: 16 (such as the rotary servo motor HK series) • When the servo motor resolution is other than 26 bits: 1
PA07	Electronic gear denominator*1	1	1
PC79.0	DI status read selection*1	0h	Eh
PD41.2	Limit switch enabled status selection*1	0h	1h: Enabled only in the home position return mode
PD41.3	Sensor input method selection*1	0h	1h: Input from controller (FLS/RLS/DOG)
PD60	DI pin polarity selection*1	00000000h	00000000h
PT01.1	Speed/acceleration/deceleration unit selection*2	0h	0h
PT08	Home position return position data*1	0	0h
PT15	Software position limit +	0	0
PT17	Software position limit -	0	0
PT29.0	Device input polarity 1*1	0h	1h: Dog detection with ON status

*1 The parameter is enabled after restarting the Motion module or MR-J5(W)-G.

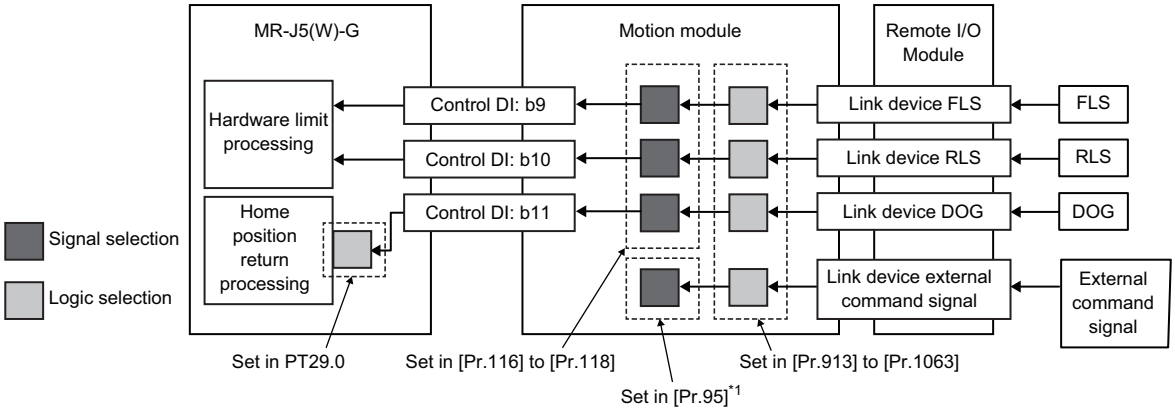
*2 The parameter is enabled after restarting the MR-J5(W)-G.

The setting contents of the servo parameters are shown below.

• External input signal from servo amplifier and buffer memory



• Link device external signal



*1 No setting is required when the link device external command signal is used as a main shaft/auxiliary shaft clutch control request.

A

Set the following values for the signal logic selection of the servo amplifier.

No.	Name	Default value	Setting value
PC79.0	DI status read selection	0h	Eh: The supported pin No. is shown below. bit1: Returns the ON/OFF status of the DI1 pin. bit2: Returns the ON/OFF status of the DI2 pin. bit3: Returns the ON/OFF status of the DI3 pin.
PD60.0	DI pin polarity selection	0h	0h: The supported pin No. is shown below. bit0: DI pin polarity selection 1 (Turns on with 24 V input) bit1: DI pin polarity selection 2 (Turns on with 24 V input) bit2: DI pin polarity selection 3 (Turns on with 24 V input)
PT29.0	Device input polarity 1	0h	1h: Dog detection with ON status

When "[Pr.118] DOG signal selection" is set to "1: Servo amplifier", the DOG signal is returned at the timing of home position return, and the detection accuracy of the DOG signal may vary compared to a case where the DOG signal is directly detected by the servo amplifier due to communication.
If the detection position accuracy is poor, adjust servo parameters such as "Home position return position data (PT08)" and "Movement amount after proximity dog (PT09)" to values that take into account the delay in the communication cycle.
In addition, the variety becomes larger when the communication cycle is long.

■Network parameter setting for using MR-J5(W)-G

When connecting MR-J5(W)-G in cyclic synchronous mode, select the Motion control station in the network configuration settings.

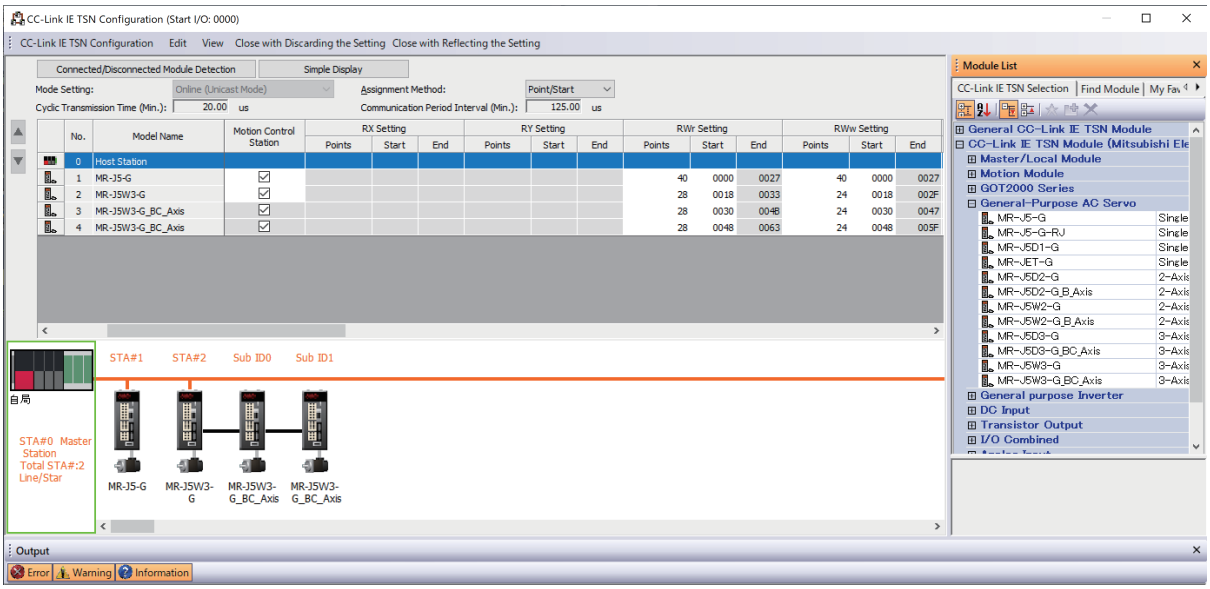
Precautions

• When setting parameters in GX Works3 version 1.085P or later

Configure the RWr points and RWw points of the device station selected as the Motion control station as follows. Set the start/end of RWr and RWw manually or use the Device No. Reassignment function so that the link device assignment does not overlap.

Servo amplifier	RWr points	RWw points
Multi-axis servo amplifier	28 points	24 points
Single axis servo amplifier	40 points	40 points

The following shows a network configuration setting example for connecting MR-J5-G and MR-J5W3-G in cyclic synchronous mode.



■PDO mapping for using MR-J5(W)-G

When operation is performed with the motion control station, the PDO mapping setting is not required because the Motion module performs assignment automatically.

The following tables show the mapping patterns when operation is performed with the motion control station.

• TPDO mapping

Entry No.	Index	Sub Index	Size [bit]	Entry name	Remarks
1	0x1D02	0x01	16	Watchdog counter UL 1	Basic function area (fixed)
2	0x6061	0x00	8	Modes of operation display	
3	0x0000	0x00	8	GAP	
4	0x6064	0x00	32	Position actual value	
5	0x606C	0x00	32	Velocity actual value	
6	0x60F4	0x00	32	Following error actual value	
7	0x6041	0x00	16	Statusword	
8	0x0000	0x00	16	GAP	
9	0x6077	0x00	16	Torque actual value	
10	0x2D11	0x00	16	Status DO 1	
11	0x2D12	0x00	16	Status DO 2	
12	0x2D13	0x00	16	Status DO 3	
13	0x2D14	0x00	16	Status DO 4	
14	0x2D15	0x00	16	Status DO 5	
15	0x2A41	0x00	32	Current alarm	
16	0x2D21	0x00	32	Reserved	
17	0x2D22	0x00	16	Reserved	
18	0x60FD	0x00	32	Digital inputs	
19	0x2B08	0x00	16	Regenerative load ratio	Optional data monitor area (When the optional data monitor setting is set to the default)*1
20	0x2B09	0x00	16	Effective load ratio	
21	0x2B0A	0x00	16	Peak load ratio	
22	0x0000	0x00	16	GAP	
23	0x2D37	0x00	32	Scale ABS counter	Synchronous encoder via servo amplifier area*2
24	0x2D36	0x00	32	Scale cycle counter	
25	0x2D3C	0x00	32	Scale measurement encoder reception status	
26	0x60B9	0x00	16	Touch probe status	High-accuracy mark detection area*2
27	0x60D1	0x00	32	Touch probe time stamp 1 positive value	
28	0x60D2	0x00	32	Touch probe time stamp 1 negative value	

*1 The mapping changes according to the settings of "[Pr.91] Optional data monitor: Data type setting 1" to "[Pr.94] Optional data monitor: Data type setting 4" and "[Pr.591] Optional data monitor: Data type expansion setting 1" to "[Pr.594] Optional data monitor: Data type expansion setting 4".

*2 It becomes GAP when a single axis servo amplifier (MR-J5-G) is used and the function is not used. In the case of multi-axis servo amplifier (MR-J5W-G or MR-J5D-G (except for MR-J5D1-G)), it is not assigned.

• RPDO mapping

Entry No.	Index	Sub Index	Size [bit]	Entry name	Remarks
1	0x1D01	0x01	16	Watchdog counter DL 1	Basic function area (fixed)
2	0x6060	0x00	8	Modes of operation	
3	0x0000	0x00	8	GAP	
4	0x607A	0x00	32	Target position	
5	0x60FF	0x00	32	Target velocity	
6	0x6040	0x00	16	Controlword	
7	0x60E0	0x00	16	Positive torque limit value	
8	0x60E1	0x00	16	Negative torque limit value	
9	0x6071	0x00	16	Target torque	
10	0x2D20	0x00	32	Velocity limit value	
11	0x2D01	0x00	16	Control DI 1	
12	0x2D02	0x00	16	Control DI 2	
13	0x2D03	0x00	16	Control DI 3	
14	0x2D04	0x00	16	Control DI 4	
15	0x2D05	0x00	16	Control DI 5	

Precautions

- When connecting the Motion module to the MR-J5(W)-G series, use the software version B2 or later for the servo amplifier. If a software version earlier than B2 is used, connection may not be established correctly.
- Set "Network Synchronous Communication" to "Asynchronous". The setting value is ignored when "Synchronous" is set.
- When the parameter automatic setting is enabled in the network configuration settings on GX Works3, if the parameters are changed for multiple stations simultaneously in the communication of MR Configurator 2, the changed parameters may not be applied on the CPU module depending on the communication load status. Change one station at a time. Or, start MR Configurator2 via GX Works3, change the parameters, and write the project to the CPU module.
- Motion control cannot be performed unless the same IP address as the motion control station set in the network configuration settings is set in "[Pr.141] IP address". Review the parameter settings.
- If an operation cycle over occurs in the Motion module during motor operation and the commands before the operation cycle over and after a restoration greatly differ, the servo alarm [AL.035_Command frequency error] may be detected in MR-J5(W)-G. Increase the operation cycle or review the program to decrease the load if necessary.
- In the "Encoder position during rotation" displayed when monitoring the current position history, the value equal to the multiplied inverse number of the electronic gear ratio of the servo amplifier (the command unit) is displayed.
- Match the current network configuration setting to the actual system configuration. If there is a difference, the Motion module may not be able to recognize device stations correctly. When disabling any of the axes with the "control axis disable switch function" of a multi-axis servo amplifier, configure the following settings for the disabled axis. Otherwise, the Motion module may not be able to recognize device stations correctly.

  • Set "[Pr.141] IP address" and "[Pr.142] Multidrop number" to the IP address and multidrop number of the disabled axis.
  • Set "[Pr.101] Virtual servo amplifier setting" to "1: Use as virtual servo amplifier".

- Do not assign MR-J5(W)-G which is set to CC-Link IE TSN Class A to any axis. Doing so causes [AL.19E.2_Control mode setting warning 2] in MR-J5(W)-G during connection.

MR-J5(W)-G (other than cyclic synchronous mode) connection method

This section describes how to configure settings when connecting MR-J5(W)-G in a mode other than the cyclic synchronous mode and use various functions. For details of wiring and parameters of MR-J5(W)-G, refer to the MR-J5(W)-G manuals.

For network settings, refer to "PARAMETER SETTINGS" in the following manual.

MELSEC iQ-R Motion Module User's Manual (Network)

The firmware of MR-J5(W)-G that can be used in modes other than the cyclic synchronous mode is as follows.

Model name	Mode	Version
MR-J5(W)-G	Profile mode	A4 or later
	Point table mode	B8 or later

Setting method

An example using two stations for MR-J5(W)-G is shown below. In this example, the 1st station (192.168.3.1) uses the cyclic synchronous mode and the 2nd station (192.168.3.2) uses a mode other than the cyclic synchronous mode.

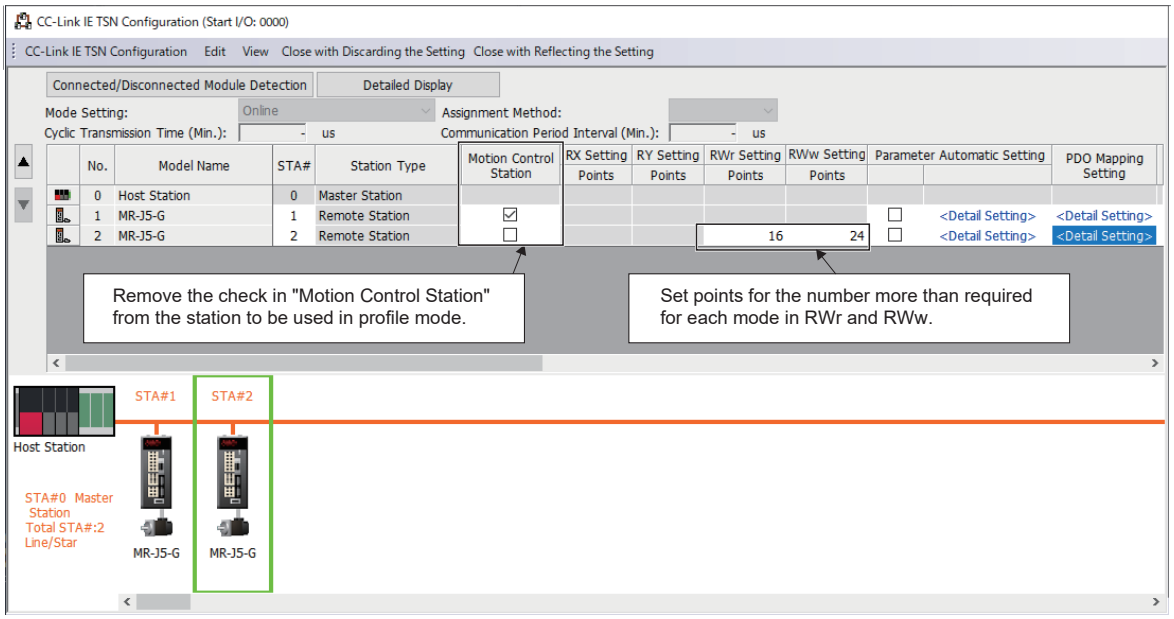
■CPU setting [GX Works3]

1. Set "Motion Control Station", "RWr Setting", and "RWw Setting".

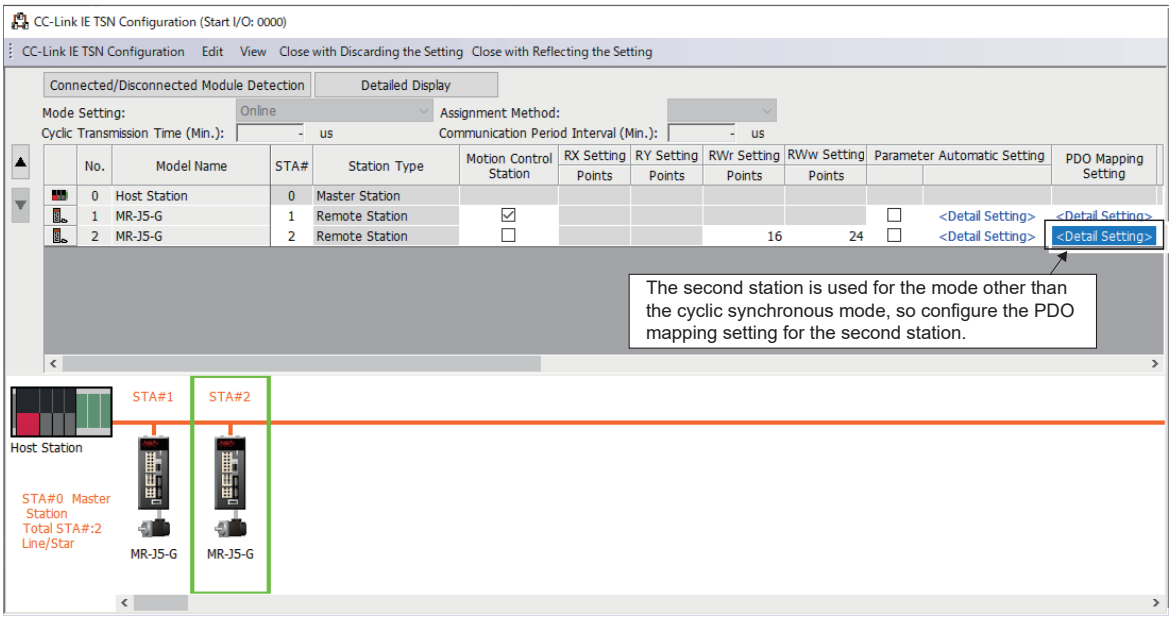
Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Target module ⇨ [Module Parameter (Network)] ⇨ [Basic Settings] ⇨ [Network Configuration Settings]

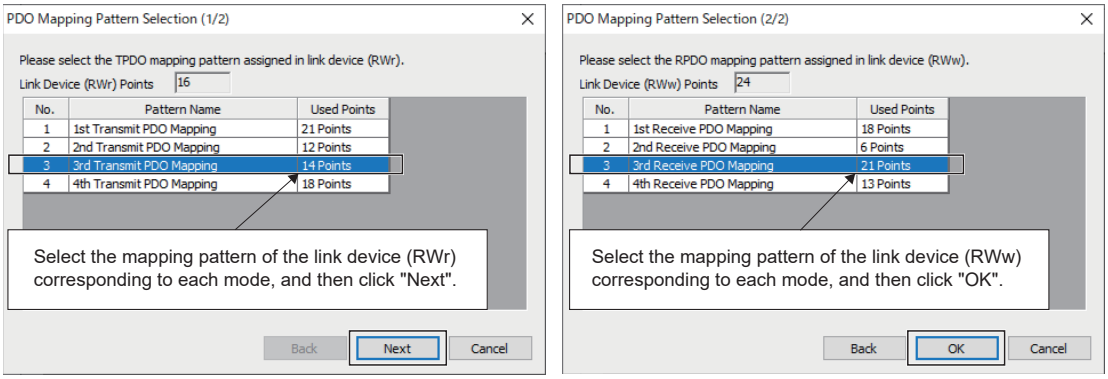
Points of Rwr and RWw required for each mode are as follows.

Mode	RWr	RWw
Profile mode	14 points or more	21 points or more
Point table mode	18 points or more	13 points or more



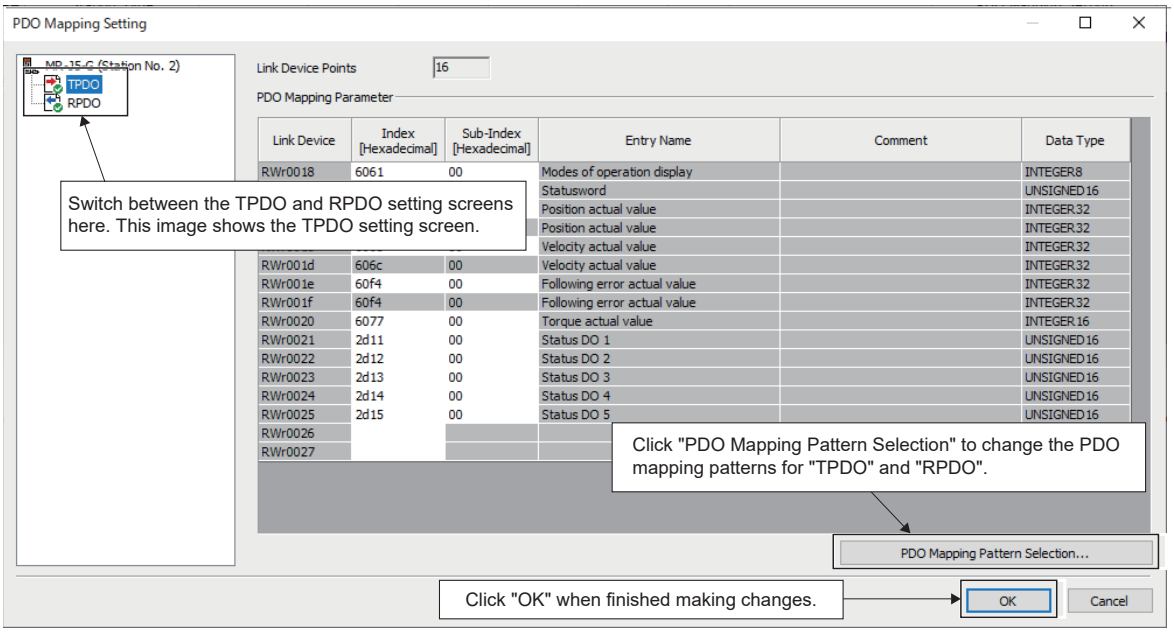
2. Set the PDO mapping pattern selection for the station to be used in a mode other than the cyclic synchronous mode in "Detail Setting" of "PDO Mapping Setting".





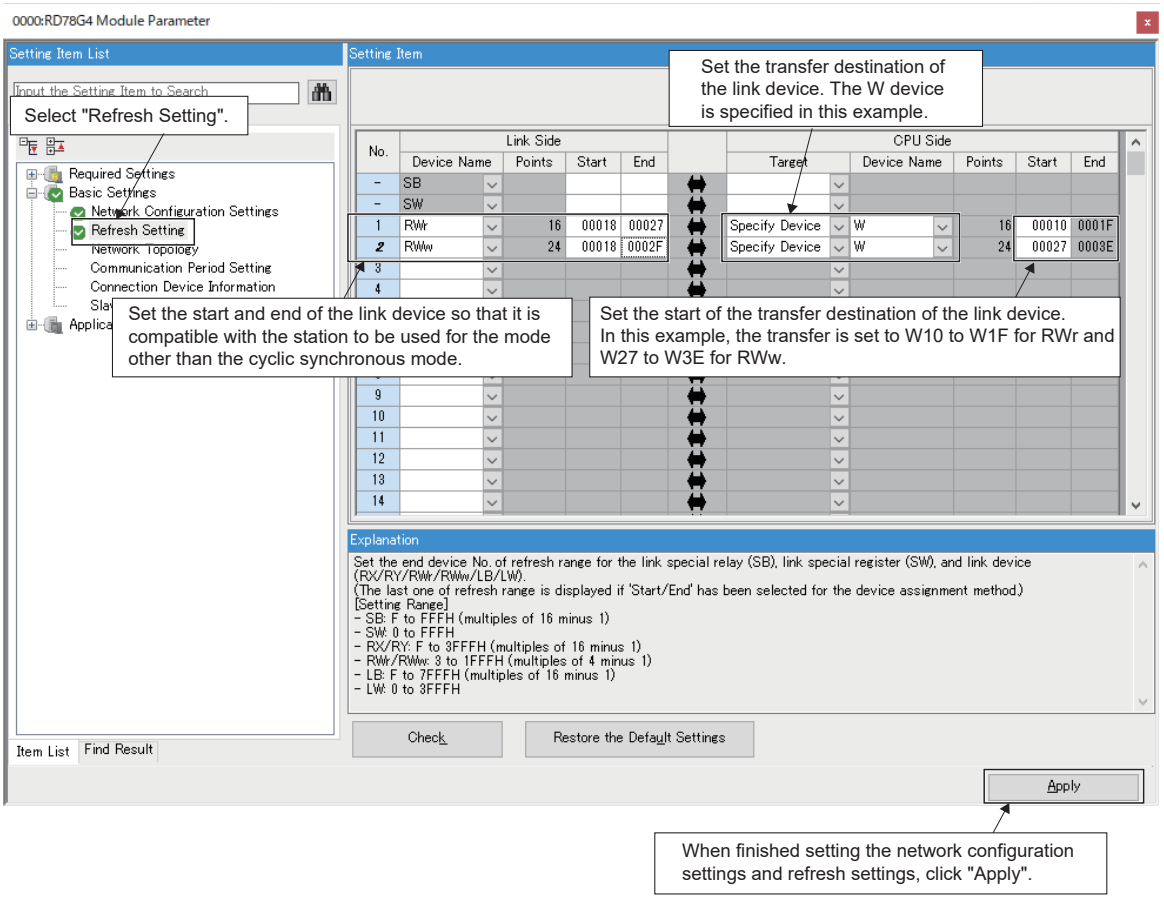
The settings for the mapping patterns corresponding to each mode are as follows.

Mode	RWr	RWw
Profile mode	[No.3] 3rd Transmit PDO Mapping	[No.3] 3rd Receive PDO Mapping
Point table mode	[No.4] 4th Transmit PDO Mapping	[No.4] 4th Receive PDO Mapping



3. Set the transfer ranges between the link device and the CPU module device of the station for which a mode other than cyclic synchronous mode is set.

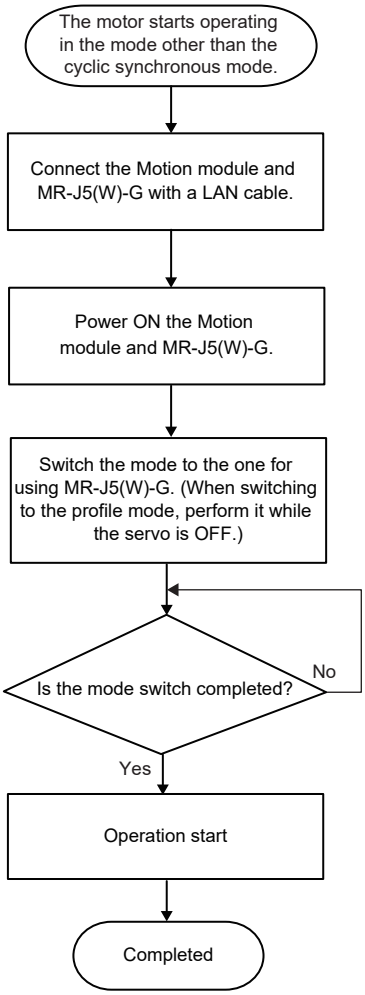
Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Target module ⇨ [Module Parameter (Network)] ⇨ [Basic Settings] ⇨ [Refresh Setting]



4. To perform control in a mode other than the cyclic synchronous mode, operate the link device corresponding to each object.

Application

The following figure describes the process for driving a motor in a mode other than the cyclic synchronous mode.



Change the link device to which Modes of operation is assigned from the program or watch and change the mode to the one for using MR-J5(W)-G. For details of the setting value, refer to the manual of MR-J5(W)-G.
(Example: When changing to the pp mode, set the link device that is corresponding to Modes of operation to "1".)

Refer to Modes of operation display and confirm that the control mode of MR-J5(W)-G has been switched.

Precautions

- Do not execute servo-on before switching to the profile mode. An improper operation, such as sudden acceleration of the motors, may occur.
- Do not switch the mode to the cyclic synchronous mode after switching to the profile mode. An improper operation, such as sudden acceleration of the motors, may occur.
- When using in a mode other than the cyclic synchronous mode, the Motion module does not perform operations such as limit check of a command or issuance of a forced stop command. Take safety measures at the user's program or MR-J5(W)-G side.
- When the parameter automatic setting is enabled in the network configuration settings on GX Works3, if the parameters are changed for multiple stations simultaneously in the communication of MR Configurator 2, the changed parameters may not be applied on the CPU module depending on the communication load status. Change one station at a time. Or, start MR Configurator2 via GX Works3, change the parameters, and write the project to the CPU module.
- Do not set the axes that are used in the profile mode. If set, an error occurs.

MR-JET-G connection method

This section describes how to configure settings when connecting MR-JET-G and use various functions.
For details of wiring and parameters of MR-JET-G, refer to the MR-JET-G manuals.

Parameter setting value for using MR-JET-G

To perform motion control with MR-JET-G, set the parameters of MR-JET-G as shown below.
When the parameters are not set as shown below, "Servo parameter invalid" (error code: 1DC8H) occurs and the values will be overwritten from the controller.

No.	Name	Default value	Setting value
PA06	Electronic gear numerator*1	1	1
PA07	Electronic gear denominator*1	1	1
PD41.3	Sensor input method selection*1	0h	1h: Input from controller (FLS/RLS/DOG)
PD60	DI pin polarity selection*1	00000000h	00000000h
PT01.1	Speed/acceleration/deceleration unit selection*2	0h	0h
PT15	Software position limit +	0	0
PT17	Software position limit -	0	0
PT29.0	Device input polarity 1*1	0h	1h: Dog detection with ON status

*1 The parameter is enabled after restarting the Motion module or MR-JET-G.
*2 The parameter is enabled after restarting the MR-JET-G.

PDO mapping for using MR-JET-G

When operation is performed with the motion control station, the PDO mapping setting is not required because the Motion module performs assignment automatically.
Details of the mapping are the same as MR-J5(W)-G (cyclic synchronous mode).

Precautions

- In the MR-JET-G functions related to the Motion module, the MR-JET-G does not support the following function. For details, refer to the manual of the servo amplifier.

  • Scale measurement function

- When the parameter automatic setting is enabled in the network configuration settings on GX Works3, if the parameters are changed for multiple stations simultaneously in the communication of MR Configurator 2, the changed parameters may not be applied on the CPU module depending on the communication load status. Change one station at a time. Or, start MR Configurator2 via GX Works3, change the parameters, and write the project to the CPU module.
- Motion control cannot be performed unless the same IP address as the motion control station set in the network configuration settings is set in "[Pr.141] IP address". Review the parameter settings.
- If an operation cycle over occurs in the Motion module during motor operation and the commands before the operation cycle over and after a restoration greatly differ, the servo alarm [AL.035_Command frequency error] may be detected in MR-JET-G. Increase the operation cycle or review the program to decrease the load if necessary.

Related function

Safety communication

The safety CPU modules and firmware of MR-J5-G-RJ that can be used for safe communications in combination with the Motion module are as follows.

Model name	Version
RnSFCPU	R08SFCPU/R16SFCPU/R32SFCPU/R120SFCPU: 20 or later
MR-J5-G-RJ	B2 or later For details, refer to the following. MR-J5-G/MR-J5W-G User's Manual (Introduction)
MR-J5D-G	C0 or later For details, refer to the following. MR-J5D-G User's Manual (Introduction)

■Precautions on safety communications with MR-J5-G-RJ

- When performing safety communication with the MR-J5-G-RJ, the servo warning [AL. 5E2.1_Secure communication unconnected warning A (Safety monitoring function)] or [AL. 5E2.9_Secure communication unconnected warning B (Safety monitoring function)] occurs on the driver until the safety communication is established, and "Driver warning" (warning code: 0EC0H) is detected on the motion system at the time of connection. If a warning is referenced as a program execution condition, perform an error reset after the connection.
- The functional safety parameters cannot be distributed by the parameter automatic setting because they must be read and confirmed that they are set as intended after setting. Use MR Configurator2 for setting. For the setting procedure, refer to the following.
  For MR-J5(W)-G: MR-J5 User's Manual (Function)

Driver communication

The following provides an example for driver communication.

For the setting procedure, refer to the following.

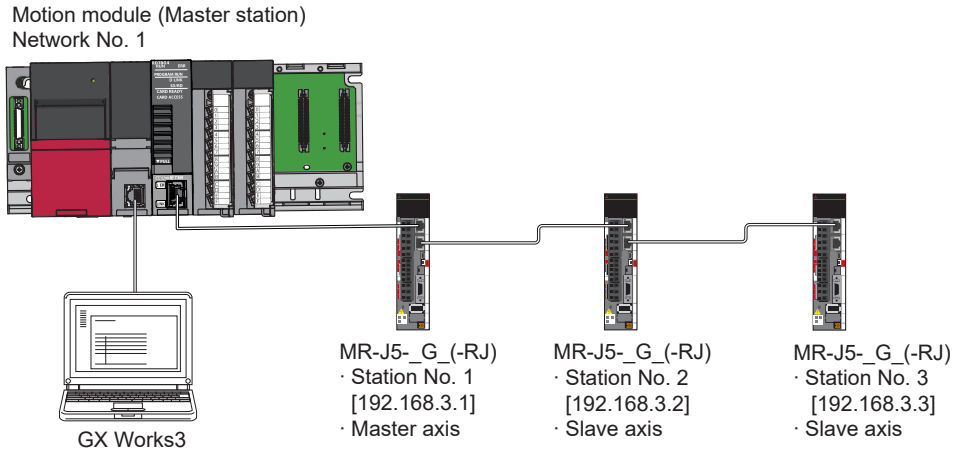
☞ Page 356 Setting method

■Setting example

- Setting method of MR-J5-_G_(-RJ)

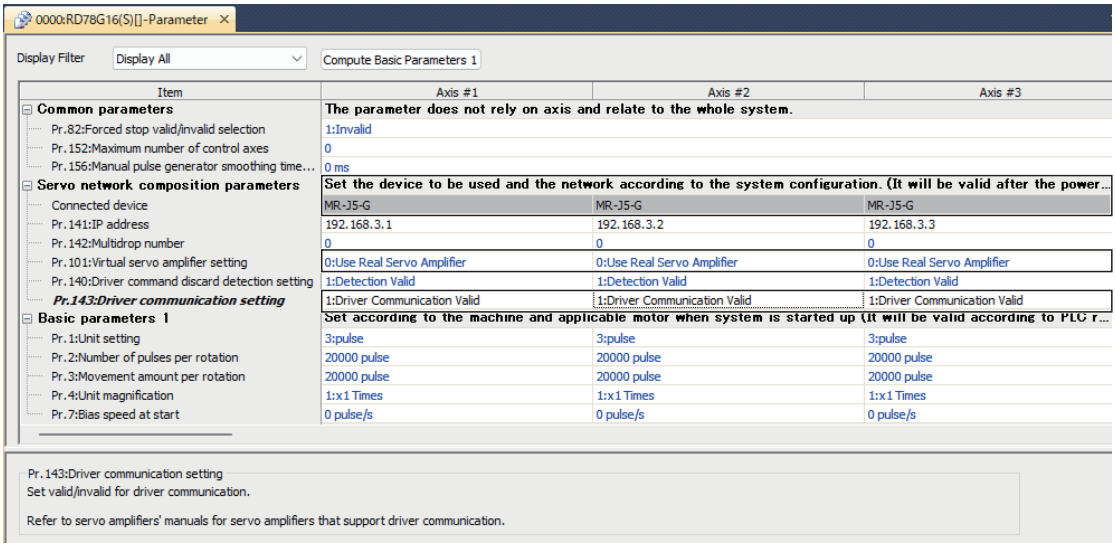
The following provides an example of the system configuration below.

<System configuration example>



<Simple Motion module setting>

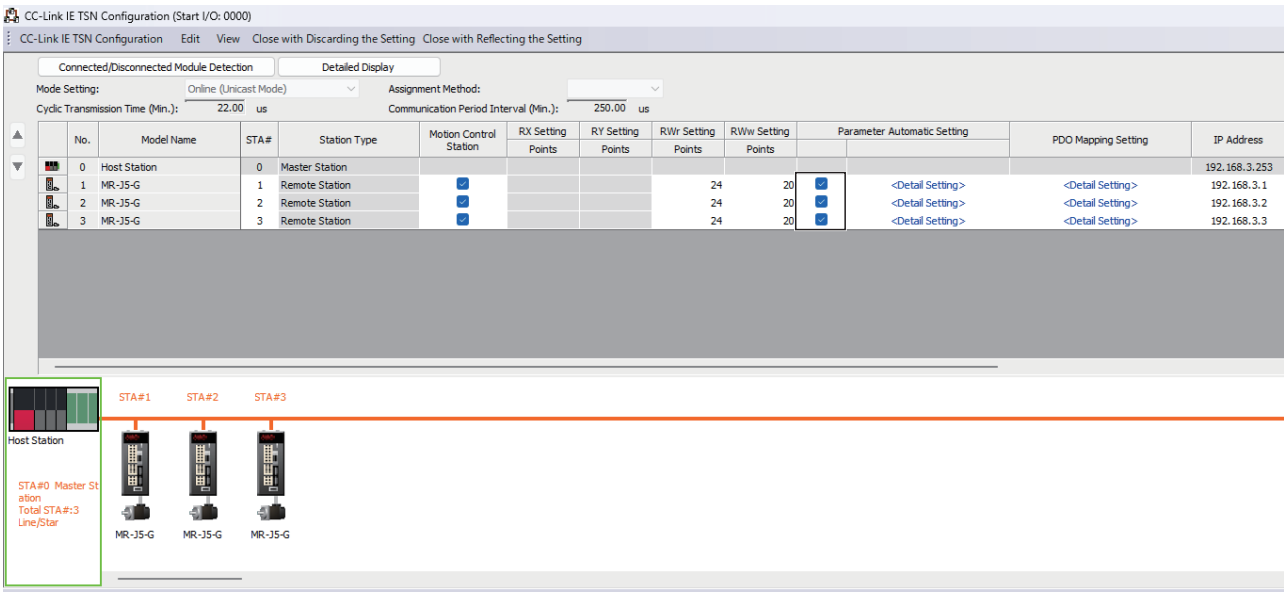
Select the MR-J5-_G_(-RJ) that supports driver communication and set "1: Driver communication enabled" for the axes to be specified as the master axis and slave axis. In addition, set "0: Use for the actual servo amplifier".



<Network configuration setting>

Select "Motion Control Station" and "Parameter Automatic Setting" check boxes for the stations specified as the master axis and slave axis.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Target module ⇨ [Module Parameter (Network)] ⇨ [Basic Settings] ⇨ [Network Configuration Settings] ⇨ <Detail Settings>



<Servo parameter setting>

Select the "Parameter Automatic Setting" check boxes for the stations specified as the master axis and slave axis.

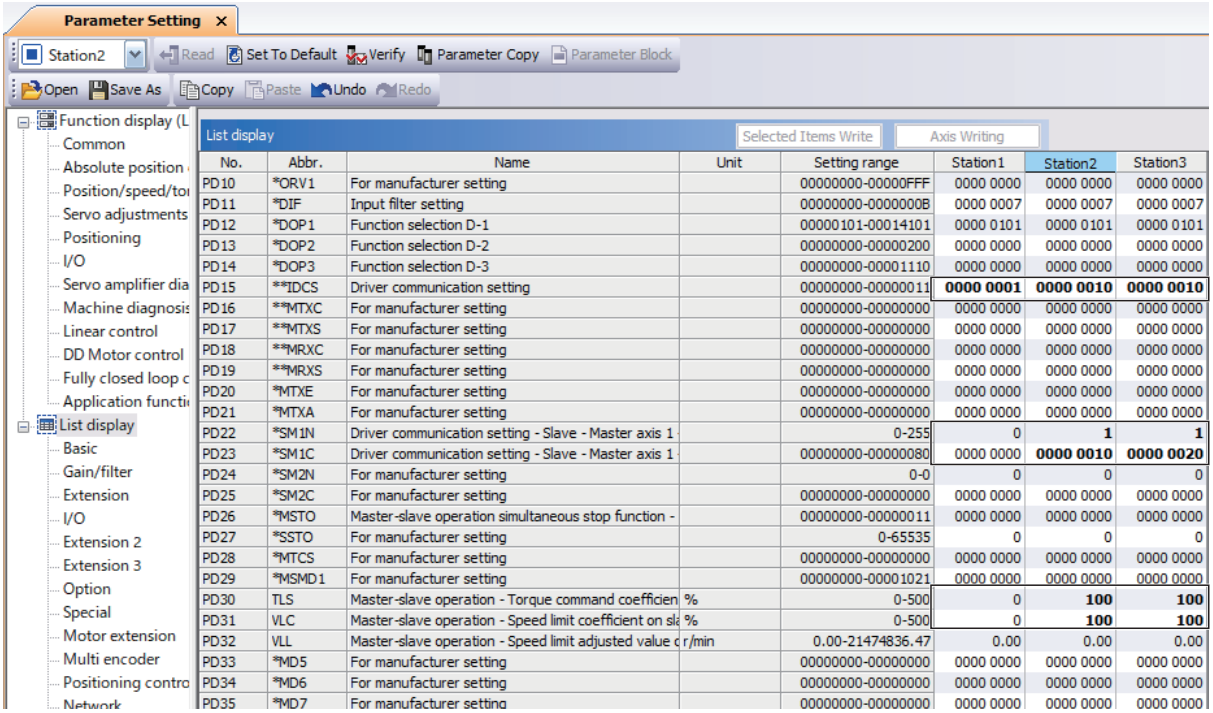
☞ Page 357 Details of servo parameters

Set as follows for this configuration example as follows.

No.	Parameter name	Station 1	Station 2	Station 3
[PD15.0]	Master axis operation selection	1: Valid	0: Invalid	0: Invalid
[PD15.1]	Slave axis operation selection	0: Invalid	1: Valid	1: Valid
[PD22]	Driver communication setting - Slave - Master axis 1 - Station No. setting	0	1	1
[PD23.1]	Driver communication setting - Slave - Master axis 1 - Control slave axis No. setting	0	1	2
[PD30]	Master-slave operation - Slave-side torque command coefficient	0	100*1	100*1
[PD31]	Master-slave operation - Slave-side speed limit coefficient	0	100*1	100*1

*1 This setting should be in accordance with the environment in which you will use the product.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Target module ⇨ [Module Parameter (Network)] ⇨ [Basic Settings] ⇨ [Network Configuration Settings] ⇨ <Detail Settings>



No.	Abbr.	Name	Unit	Setting range	Station1	Station2	Station3
PD10	*ORV1	For manufacturer setting		00000000-00000FFF	0000 0000	0000 0000	0000 0000
PD11	*DIF	Input filter setting		00000000-0000000B	0000 0007	0000 0007	0000 0007
PD12	*DOP1	Function selection D-1		00000101-00014101	0000 0101	0000 0101	0000 0101
PD13	*DOP2	Function selection D-2		00000000-00000200	0000 0000	0000 0000	0000 0000
PD14	*DOP3	Function selection D-3		00000000-00001110	0000 0000	0000 0000	0000 0000
PD15	**IDCS	Driver communication setting		00000000-00000011	**0000 0001**	**0000 0010**	**0000 0010**
PD16	**MTXC	For manufacturer setting		00000000-00000000	0000 0000	0000 0000	0000 0000
PD17	**MTXS	For manufacturer setting		00000000-00000000	0000 0000	0000 0000	0000 0000
PD18	**MRXC	For manufacturer setting		00000000-00000000	0000 0000	0000 0000	0000 0000
PD19	**MRXS	For manufacturer setting		00000000-00000000	0000 0000	0000 0000	0000 0000
PD20	*MTXE	For manufacturer setting		00000000-00000000	0000 0000	0000 0000	0000 0000
PD21	*MTXA	For manufacturer setting		00000000-00000000	0000 0000	0000 0000	0000 0000
PD22	*SM1N	Driver communication setting - Slave - Master axis 1		0-255	0	**1**	**1**
PD23	*SM1C	Driver communication setting - Slave - Master axis 1		00000000-00000080	0000 0000	**0000 0010**	**0000 0020**
PD24	*SM2N	For manufacturer setting		0-0	0	0	0
PD25	*SM2C	For manufacturer setting		00000000-00000000	0000 0000	0000 0000	0000 0000
PD26	*MSTO	Master-slave operation simultaneous stop function -		00000000-00000011	0000 0000	0000 0000	0000 0000
PD27	*SSTO	For manufacturer setting		0-65535	0	0	0
PD28	*MTCS	For manufacturer setting		00000000-00000000	0000 0000	0000 0000	0000 0000
PD29	*MSMD1	For manufacturer setting		00000000-00001021	0000 0000	0000 0000	0000 0000
PD30	TLS	Master-slave operation - Torque command coefficien	%	0-500	0	**100**	**100**
PD31	VLC	Master-slave operation - Speed limit coefficient on sl	%	0-500	0	**100**	**100**
PD32	VLL	Master-slave operation - Speed limit adjusted value c	r/min	0.00-21474836.47	0.00	0.00	0.00
PD33	*MD5	For manufacturer setting		00000000-00000000	0000 0000	0000 0000	0000 0000
PD34	*MD6	For manufacturer setting		00000000-00000000	0000 0000	0000 0000	0000 0000
PD35	*MD7	For manufacturer setting		00000000-00000000	0000 0000	0000 0000	0000 0000

Set other servo parameters according to your environment.

• How to configure the basic period setting

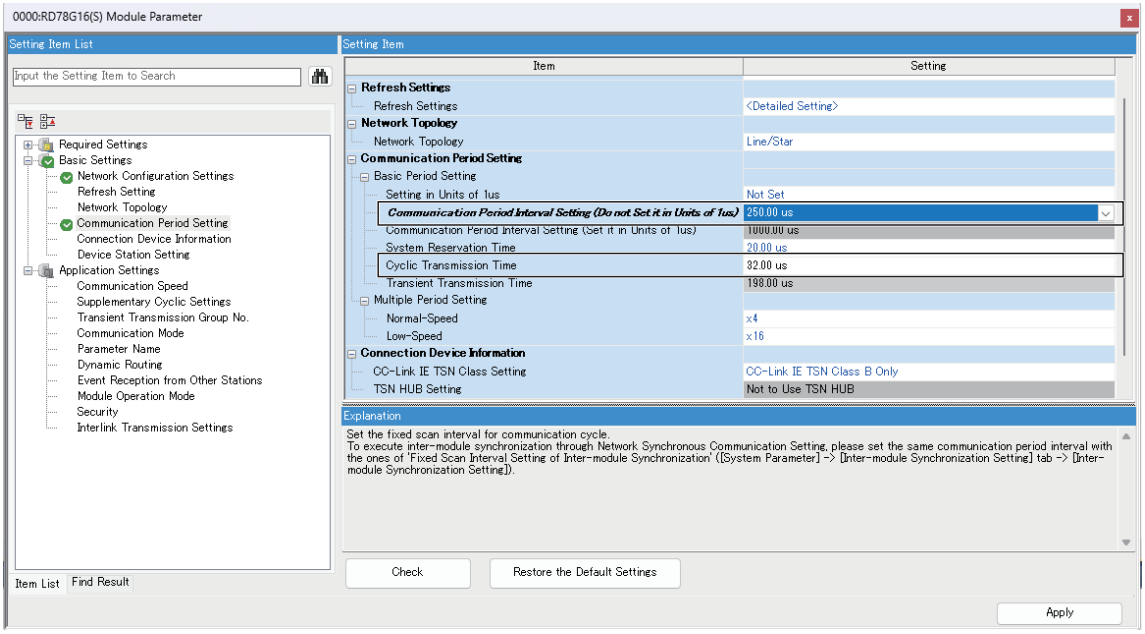
Configure the communication cycle interval setting and cyclic transmission time.

Refer to the following for setting details.

☞ Page 352 Communication cycle interval setting

In this configuration example, set the communication cycle interval setting to "250.00μs", and the cyclic transmission time to "32.00μs".

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Target module ⇨ [Module Parameter (Network)] ⇨ [Basic Settings] ⇨ [Basic Cycle Settings] ⇨ <Detail Settings>



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Appendix 4 Setting Example of Motion Module [MODE: Simple Motion]

This sections describes the setting procedure all the way up to servo ON when combining the Motion module and servo amplifier MR-J5(W)-G.

In this section, "_" in "RD78G_(S)" or "RD78G_" indicates the number of control axes.

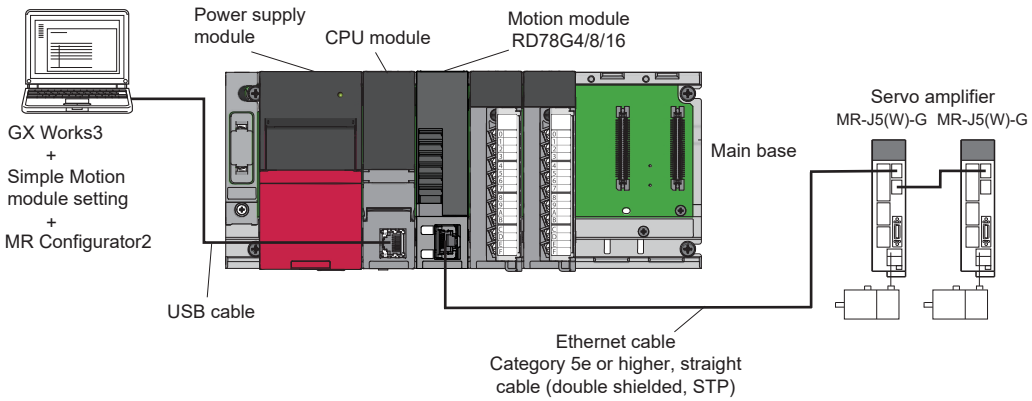
Preparation

■Preparing the module/engineering tool and checking the version

Category		Model name	Supported version
Module	CPU module	R00CPU R01CPU R02CPU	Version 12 or later
		R04CPU R08CPU R16CPU R32CPU R120CPU	Version 44 or later
		R04ENCPU R08ENCPU R16ENCPU R32ENCPU R120ENCPU	Version 44 or later
	Motion module	RD78G4 RD78G8 RD78G16	070716 or later Version of the base system software (2 digits) Version of the boot software (for control) (2 digits) Version of the boot software (for network) (2 digits)
	Servo amplifier	MR-J5(W)-G	Version B2 or later
Engineering tool	Programming tool for programmable controller	GX Works3	Version 1.075D or later
	Simple Motion module setting*1	—	Version 1.165X or later
	Servo amplifier setting/monitoring tool	MR Configurator2	Version 1.100E or later

*1 This is the same tool as when using the RD77MS. It is a different tool from the one for the PLCopen motion control FB mode.

■System configuration



Project creation

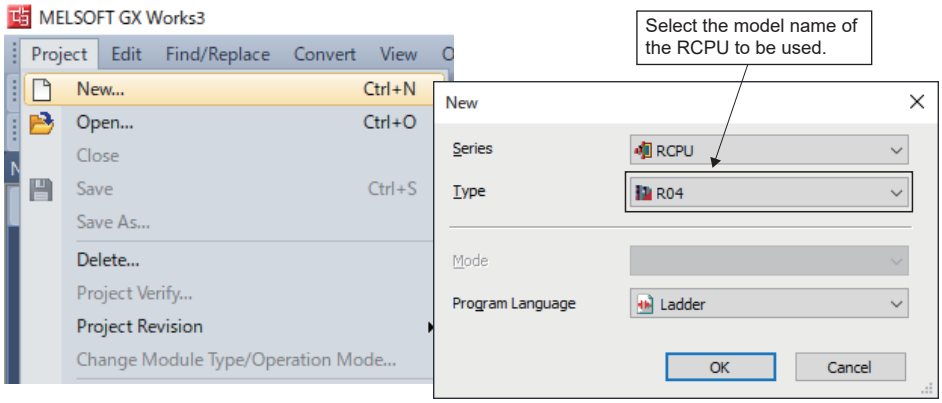
1. Starting GX Works3.

• Start GX Works3.

2. Creating a new project.

• Create a new project.

[Project]⇨[New]



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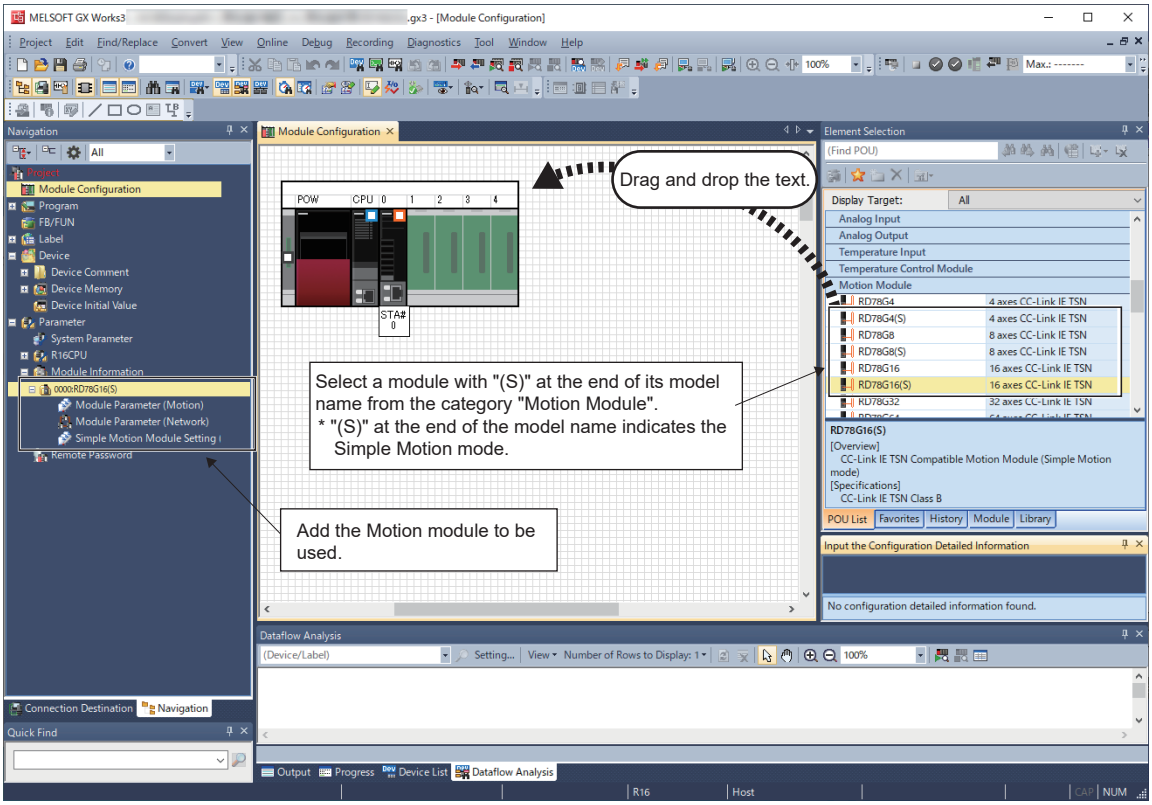
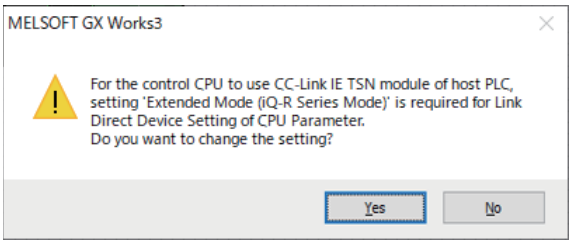
■Adding a module

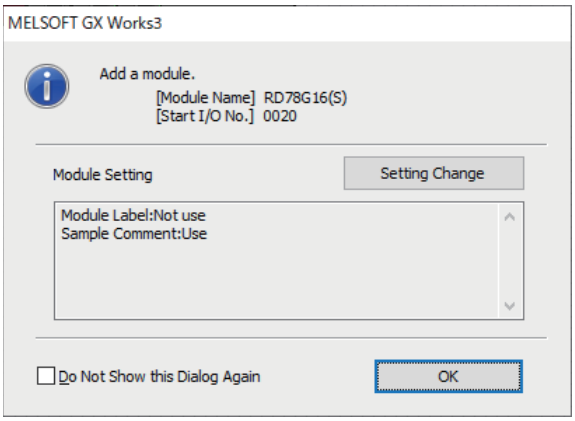
- In the "Element Selection" window of the module map, select the base, power supply, and Motion module to be used, and drag and drop them.



- If the following message appears during the setting of RD78G_(S), click "Yes".



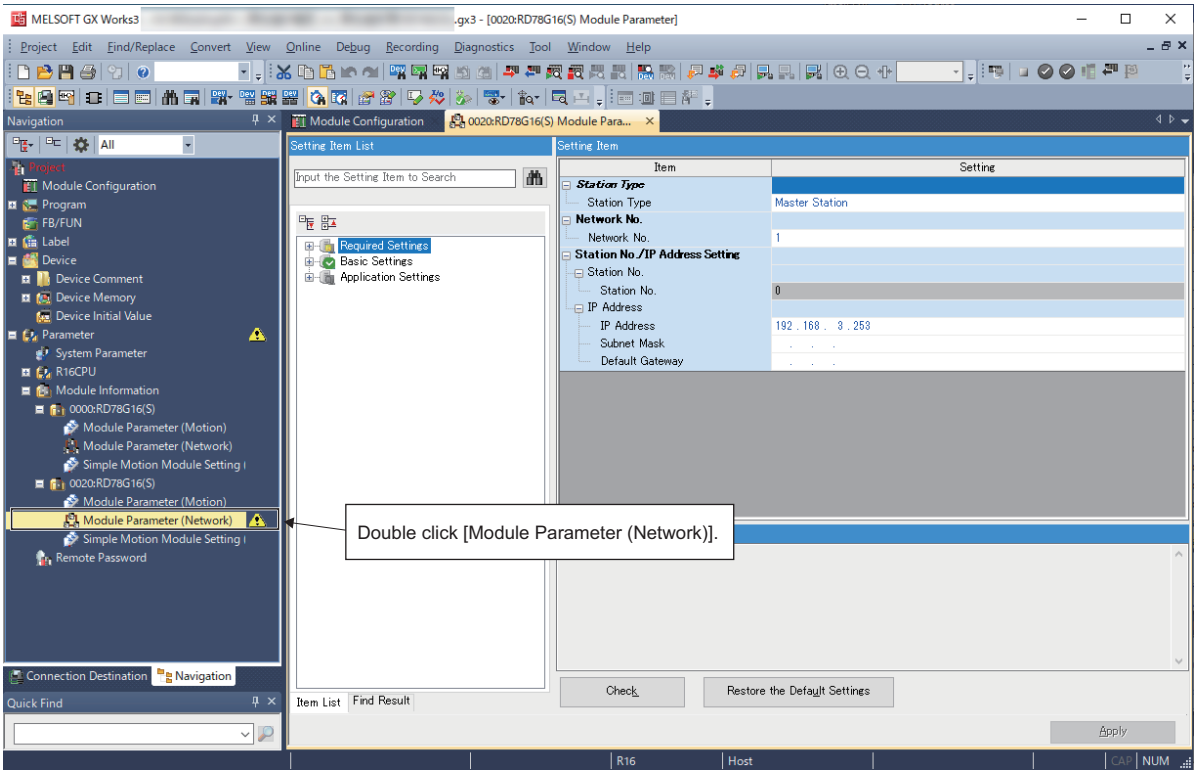
- If not using module labels or module FBs, set "Module Label" to "Not use".



■Network parameter setting

• Open the parameter setting screen and set the servo amplifier be used and the servo parameters.

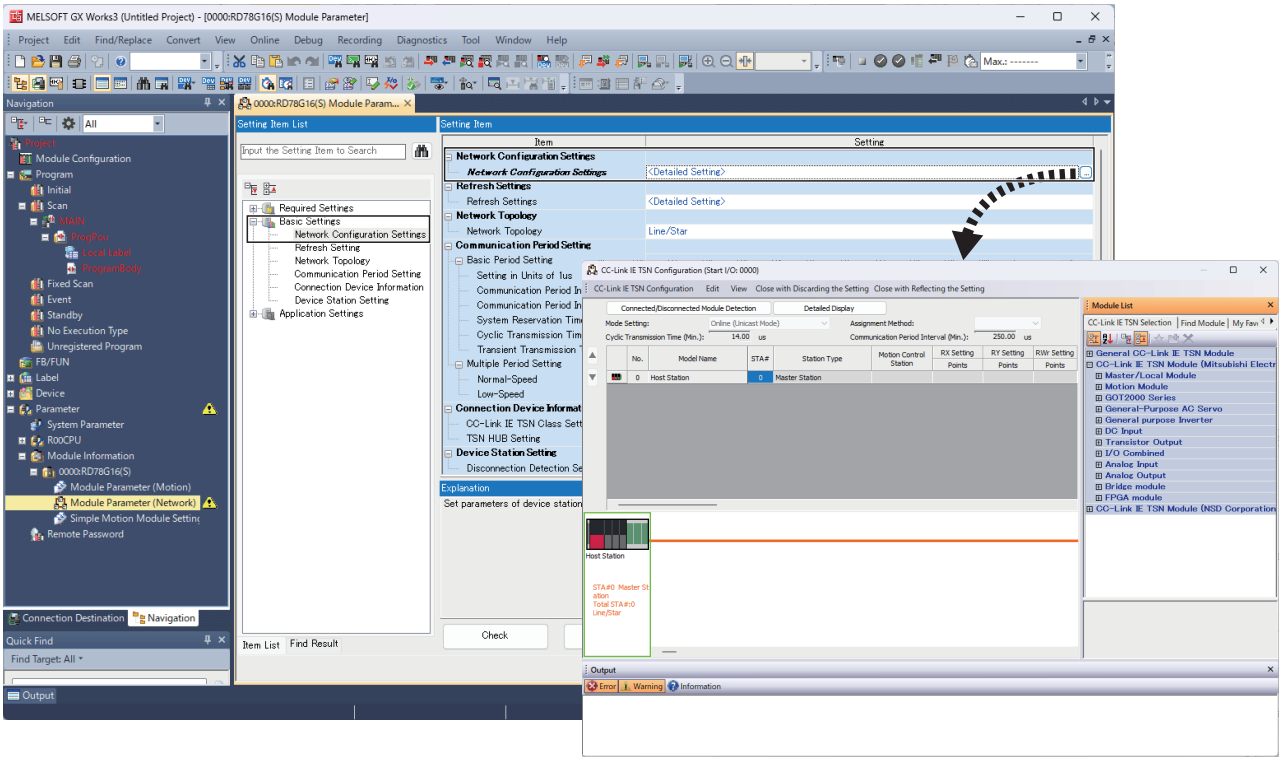
Navigation window⇨"Parameter"⇨"Module Information"⇨Target module⇨[Module Parameter (Network)]



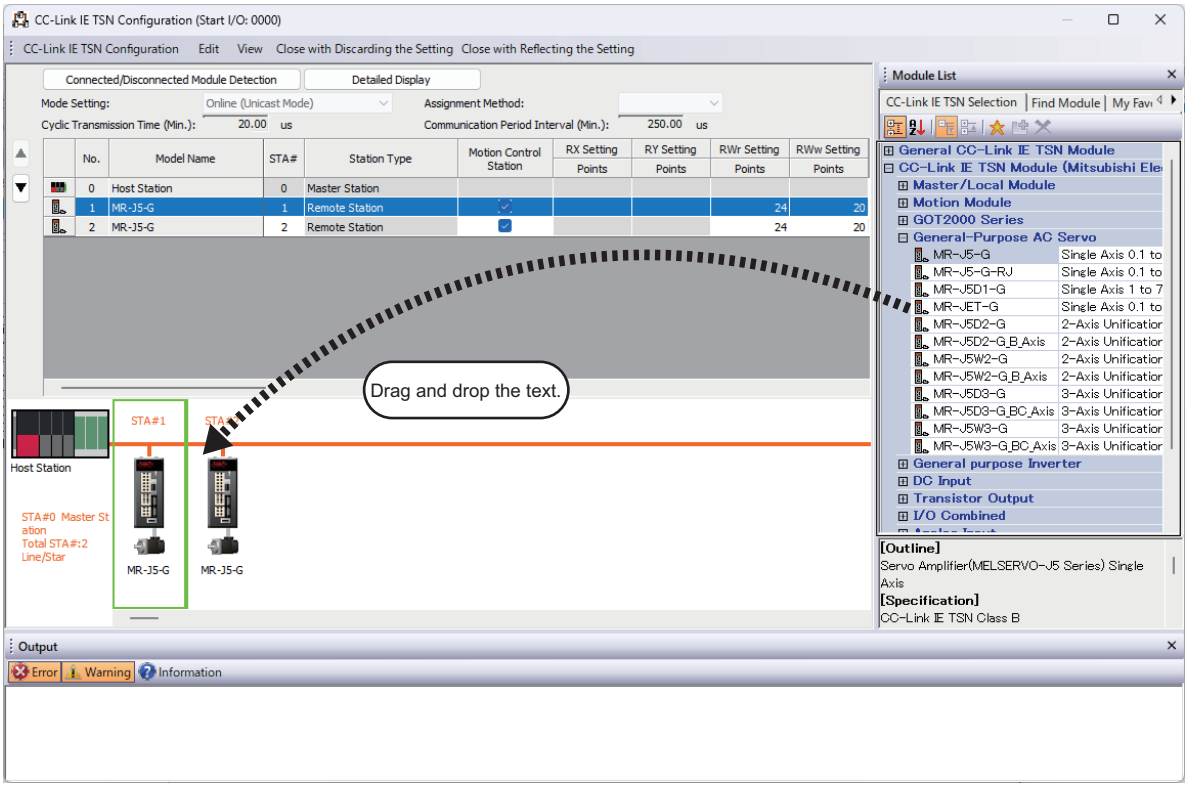
■Network configuration setting

• Start the network configuration

Double click Navigation window⇨"Parameter"⇨"Module Information"⇨Target module⇨[Module Parameter (Network)]⇨[Basic Settings]⇨[Network Configuration Settings] (or click the button on the right side)⇨"CC-Link IE TSN Configuration" screen

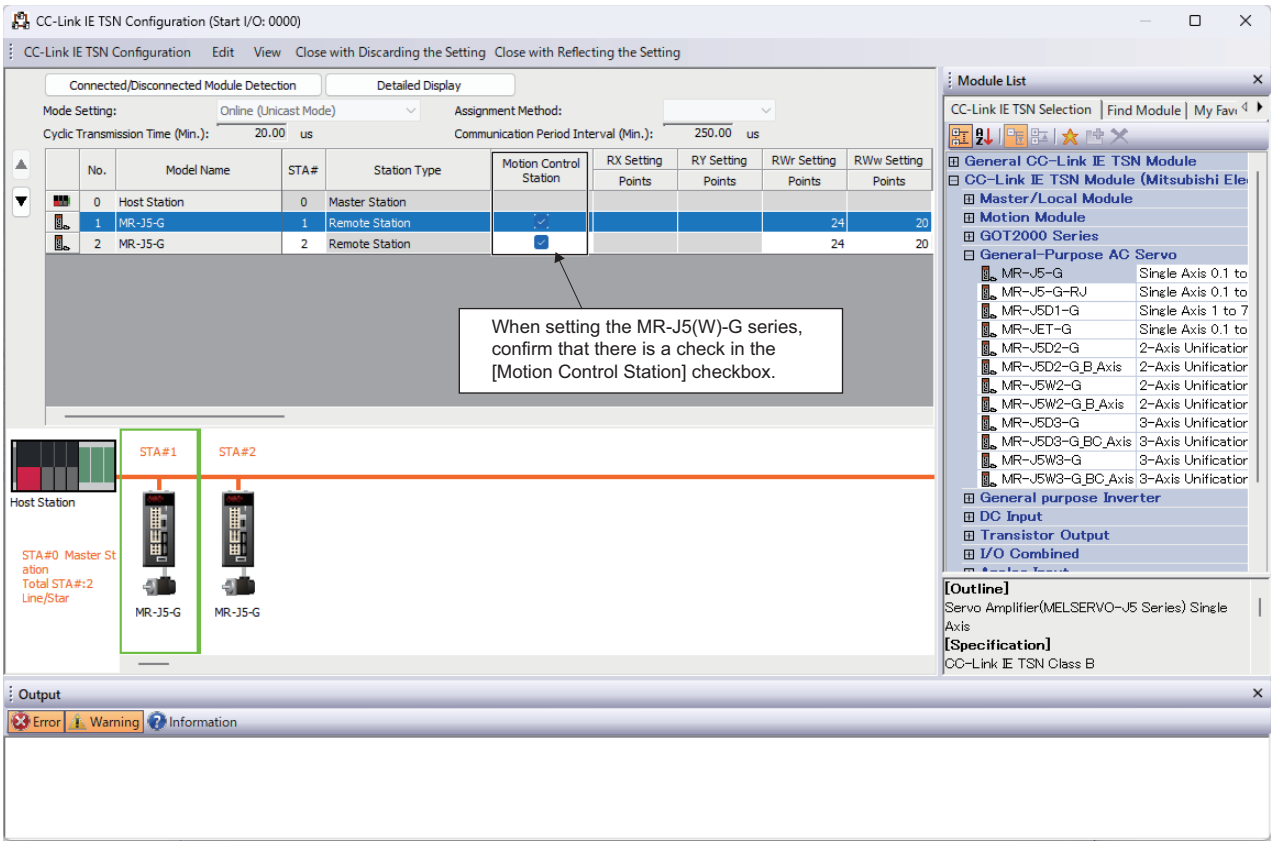


- Select and add modules from "Module List" on the "CC-Link IE TSN Configuration" screen.
- A default station No. and I/O point No. are set when a module is added. IP addresses are set automatically in the order in which the modules were added via drag and drop according to the setting and station No. of the master station.



■PDO mapping setting

- When using the Simple Motion mode, the PDO mapping setting is not required as the PDO mapping is fixed to the external signal of the servo amplifier.

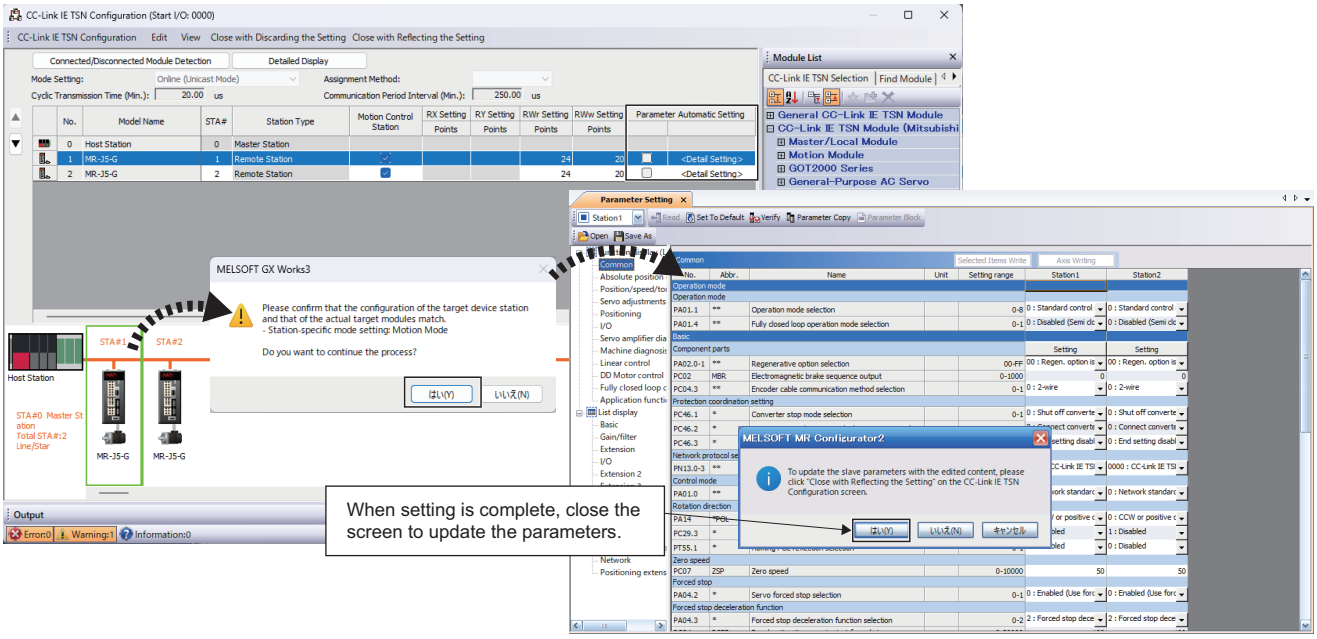


■Servo parameter setting

• Set the servo parameters. For the setting details, refer to the following.

☞ Page 721 Servo parameter setting value when using MR-J5(W)-G

Double click the servo amplifier icon or [Detail Setting] in "Parameter Automatic Setting"



■Servo parameter setting value when using MR-J5(W)-G

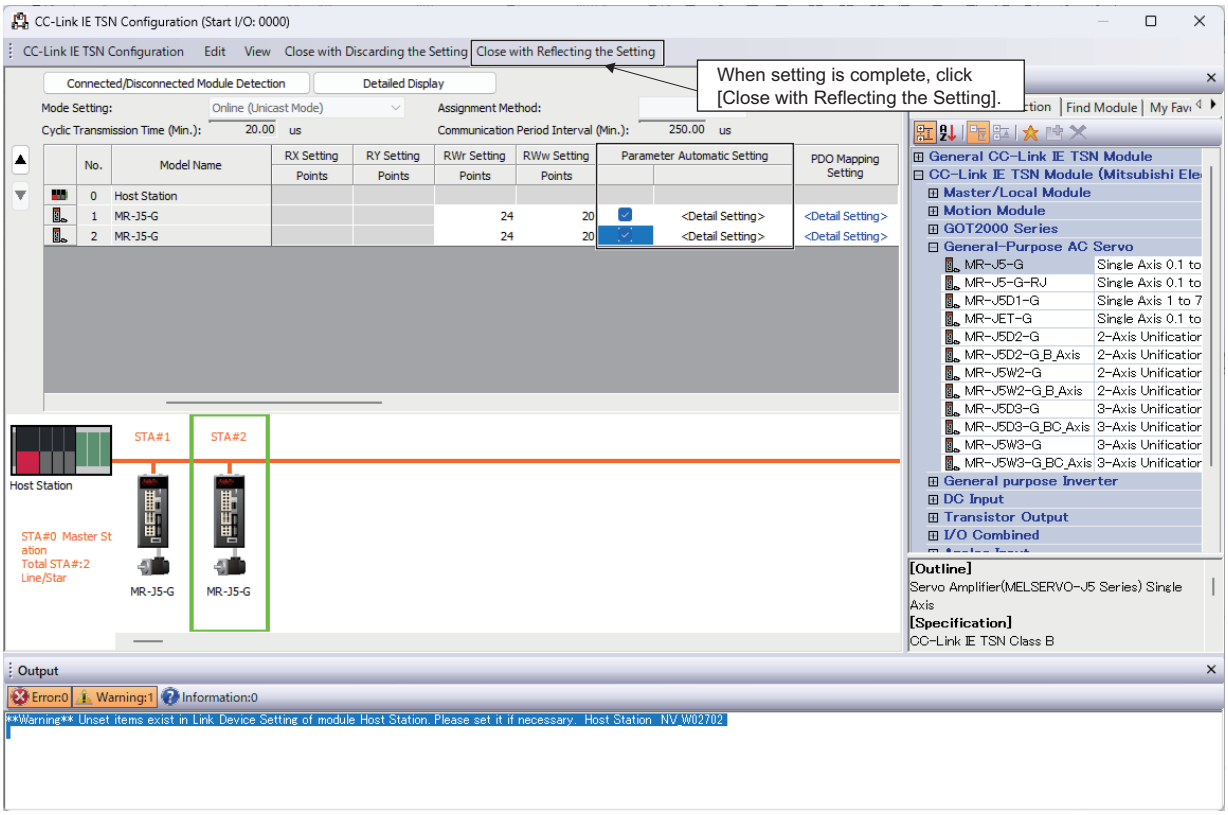
Set the parameters of MR-J5(W)-G as shown below when executing motion control with MR-J5(W)-G. When the parameters are not set as shown below, "Servo parameter invalid" (error code: 1DC8H) occurs and the values will be overwritten automatically from the controller. When an error occurs, reset said error after resetting the Motion module or MR-J5(W)-G

Classification	No.	Name	Default value	Setting value
Basic setting	PA06	Electronic gear numerator*1	1	• When using the rotary servo motor HK-KT series: 16 • Other (when not using the rotary servo motor HK-KT series): 1
	PA07	Electronic gear denominator*1	1	1
Expansion setting	PC79.0	DI status read selection*1	0h	Eh bit1: Returns the ON/OFF status of the DI1 pin. bit2: Returns the ON/OFF status of the DI2 pin. bit3: Returns the ON/OFF status of the DI3 pin.
I/O setting	PD41.2	Limit switch enabled status selection*1	0h	1h (only enabled in homing mode)
	PD41.3	Sensor input method selection*1	0h	1h: Input from controller (C_FLS/C_RLS/C_DOG)
	PD60.0	DI pin polarity selection*1	0h	0h bit0: DI pin polarity selection 1 (Turns on with 24 V input) bit1: DI pin polarity selection 2 (Turns on with 24 V input) bit2: DI pin polarity selection 3 (Turns on with 24 V input)
Positioning control	PT01.1	Speed/acceleration/deceleration unit selection*2	0h	0h
	PT08	Homing position data*1	0	0
	PT15	Software position limit +	0	0
	PT17	Software position limit -	0	0
	PT29.0	Device input polarity 1*1	0h	1h: Dog detection with on

*1 The parameter is enabled after resetting the Motion module or MR-J5(W)-G.
*2 The parameter is enabled after resetting the MR-J5(W)-G.

■Reflecting the network configuration setting

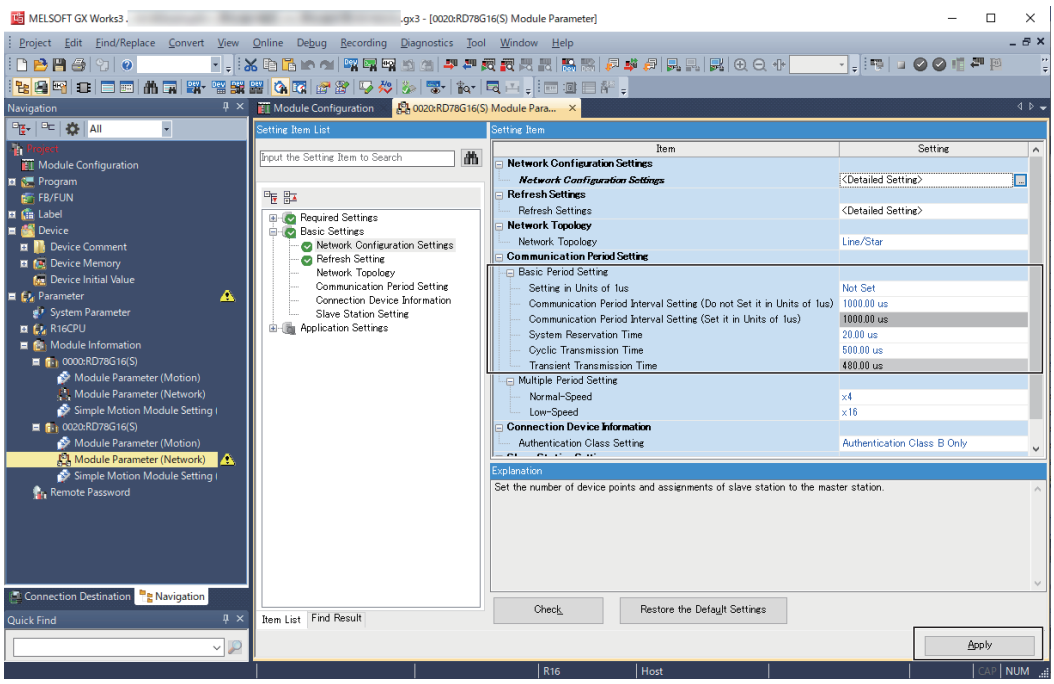
Place a check in the checkbox in "Parameter Automatic Setting".



■Applying the operation cycle setting and module parameters

The operation cycle is set in "Communication Period Interval Setting" of "Communication Period Setting".

Click [Apply] to apply the settings in Module Parameters (Network).

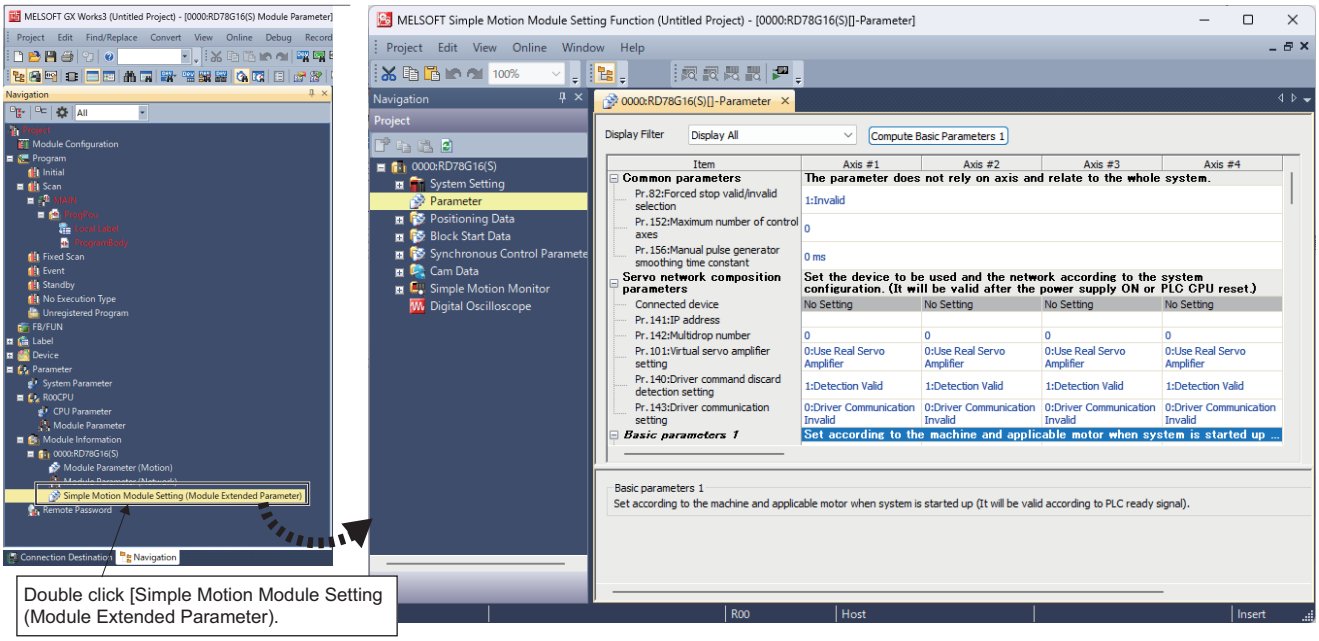


Simple Motion Module Setting

■Starting the Simple Motion Module Setting

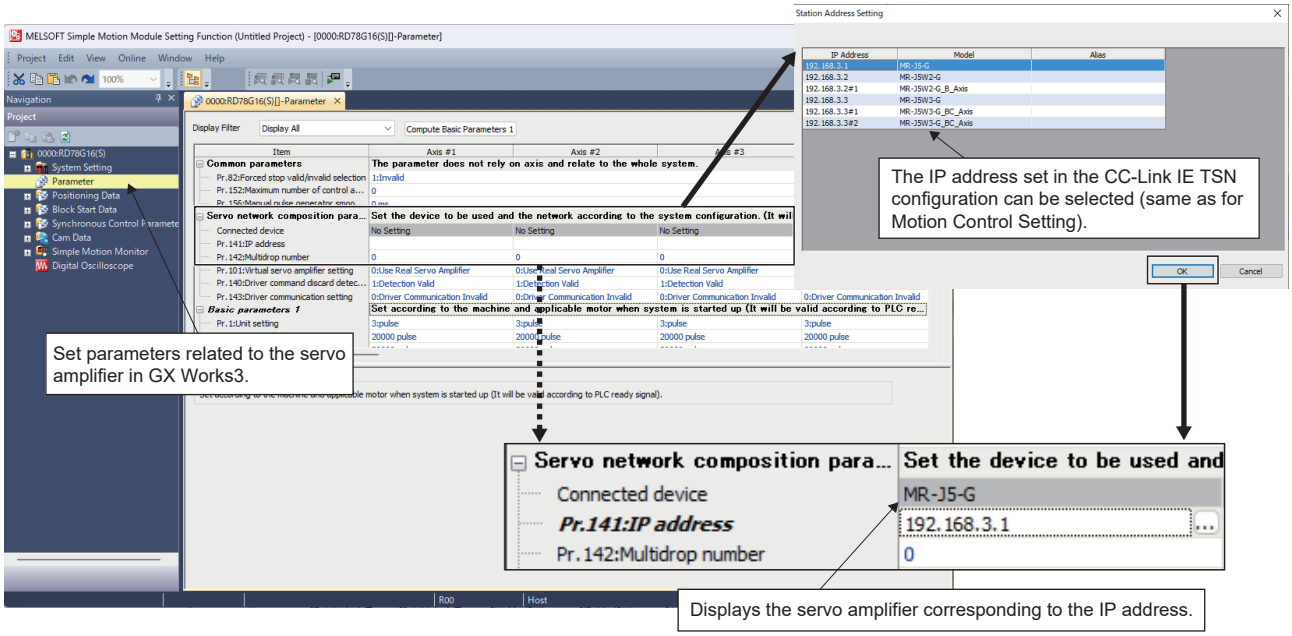
Start the Simple Motion Module Setting screen.

Navigation window⇨[Parameter]⇨[Module Information]⇨[Target module]⇨[Simple Motion Module Setting (Module Extended Parameter)]



■Setting the axis

Set the servo network configuration parameters "[Pr.141] IP address specification" and "[Pr.142] Multidrop number".



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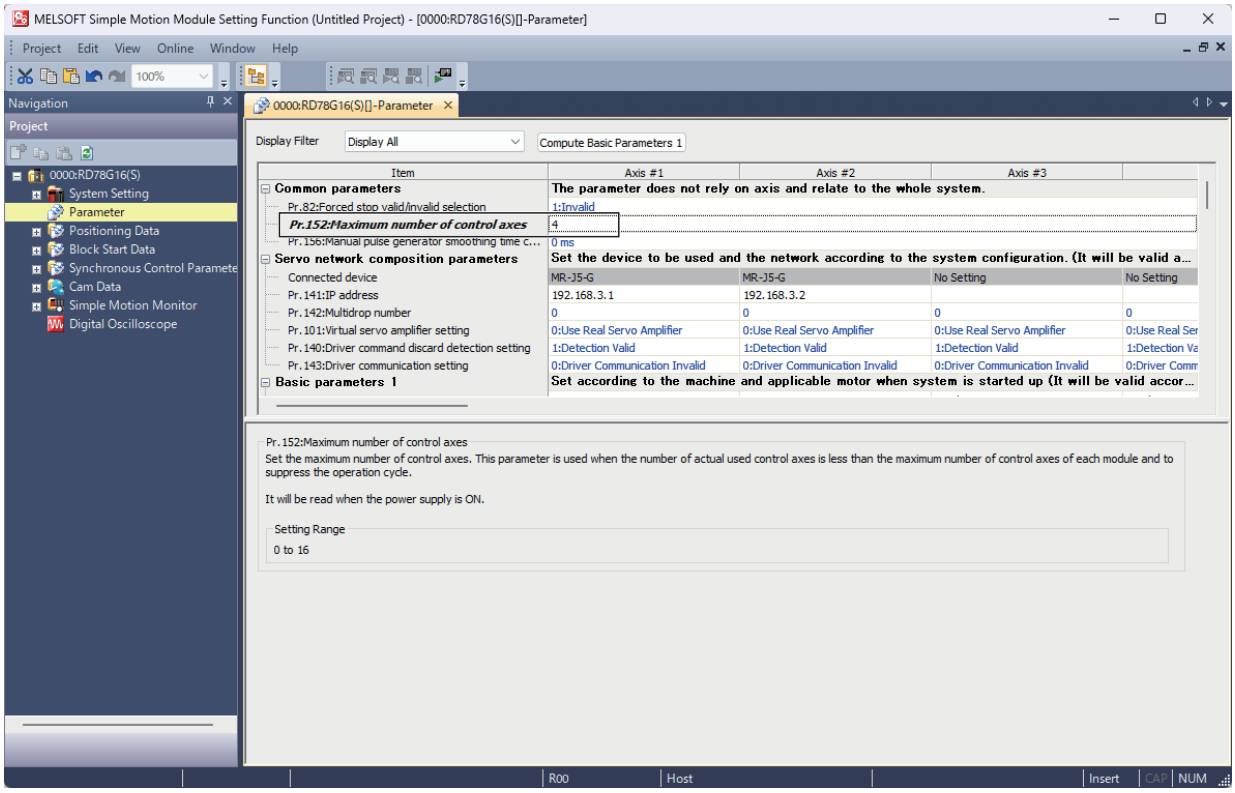
■Setting the maximum number of control axes

If "communication cycle interval setting (operation cycle)" is changed from the default value, change "[Pr.152] Maximum number of control axes" as well.

Communication cycle interval setting	Recommended setting of "[Pr.152] Maximum number of control axes"*1
250.00μs	4
500.00μs	8
1000.00μs	16

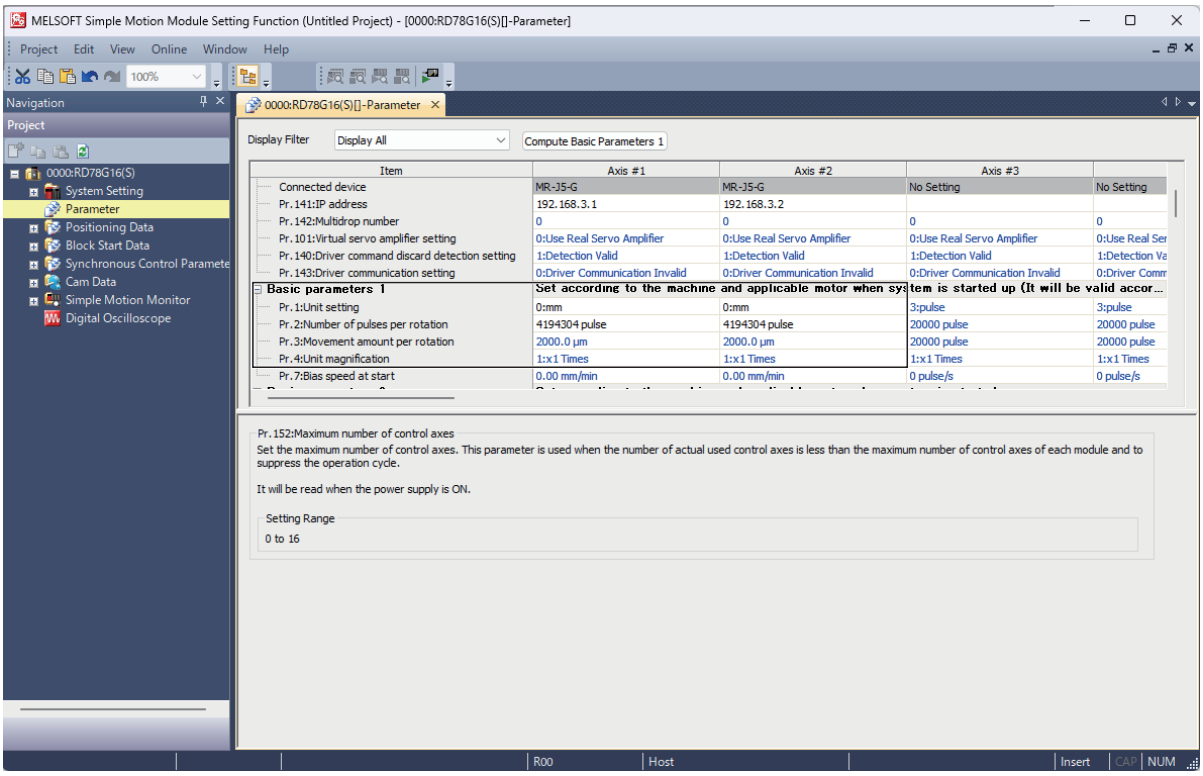
*1 In the case of 4-axis and 8-axis modules, the maximum number of axes of the module is the default value "0".



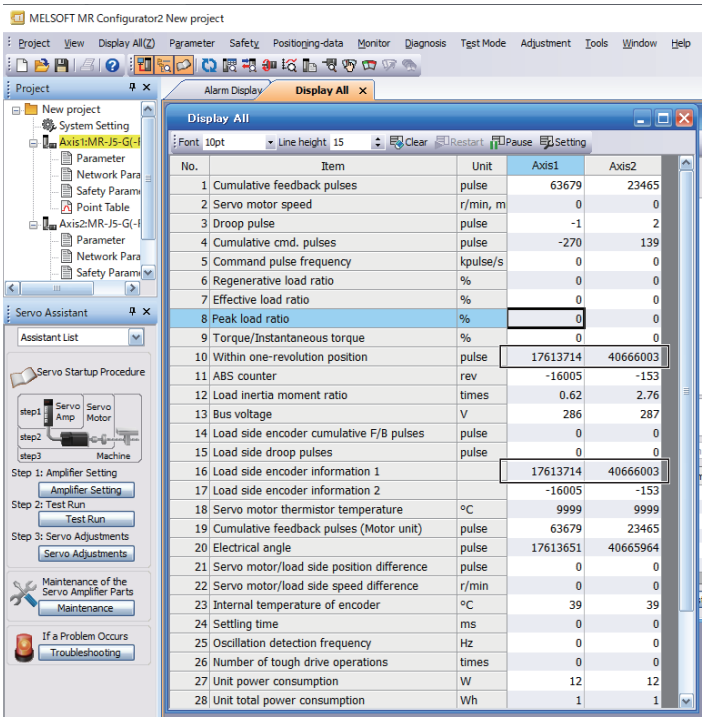
■Setting the electronic gear

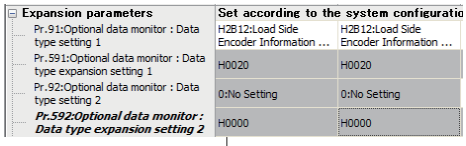
- When using a rotary MR-J5(W)-G motor, set the resolution of the electronic gear to the MR-J4(W)-B motor resolution (22 bit, or 4194304pulse) instead of 26 bit (67108864pulse). The Motion module automatically overwrites the electronic gear of the servo amplifier parameters. For details, refer to the following.

☞ Page 721 Servo parameter setting value when using MR-J5(W)-G

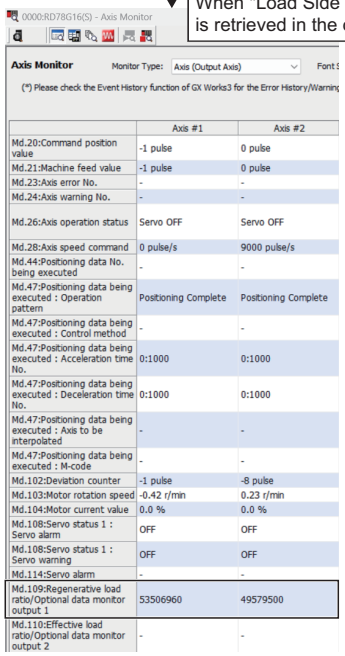


- The basic position information per rotation for the servo amplifier is 26 bit (67108864pulse).





When "Load Side Encoder Information" is retrieved in the optional data monitor.



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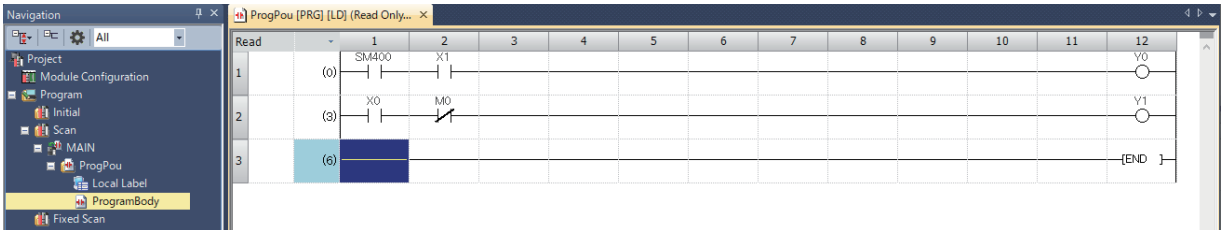
Program

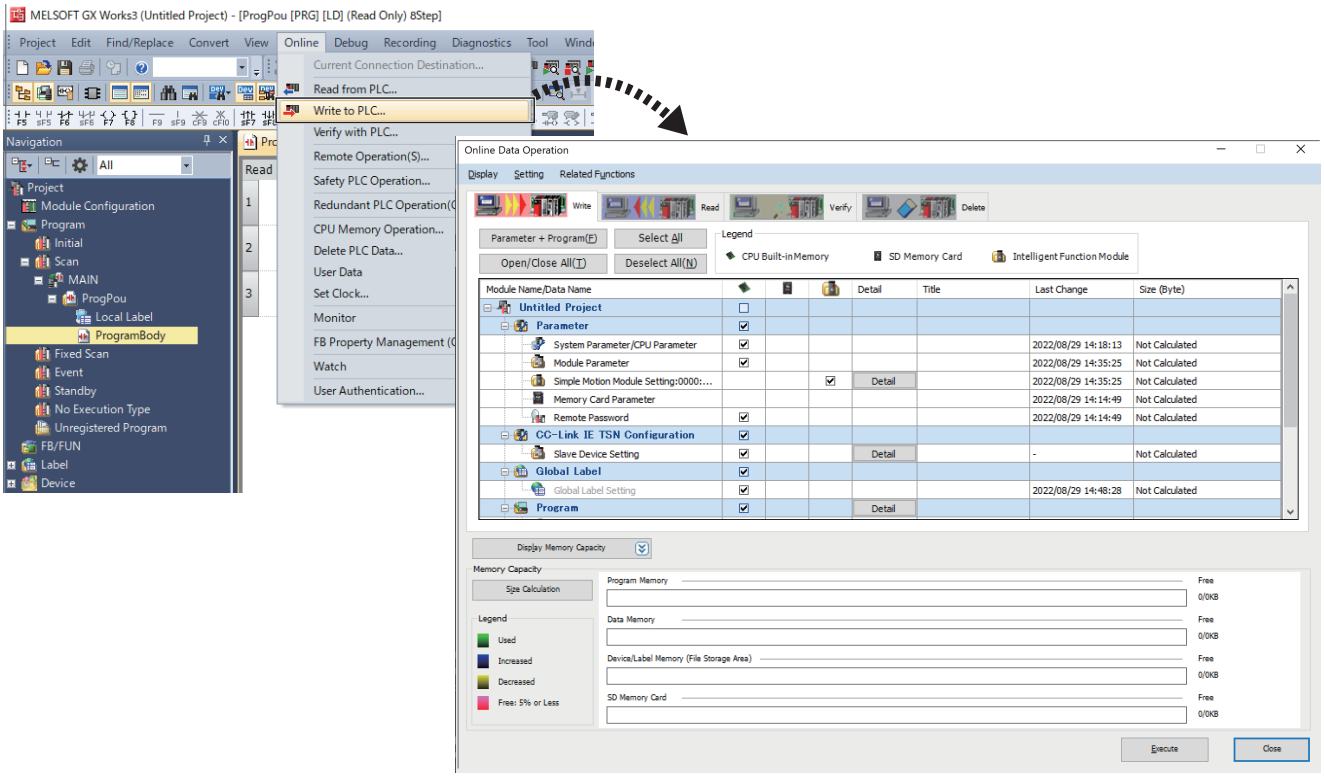
The I/O No. of the Motion module starts from 0. In the program below, PLC READY of the Motion module with the I/O No. "0" is turned ON and the servo ON of the axis used can be executed.



Writing/reading of data and operation mode switching

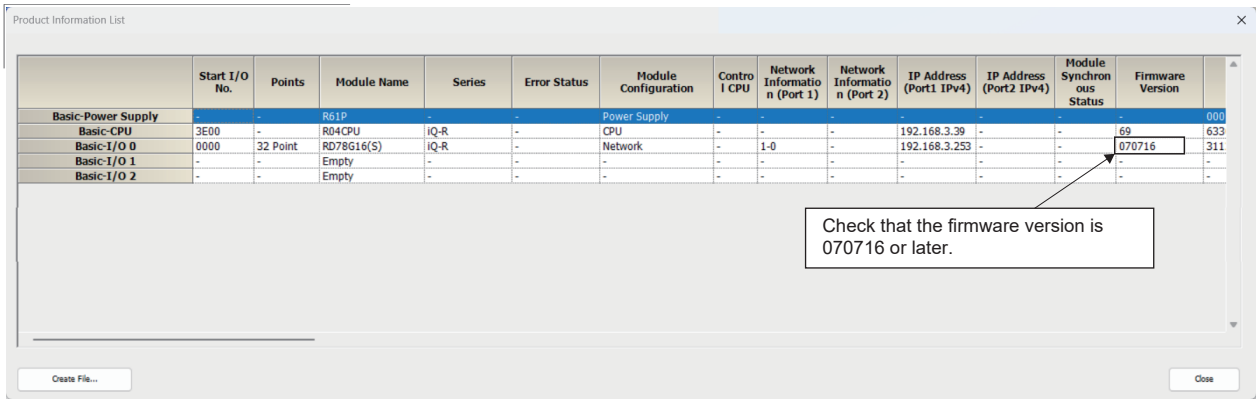
■Writing/reading of data

Data, including data set in the Simple Motion Module Setting, is written/read from GX Works3.



■Operation mode switching of RD78G

1. Check that the firmware version of the RD78G module is 070716 or later (Simple Motion mode-compatible version) in "Product Information List" of "System Monitor".

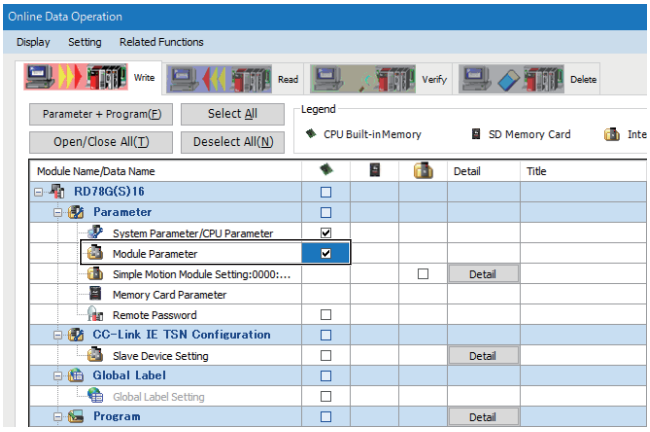


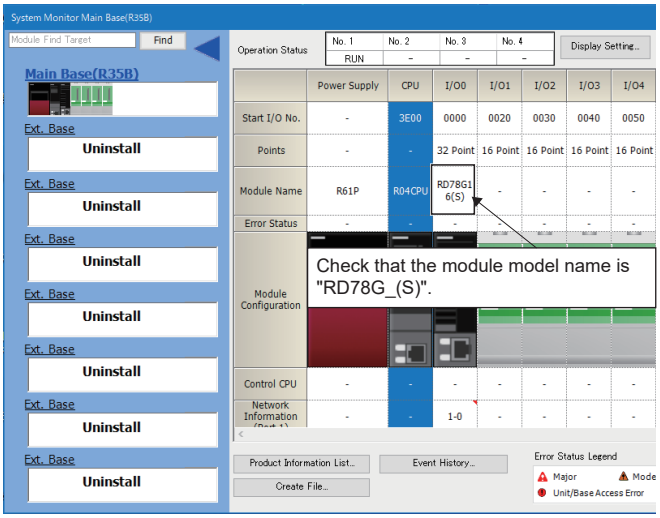
2. If not, upgrade the version of the basic system software, boot software, and network boot software.*1

*1 For details, refer to the following.

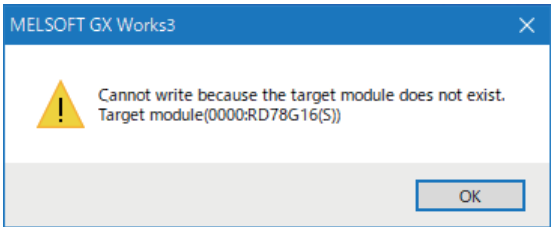
☞ Page 389 Software Installation to the Own Module

3. Write "Module Parameter" in which RD78G_(S) is set in the module information to the CPU module to set the Motion module to the Simple Motion mode. After the data is written, reset the CPU module and check that the module model name is "RD78G_(S)" in "System Monitor". The operation mode can be checked in the buffer memory Un\G16252849 as well. (0: PLCopen motion control FB mode, 1: Simple Motion mode)





4. When the module parameter is not written and the operation is performed, the data of the Simple Motion module setting cannot be written and the following message appears. (The same message appears when the operation is performed on the version that is not compatible with the Simple Motion mode.)



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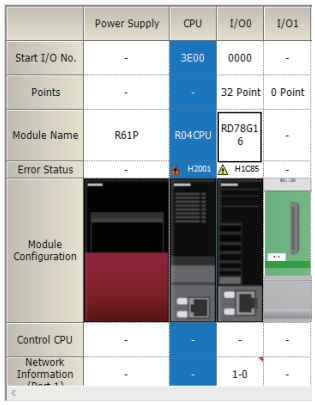
Point

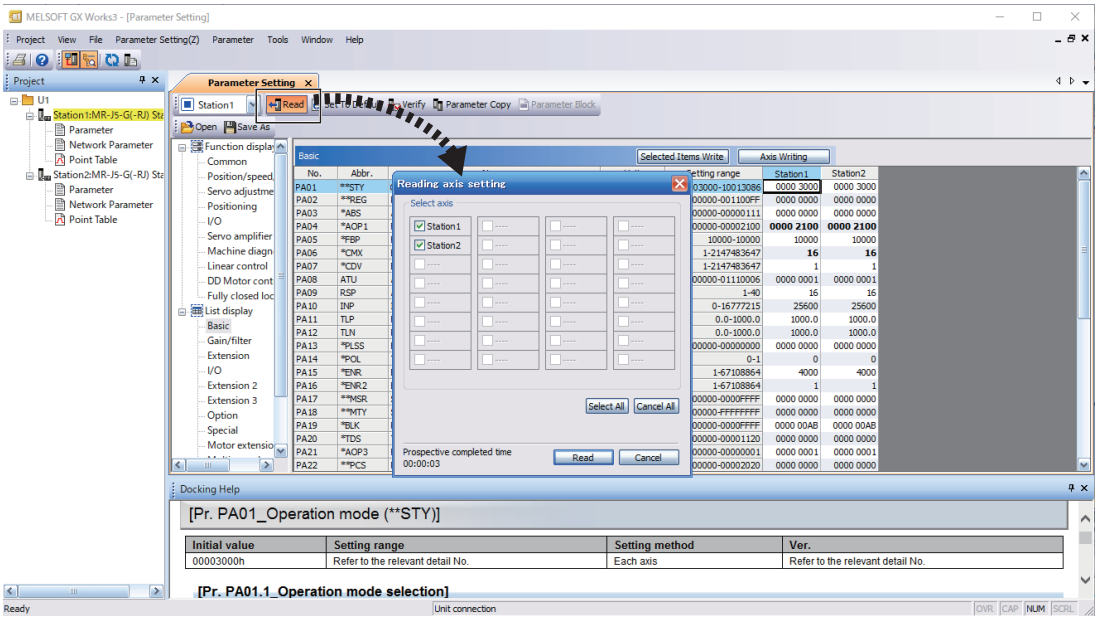
When the data of the CPU module is deleted, or the module parameter of RD78G_ is written, the module model name is set to "RD78G_" (PLCopen motion control FB mode).



Precautions

- To perform mark detection for an axis performing dog method home position return, etc. with the input signal of the servo amplifier, it is necessary to either perform mark detection using the DOG signal of an axis not performing home position return, or use the home position return DOG signal via the buffer memory.
- When the servo amplifier is used with the parameter automatic setting, the servo parameter "Parameter automatic backup update interval (PN20)"*1 is required to be set to perform "Automatic update of saved parameters (automatic update when parameters are updated on the servo amplifier side)". After the power is turned on, backup is performed every set time when the parameters that have been distributed and the current parameters are different. To reflect changes made to parameters in a project, reopen the servo parameter setting window and apply the servo parameters to the project by directly reading said parameters from the servo amplifier via "Read".

*1 The number of times for writing data from the CPU module to the data memory is limited. For details, refer to the following.
MR-J5-G/MR-J5W-G User's Manual (Parameters)



- Turning off the power supply of the servo amplifier while changing servo parameters to the recommended setting may cause the servo parameters to become corrupted. Turn off the power supply of the servo amplifier after confirming that the Motion module is on one of the following states.
  - "Servo parameter invalid (error code: 1DC8H)" occurs
  - "[Md.190] Controller position value restoration complete status" is "1: Complete INC restoration" or "2: Complete ABS restoration"

- When using in the absolute position system, change the servo parameter "[AL.0E3 Absolute position counter warning] selection (PC29.5)" from "1: Enabled (default value) to "0: Invalid".*1

*1 When it is not set, the servo alarm [AL.0E3 Absolute position counter warning] occurs in the system of infinite feed, and the absolute position is lost.

■Updating the firmware version

The firmware version of the Motion module cannot be updated from the engineering tool in the Simple Motion mode. Use the SD memory card to update the firmware version.

Point

In the PLCopen motion control FB mode, the Simple Motion mode add-on can be written with the "motion control setting function" by selecting [Tool] ⇨ [Add-on Management] or [Install Motion Software]. When the installation operation is performed from the engineering tool, the mode is required to be switched to the PLCopen motion control FB mode once.

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Appendix 5 List of Add-on Libraries

The following shows the versions of each add-on corresponding to the software version of the Motion module.

×: Not supported

Motion module software version	Add-on library name						
	baseSystem	MotionEngine	Axis	MotionControl_General	MotionControl_Sync	AbsSystem	ServoDriver_CANopen
16	1.16.1.0	1.15.1.0	1.15.1.0	1.15.1.0	1.15.1.0	1.15.1.0	1.15.1.0
17	1.17.1.0	1.16.1.0	1.16.1.0	1.16.1.0	1.16.1.0	1.16.1.0	1.16.1.0
18	1.18.1.0	1.17.1.0	1.17.1.0	1.17.1.0	1.17.1.0	1.17.1.0	1.17.1.0
20	1.20.1.0	1.19.1.0	1.19.1.0	1.19.1.0	1.19.1.0	1.19.1.0	1.19.1.0
21	1.21.1.0	1.20.1.0	1.20.1.0	1.20.1.0	1.20.1.0	1.20.1.0	1.20.1.0
22	1.22.1.0	1.21.1.0	1.21.1.0	1.21.1.0	1.21.1.0	1.21.1.0	1.21.1.0
24	1.24.1.0	1.23.1.0	1.23.1.0	1.23.1.0	1.23.1.0	1.23.1.0	1.23.1.0
26	1.26.1.0	1.25.1.0	1.25.1.0	1.25.1.0	1.25.1.0	1.25.1.0	1.25.1.0
28	1.28.1.0	1.27.1.0	1.27.1.0	1.27.1.0	1.27.1.0	1.27.1.0	1.27.1.0
30	1.30.1.0	1.29.1.0	1.29.1.0	1.29.1.0	1.29.1.0	1.29.1.0	1.29.1.0
31	1.31.1.0	1.30.1.0	1.30.1.0	1.30.1.0	1.30.1.0	1.30.1.0	1.30.1.0
32	1.32.1.0	1.31.1.0	1.31.1.0	1.31.1.0	1.31.1.0	1.31.1.0	1.31.1.0
34	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0
36	1.36.1.0	1.35.1.0	1.35.1.0	1.35.1.0	1.35.1.0	1.35.1.0	1.35.1.0

Motion module software version	Add-on library name						
	NetworkDriver_CCIETSN	PlcInstruction	SignalIO	ExternalSignal	Program_ST	Logging	MotionEventHist
16	1.15.1.0	1.15.1.0	1.15.1.0	1.15.1.0	1.15.1.0	1.15.1.0	1.15.1.0
17	1.16.1.0	1.16.1.0	1.16.1.0	1.16.1.0	1.16.1.0	1.16.1.0	1.16.1.0
18	1.17.1.0	1.17.1.0	1.17.1.0	1.17.1.0	1.17.1.0	1.17.1.0	1.17.1.0
20	1.19.1.0	1.19.1.0	1.19.1.0	1.19.1.0	1.19.1.0	1.19.1.0	1.19.1.0
21	1.20.1.0	1.20.1.0	1.20.1.0	1.20.1.0	1.20.1.0	1.20.1.0	1.20.1.0
22	1.21.1.0	1.21.1.0	1.21.1.0	1.21.1.0	1.21.1.0	1.21.1.0	1.21.1.0
24	1.23.1.0	1.23.1.0	1.23.1.0	1.23.1.0	1.23.1.0	1.23.1.0	1.23.1.0
26	1.25.1.0	1.25.1.0	1.25.1.0	1.25.1.0	1.25.1.0	1.25.1.0	1.25.1.0
28	1.27.1.0	1.27.1.0	1.27.1.0	1.27.1.0	1.27.1.0	1.27.1.0	1.27.1.0
30	1.29.1.0	1.29.1.0	1.29.1.0	1.29.1.0	1.29.1.0	1.29.1.0	1.29.1.0
31	1.30.1.0	1.30.1.0	1.30.1.0	1.30.1.0	1.30.1.0	1.30.1.0	1.30.1.0
32	1.31.1.0	1.31.1.0	1.31.1.0	1.31.1.0	1.31.1.0	1.31.1.0	1.31.1.0
34	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0
36	1.35.1.0	1.35.1.0	1.35.1.0	1.35.1.0	1.35.1.0	1.35.1.0	1.35.1.0

Motion module software version	Add-on library name						
	FileTransfer	MotionControl_AxisFilter	ProfileControl	PackagingApp	ServoSystem Recorder	SimpleMotion	MotionControl_AdvancedSync
16	1.15.1.0	1.15.1.0	1.15.1.0	1.15.1.0	1.15.1.0	1.15.1.0	×
17	1.16.1.0	1.16.1.0	1.16.1.0	1.16.1.0	1.16.1.0	1.16.1.0	×
18	1.17.1.0	1.17.1.0	1.17.1.0	1.17.1.0	1.17.1.0	1.17.1.0	×
20	1.19.1.0	1.19.1.0	1.19.1.0	1.19.1.0	1.19.1.0	1.19.1.0	×
21	1.20.1.0	1.20.1.0	1.20.1.0	1.20.1.0	1.20.1.0	1.20.1.0	×
22	1.21.1.0	1.21.1.0	1.21.1.0	1.21.1.0	1.21.1.0	1.21.1.0	×
24	1.23.1.0	1.23.1.0	1.23.1.0	1.23.1.0	1.23.1.0	1.23.1.0	1.23.1.0
26	1.25.1.0	1.25.1.0	1.25.1.0	1.25.1.0	1.25.1.0	1.25.1.0	1.25.1.0
28	1.27.1.0	1.27.1.0	1.27.1.0	1.27.1.0	1.27.1.0	1.27.1.0	1.27.1.0
30	1.29.1.0	1.29.1.0	1.29.1.0	1.29.1.0	1.29.1.0	1.29.1.0	1.29.1.0
31	1.30.1.0	1.30.1.0	1.30.1.0	1.30.1.0	1.30.1.0	1.30.1.0	1.30.1.0
32	1.31.1.0	1.31.1.0	1.31.1.0	1.31.1.0	1.31.1.0	1.31.1.0	1.31.1.0
34	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0	1.33.1.0
36	1.35.1.0	1.35.1.0	1.35.1.0	1.35.1.0	1.35.1.0	1.35.1.0	1.35.1.0

The following shows the details of the add-on libraries.

—: No dependent add-on

Add-on library name	Name	Description	Dependent add-on (required)	Dependent add-on (with functional restrictions)
baseSystem	Basic system software	Basic software	—	—
MotionEngine	Basic motion control	A basic add-on for motion control	[baseSystem] [Axis]	—
Axis	Axis control	An add-on for axis control	[baseSystem] [MotionEngine]	[AbsSystem] [ServoDriver] [SignalIO] [MotionEventHist]
MotionControl_General	PLCopen motion control single axis/multi-axis control FB	Enables the PLCopen® motion control single axis/multi-axis control FB.	[baseSystem] [MotionEngine] [Axis]	[SignalIO]
MotionControl_Sync	PLCopen motion control synchronous control	Enables the PLCopen® motion control synchronous control FB.	[baseSystem] [MotionEngine] [Axis] [MotionControl_General]	—
AbsSystem	Absolute position control	Enables the absolute position control.	[baseSystem] [Axis]	—
ServoDriver_CANopen	Servo driver (CANopen)	A servo driver for CANopen	[baseSystem] [Axis] [NetworkDriver_CCIETSN] [SignalIO]	—
NetworkDriver_CCIETSN	Network driver (CC-Link IE TSN)	A network driver for CC-Link IE TSN	[baseSystem]	—
PlcInstruction	External sequence dedicated instruction	Enables external sequence dedicated instructions.	[baseSystem]	[PLCopenMC_General] [ST] [SignalIO]
SignalIO	I/O signal	Provides I/O functions of signals.	[baseSystem]	[Axis]
ExternalSignal	External signal	Enables external signals.	[baseSystem] [SignalIO] [Axis]	—
Program_ST	ST language execution	An add-on for executing the ST language	[baseSystem]	[PLCopenMC_General]
Logging	Logging	Provides the logging function.	[baseSystem] [SignalIO]	—
MotionEventHist	Motion event history	An add-on for motion event history	[baseSystem]	—
FileTransfer	File transfer	Provides the file transfer function.	[baseSystem]	—

Add-on library name	Name	Description	Dependent add-on (required)	Dependent add-on (with functional restrictions)
MotionControl_AxisFilter	Command filter	Enables the PLCopen® motion control command filter control FB.	[baseSystem] [MotionEngine] [Axis] [MotionControl_General] [MotionControl_Sync]	—
ProfileControl	Operation profile control	Enables the operation profile control.	[baseSystem] [MotionEngine] [Axis] [MotionControl_General] [MotionControl_Sync]	[SignalIO]
PackagingApp	Packaging	Provides functions for packaging machines.	[baseSystem] [ProfileControl]	—
ServoSystemRecorder	Servo system recorder	Provides the servo system recorder function.	[baseSystem] [Logging] [Axis]	[ServoDriver_CANopen]
SimpleMotion	Simple Motion	An add-on for Simple Motion	[baseSystem] [Axis] [ServoDriver_CANopen] [NetworkDriver_CCIETSN] [SignalIO]	—
MotionControl_AdvancedSync	Advanced synchronous control	Provides advanced synchronous control functions.	[baseSystem] [Axis] [MotionEngine] [MotionControl_General]	[AbsSystem] [SignalIO] [ProfileControl]

Point

baseSystem is required.

Appendix 6 List of Boot Software

The following shows the versions of each boot corresponding to the software version of the Motion module.

Motion module software version	Boot name	
	Network boot software	Boot software
16	7	7
17	8	8
18	8	8
20	9	9
21	9	9
22	10	10
24	11	11
26	12	12
28	13	13
30	14	14
31	14	14
32	15	15
34	16	16
36	17	17

Appendix 7 Restrictions by the Version

Compatible versions of the engineering tool

The software versions corresponding to the Motion module are shown below.

Model	Version
	GX Works3
RD78G	1.075D or later

Point

Engineering tools other than the above do not support the Motion module.

■Compatible versions for each Motion module function

The compatible CPU module and engineering tool versions have restrictions depending on the functions of the Motion module.

The Motion module function and each compatible version are shown below.

Point

The add-on versions and software versions of the Motion module combinations are shown below.

☞ Page 730 List of Add-on Libraries

—: There is no restriction by the version.

Function	Add-on library		F/W versions of CPU module	Engineering tool version		Motion control FB Library version
	Library name	Version		GX Works3	Motion control setting function	
Supports the Simple motion mode	baseSystem	1.16	—	1.075D	—	—
	Axis	1.15				
	ServoDriver_CANopen	1.15				
	NetworkDriver_CCIETSN	1.15				
	SignalIO	1.15				
	SimpleMotion	1.15				
Supports watchdog counter	baseSystem	1.16	—	—	—	—
	NetworkDriver_CCIETSN	1.15				
Supports MR-J5D-G	baseSystem	1.17	—	—	—	—
Supports mark detection (servo amplifier TPR1 input)	SimpleMotion	1.19	—	1.080J	—	—
Servo OFF command enable function during speed/torque control	SimpleMotion	1.19	—	1.080J	—	—
Supports inter-module synchronous function	baseSystem	1.20	• R00CPU/R01CPU/R02CPU: 24 • R04CPU/R08CPU/R16CPU/R32CPUR120CPU: 57 • R04ENCPU/R08ENCPU/R16ENCPU/R32ENCPU/R120ENCPU: 57	1.080J	—	—
	SimpleMotion	1.19				
Supports driver communication	baseSystem	1.24	—	1.085P	—	—
	SimpleMotion	1.23				
Improvement of detection function of connected/disconnected devices	baseSystem	1.24	—	1.105K	—	—
Supports mutual switching of speed/torque control during servo OFF	SimpleMotion	1.29	—	—	—	—

Function	Add-on library		F/W versions of CPU module	Engineering tool version		Motion control FB Library version
	Library name	Version		GX Works3	Motion control setting function	
Supports synchronous encoder via servo amplifier, linear encoder (incremental type) and ABZ phase differential output type encoder connection	SimpleMotion	1.31	—	—	—	—
Supports IP address setting function	baseSystem	1.32	—	1.100E	—	—
Supports synchronous encoder axis via link device	baseSystem	1.34	—	1.105K	—	—
	SimpleMotion	1.33				
Supports mark detection (link device input)	baseSystem	1.34	—	1.105K	—	—
	SimpleMotion	1.33				
Supports link device external input signal/external command signal	SimpleMotion	1.35	—	1.110Q	—	—

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  Link device logic setting 335
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REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Description
August 2021	IB(NA)-0300572ENG-A	First edition
January 2022	IB(NA)-0300572ENG-B	■Added or modified parts SAFETY PRECAUTIONS, TERMS, GENERIC TERMS AND ABBREVIATIONS, Section 2.1, 2.2, 2.3, 3.1, 5.4, Chapter 6, Section 7.1, 8.3, 8.9, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.9, 9.10, 9.11, 9.12, 10.2, 12.1, 12.2, 12.3, 12.6, 12.7, 12.8, 12.9, 14.1, 14.2, 14.3, 14.4, 14.5, Appendix 1, 3, 4, 5, 6, INDEX
August 2022	IB(NA)-0300572ENG-C	■Added or modified parts SAFETY PRECAUTIONS, COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES, RELEVANT MANUALS, TERMS, Section 1.1. 1.2, 1.3, 3.1, 3.2, 4.5, 5.2, 5.3, 5.4, Chapter 6, Section 7.1, 8.2, 8.3, 8.4, 8.6, 8.7, 8.8, 8.9, 9.2, 9.3, 9.4, 9.6, 9.7, 9.8, 9.10, 9.11, 9.12, 9.13, 11.2, 11.3, 12.1, 12.2, 12.3, 12.4, 12.7, 12.8, 12.9, 13.2, 13.3, 13.4, 14.1, 14.2, 14.3, 14.4, 14.5, Appendix 2, 3, 4, 5, 6, INDEX
November 2022	IB(NA)-0300572ENG-D	■Added or modified parts Section 1.1, 3.2, 4.5, 8.6, 9.7, 10.2, 12.8, Appendix 3, WARRANTY
May 2023	IB(NA)-0300572ENG-E	■Added or modified parts SAFETY PRECAUTIONS, TERMS, GENERIC TERMS AND ABBREVIATIONS, Section 1.1, 1.2, 2.2, 3.1, 3.2, 4.4, 5.2, 5.3, Chapter 6, Section 7.1, 8.3, 8.4, 8.8, 8.9, 9.1, 9.4, 9.7, 9.8, 9.10, 9.12, 9.13, 10.2, 12.2, 12.3, 12.6, 12.9, 14.4, 14.5, 14.6, Appendix 3, 4, 5, 6
November 2023	IB(NA)-0300572ENG-F	■Added or modified parts Appendix 4, Appendix 5, INFORMATION AND SERVICES, TRADEMARKS
September 2024	IB(NA)-0300572ENG-G	■Added functions Link device external signal assignment function ■Added or modified parts TERMS, GENERIC TERMS AND ABBREVIATIONS, Section 2.2, 3.1, 3.2, 4.4, 5.4, 7.1, 8.1, 8.2, 8.3, 8.4, 8.8, 8.9, 9.1, 9.2, 9.3, 9.5, 9.6, 9.7, 9.8, 9.9, 9.11, 9.13, 9.14, 10.2, 12.1, 12.2, 12.3, 12.4, 12.7, 12.8, 12.9, 13.2, 14.2, 14.3, 14.4, 14.5, Appendix 3, 4, 5, 6, 7, TRADEMARKS
February 2025	IB(NA)-0300572ENG-H	■Added or modified parts SAFETY PRECAUTIONS, RELEVANT MANUALS, TERMS, GENERIC TERMS AND ABBREVIATIONS, Section 1.1, 2.1, 3.2, 8.3, 8.4, 8.8, 9.1, 9.2, 9.3, 9.4, 9.5, 9.9, 12.1, 12.2, 12.3, 12.7, 12.9, 14.4, 14.5, Appendix 3, 5, 6, 7, INDEX

Japanese manual number: IB-0300571-J

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WARRANTY

Warranty

1. Warranty period and coverage

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit is repaired or replaced.

[Term]

For terms of warranty, please contact your original place of purchase.

[Limitations]

(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.

(2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.

(3) Even during the term of warranty, the repair cost will be charged on you in the following cases;

1. a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
2. a failure caused by any alteration, etc. to the Product made on your side without our approval
3. a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
4. a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
5. any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
6. a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
7. a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
8. any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.

(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product. However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product

(1) For the use of our Motion module, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in the Motion module, and a backup or fail-safe function should operate on an external system to the Motion module when any failure or malfunction occurs.

(2) Our Motion module is designed and manufactured as a general purpose product for use at general industries.
Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

(3) Mitsubishi shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

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IB(NA)-0300572ENG-H(2502)MEE
MODEL: RD78-U-SMAP-E
MODEL CODE: 1XB035

MITSUBISHI ELECTRIC CORPORATION

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