MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-R series

MELSEC iQ-R High Speed Analog-Digital Converter Module User's Manual (Application)

-R60ADH4

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 prohibited 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 prohibited 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.

[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 MELSEC iQ-R Module Configuration Manual. 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(s) located at the bottom onto the guide(s) of the base unit, and push in the module until the hook(s) located at the top snaps into place. 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.
- When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
- 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.
- When wiring, shield the module using a cover or similar means to prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction. Remove the shield for heat dissipation before operating the system.
- 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 battery-less option cassette. Doing so may cause malfunction or failure of the module.
- 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.

[Startup and Maintenance Precautions]

⚠CAUTION

- 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.
  Safety Precautions For Static Electricity Before Using MELSEC MX Controller MX-R Model and MELSEC iQ-R Series Models (FA-A-0368)
- Use a clean and dry cloth to wipe off dirt on the module.

[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.

[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.

CONDITIONS OF USE FOR THE PRODUCT

(1) MELSEC programmable controller ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI ELECTRIC SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI ELECTRIC USER'S, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above restrictions, Mitsubishi Electric may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi Electric and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi Electric representative in your region.

(3) Mitsubishi Electric 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.

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC iQ-R series programmable controllers.
This manual describes the functions, parameter settings, and troubleshooting of the relevant product 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.

Point

Unless otherwise specified, this manual provides program examples in which the I/O numbers of X/Y0 to X/YF are assigned to the A/D converter module. Assign I/O numbers when applying the program examples to an actual system. For I/O number assignment, refer to the following.
MELSEC iQ-R Module Configuration Manual

Relevant product

R60ADH4

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RELEVANT MANUALS

The following manuals are relevant to this product.

Manual name [manual number]	Description
MELSEC iQ-R High Speed Analog-Digital Converter Module User's Manual (Application) [SH-081581ENG] (this manual)	Functions, parameter settings, I/O signals, buffer memory, and troubleshooting of the high speed analog-digital converter module
MELSEC iQ-R Module Configuration Manual [SH-081262ENG]	Combinations of MELSEC iQ-R series modules to be used, common information on installations/wiring for configuring systems, and specifications of the power supply module, base unit, SD memory card, and battery
MELSEC iQ-R High Speed Analog-Digital Converter Module User's Manual (Startup) [SH-081580ENG]	System configuration, specifications, procedures before operation, wiring, and operation examples of the high speed analog-digital converter module
MELSEC iQ-R Programming Manual (Module Dedicated Instructions) [SH-081976ENG]	Dedicated instructions for the intelligent function modules
MELSEC iQ-R Analog-Digital Converter Module/Digital-Analog Converter Module Function Block Reference [BCN-P5999-0375]	FBs of the A/D converter modules and D/A converter modules
GX Works3 Operating Manual [SH-081215ENG]	System configuration, parameter settings, and online operations of GX Works3
MELSEC iQ-R Online Module Change Manual [SH-081501ENG]	The online module change, which allows a module to be changed without stopping the system for MELSEC iQ-R series programmable controllers

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Buffer memory	A memory in an intelligent function module for storing data (such as setting values and monitored values). For a CPU module, it refers to a memory for storing data (such as setting values and monitored values of the Ethernet function, data used for data communications of the multiple CPU system function).
Engineering tool	A tool used for setting up programmable controllers, programming, debugging, and maintenance
Global label	A label that is valid for all the program data when multiple program data are created in the project. The global label has two types: a module specific label (module label), which is generated automatically by GX Works3, and an optional label, which can be created for any specified device.
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. For the module used, GX Works3 automatically generates this label, which can be used as a global label.
Offset/gain setting mode	The mode for the offset/gain setting
Redundant system with redundant extension base unit	A redundant system that is configured using extension base unit(s)
User range	An analog input range where any value can be set. This range can be set in the offset/gain setting.
Watchdog timer error	An error that occurs if the internal processing of the module is abnormal. Watchdog timer enables the module to monitor its own internal processing.

GENERIC TERMS AND ABBREVIATIONS

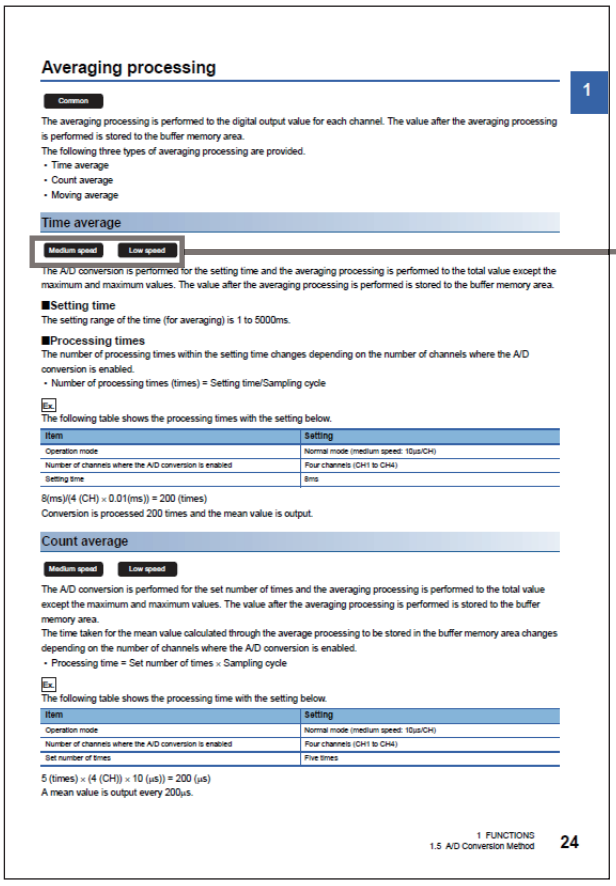
Unless otherwise specified, this manual uses the following generic terms and abbreviations.

Generic term/abbreviation	Description
A/D converter module	An abbreviation for MELSEC iQ-R series high speed analog-digital converter module
Factory default setting	A generic term for analog input ranges of 0 to 10V, 0 to 5V, 1 to 5V, -10 to 10V, 0 to 20mA, 4 to 20mA, 1 to 5V (extended mode), and 4 to 20mA (extended mode). In the window on the engineering tool, 4 to 20mA (extended mode) and 1 to 5V (extended mode) are displayed as follows: • 4 to 20mA (Extension) • 1 to 5V (Extension)
Normal mode	The mode for normal A/D conversion. Use one of the three types of modes, the normal mode (high speed: 1μs/CH), normal mode (medium speed: 10μs/CH), and normal mode (low speed: 20μs/CH).
Remote head module	An abbreviation for the RJ72GF15-T2 CC-Link IE Field Network remote head module

MANUAL PAGE ORGANIZATION

In this manual, pages about functions, I/O signals, and buffer memory areas are organized and the symbols are used as shown below.

The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.



Averaging processing

1

Common

The averaging processing is performed to the digital output value for each channel. The value after the averaging processing is performed is stored to the buffer memory area.

The following three types of averaging processing are provided.

- Time average
- Count average
- Moving average

Time average

Medium speed | Low speed

❶

The A/D conversion is performed for the setting time and the averaging processing is performed to the total value except the maximum and maximum values. The value after the averaging processing is performed is stored to the buffer memory area.

■Setting time

The setting range of the time (for averaging) is 1 to 5000ms.

■Processing times

The number of processing times within the setting time changes depending on the number of channels where the A/D conversion is enabled.

- Number of processing times (times) = Setting time/Sampling cycle

Ex.

The following table shows the processing times with the setting below.

Item	Setting
Operation mode	Normal mode (medium speed: 10μs/CH)
Number of channels where the A/D conversion is enabled	Four channels (CH1 to CH4)
Setting time	8ms

8(ms)/(4 (CH) × 0.01(ms)) = 200 (times)

Conversion is processed 200 times and the mean value is output.

Count average

Medium speed | Low speed

The A/D conversion is performed for the set number of times and the averaging processing is performed to the total value except the maximum and maximum values. The value after the averaging processing is performed is stored to the buffer memory area.

The time taken for the mean value calculated through the average processing to be stored in the buffer memory area changes depending on the number of channels where the A/D conversion is enabled.

- Processing time = Set number of times × Sampling cycle

Ex.

The following table shows the processing time with the setting below.

Item	Setting
Operation mode	Normal mode (medium speed: 10μs/CH)
Number of channels where the A/D conversion is enabled	Four channels (CH1 to CH4)
Set number of times	Five times

5 (times) × (4 (CH)) × 10 (μs)) = 200 (μs)

A mean value is output every 200μs.

1 FUNCTIONS
1.5 A/D Conversion Method
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❶ The following table lists the operation modes of the A/D converter module in which the corresponding functions and buffer memory areas can be used. Each icon indicates an operation mode as follows.

Icon	Description
Common	The corresponding functions and buffer memory areas can be used in all the operation modes.
High speed	The corresponding functions and buffer memory areas can be used in the normal mode (high speed: 1μs/CH).
Medium speed	The corresponding functions and buffer memory areas can be used in the normal mode (medium speed: 10μs/CH).
Low speed	The corresponding functions and buffer memory areas can be used in the normal mode (low speed: 20μs/CH).
Simultaneous conversion	The corresponding functions and buffer memory areas can be used in the simultaneous conversion mode (5μs/4CH).
Synchronization	The corresponding functions and buffer memory areas can be used in the inter-module synchronization mode.

For details on each mode, refer to the following.

☞ Page 17 Modes

1 FUNCTIONS

This chapter describes the functions of the A/D converter module and the setting procedures for those functions. For details on the I/O signals and the buffer memory, refer to the following.

☞ Page 193 I/O Signals
☞ Page 204 Buffer Memory Areas

Point

- This chapter describes I/O signals and buffer memory addresses for CH1. For details on the I/O signals and buffer memory addresses for CH2 and later, refer to the following.

☞ Page 193 List of I/O signals
☞ Page 204 List of buffer memory addresses

- Numerical values come in ☐ and △ of the error codes and alarm codes described in this chapter. ☐ indicates the channel where an error has occurred and △ indicates details of the error. For details on the numerical values, refer to the following.

☞ Page 183 List of Error Codes
☞ Page 190 List of Alarm Codes

1.1 Modes

The A/D converter module has the normal mode, simultaneous conversion mode, inter-module synchronization mode, and offset/gain setting mode. Change the mode according to the function used.

Normal mode

The normal A/D conversion is performed in this mode. Use the normal mode (high speed: 1μs/CH), the normal mode (medium speed: 10μs/CH), or the normal mode (low speed: 20μs/CH) for each sampling cycle. In this manual, the description of "normal mode" indicates the normal mode (high speed: 1μs/CH), normal mode (medium speed: 10μs/CH), and normal mode (low speed: 20μs/CH).

Simultaneous conversion mode

The A/D conversion is performed simultaneously in all channels. The sampling cycle is fixed to 5μs/4CH.

Inter-module synchronization mode

The A/D conversion is performed at the inter-module synchronization cycle in this mode.

Offset/gain setting mode

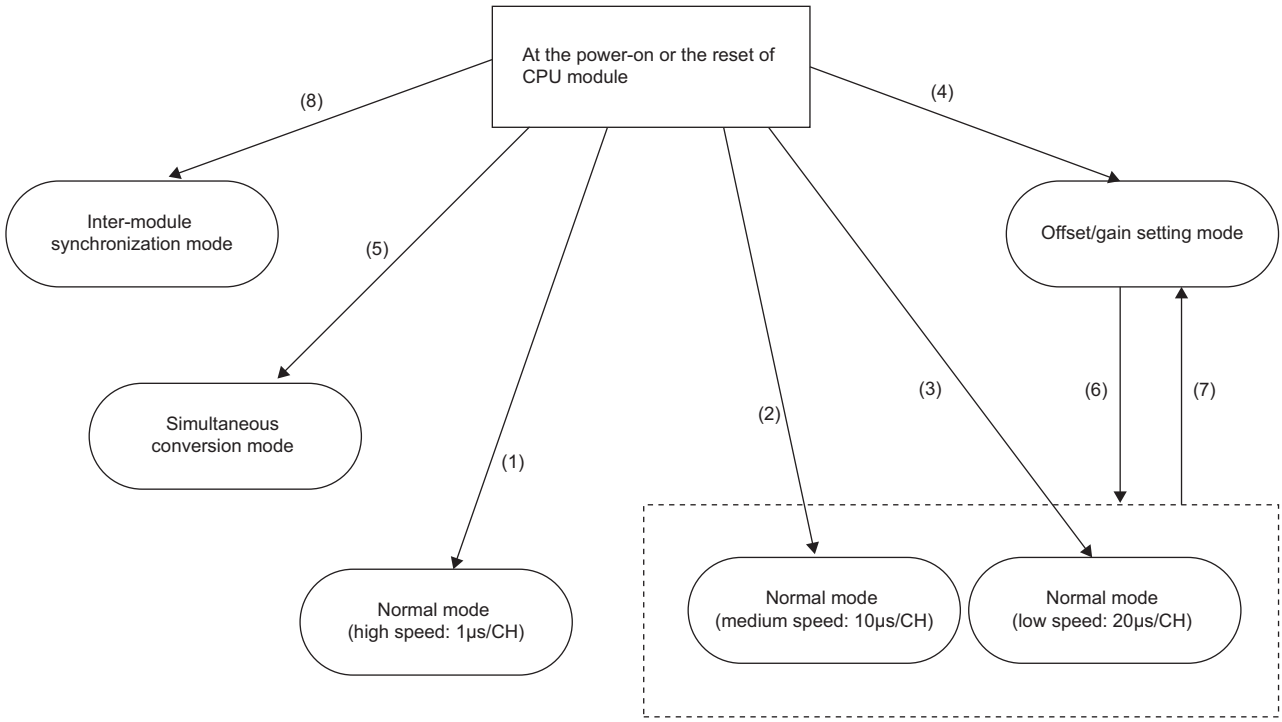
The mode for the offset/gain setting.

For details on the offset/gain setting, refer to the following.

MELSEC iQ-R High Speed Analog-Digital Converter Module User's Manual (Startup)

Mode transition

The following figure and table describe the transition condition for each mode.



No.	Transition condition	
(1) *1	Set "Normal mode (high speed: 1μs/CH)" for "Operation mode setting" in "Basic setting" of the engineering tool.	
(2)	Set "Normal mode (medium speed: 10μs/CH)" for "Operation mode setting" in "Basic setting" of the engineering tool.	
(3)	Set "Normal mode (low speed: 20μs/CH)" for "Operation mode setting" in "Basic setting" of the engineering tool.	
(4)	Set "Offset/gain setting mode" for "Operation mode setting" in "Basic setting" of the engineering tool.	
(5) *1	Set "Simultaneous conversion mode (5μs/4CH)" for "Operation mode setting" in "Basic setting" of the engineering tool.	
(6) *2*3	Change the mode with one of the following methods.	
	Method 1	Execute the G(P).OFFGAN (argument "S": 0: Shifting to the normal mode).
	Method 2	Set the following values for 'Mode switching setting' (Un\G296, Un\G297) and turn on and off 'Operating condition setting request' (Y9). • Un\G296: 5260H • Un\G297: 4144H
(7)	Change the mode with one of the following methods.	
	Method 1	Execute the G(P).OFFGAN (argument "S": 1: Shifting to the offset/gain setting mode).
	Method 2	Set the following values for 'Mode switching setting' (Un\G296, Un\G297) and turn on and off 'Operating condition setting request' (Y9). • Un\G296: 4144H • Un\G297: 5260H
(8) *1*4	Set "Synchronize" for the A/D converter module in the following parameter of the engineering tool. [System Parameter] ⇨ "Synchronization Setting within the Modules" ⇨ "Inter-module Synchronous Setting" ⇨ "Select Synchronous Target Unit between Unit"	

*1 The normal mode (high speed: 1μs/CH), the simultaneous conversion mode, and the inter-module synchronization mode are independent from the other modes. After the module is started in the normal mode (high speed: 1μs/CH), the simultaneous conversion mode, or the inter-module synchronization mode, the mode cannot be changed to the other modes. After the module is started in a mode other than the three modes, the mode cannot be switched to the normal mode (high speed: 1μs/CH), simultaneous conversion mode, and inter-module synchronization mode.

*2 The mode is shifted to the normal mode before the transition to the offset/gain setting mode.

*3 The offset/gain setting mode is set at the power-on or at the reset of the CPU module and the mode has never been shifted to the normal mode, the mode shifts to the normal mode (low speed: 20μs/CH).

*4 When "Synchronize" is set for the A/D converter module in "Select Synchronous Target Unit between Unit", the module operates in the inter-module synchronization mode regardless of "Operation mode setting". To operate the module in the normal mode, simultaneous conversion mode, or offset/gain setting mode, set "Do Not Synchronize" for the A/D converter module in "Select Synchronous Target Unit between Unit".

Checking method

The current mode can be checked with the following items.

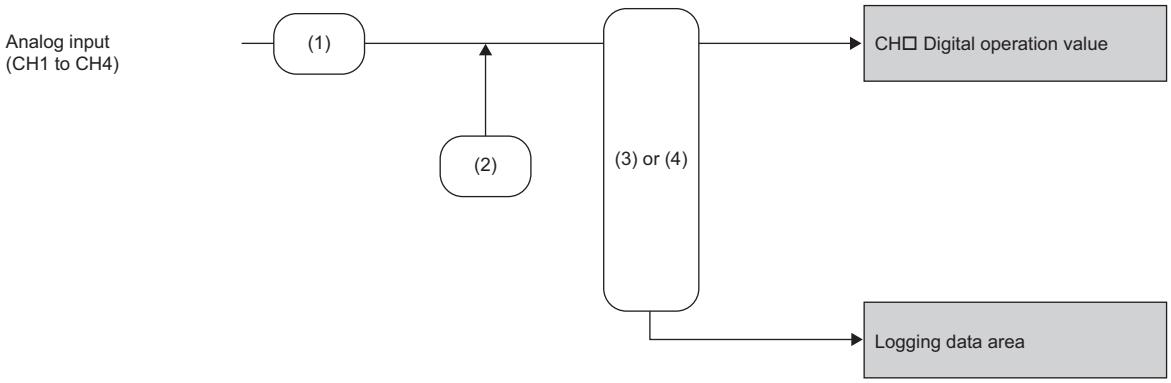
Mode		RUN LED status	Value stored in 'Operation mode monitor' (Un\G60)	'Offset/gain setting mode status flag' (XA)
Normal mode	Normal mode (high speed: 1μs/CH)	On	0	OFF
	Normal mode (medium speed: 10μs/CH)	On	1	OFF*1
	Normal mode (low speed: 20μs/CH)	On	2	OFF*1
Simultaneous conversion mode		On	3	OFF
Inter-module synchronization mode		On	4	OFF
Offset/gain setting mode		Flashing (1s cycle)	5	ON

*1 Status of when 'User range write request' (YA) is off

1.2 Processing of Each Function

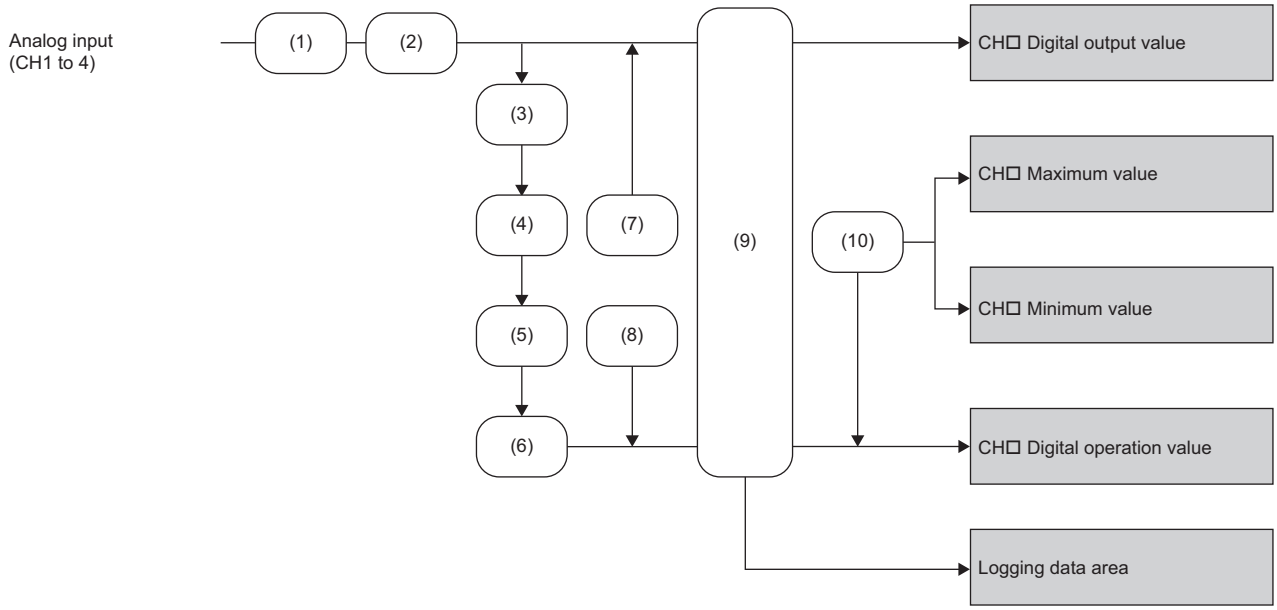
The functions are processed in the order shown below. If multiple functions are enabled, the output of the first processed function is used as the input of the next function.

• In the normal mode (high speed: 1μs/CH)



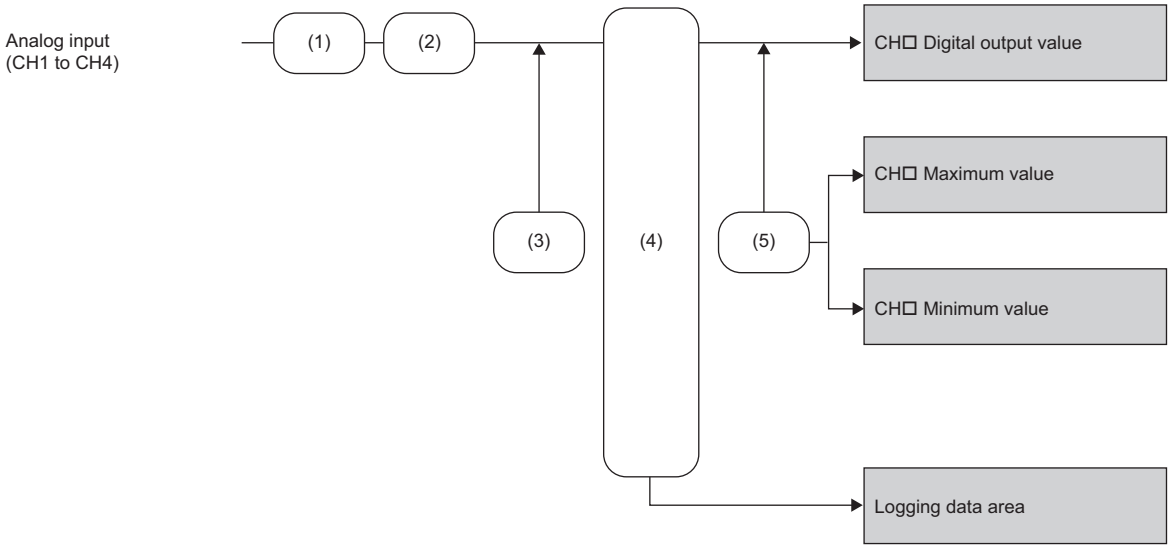
No.	Processing details
(1)	The A/D conversion is executed in one of the following A/D conversion methods. • Sampling processing • Moving average
(2)	Scaling function
(3)	High speed logging function
(4)	High speed continuous logging function

• In the normal mode (medium speed: 10μs/CH) and normal mode (low speed: 20μs/CH)



No.	Processing details
(1)	Input signal error detection function
(2)	The A/D conversion is executed in one of the following A/D conversion methods. • Sampling processing • Count average • Time average • Moving average • Primary delay filter • Low pass filter • High pass filter • Band pass filter
(3)	Digital clipping function
(4)	Scaling function
(5)	Shift function
(6)	Difference conversion function
(7)	Warning output function (rate alarm)
(8)	Warning output function (process alarm)
(9)	Normal logging function (normal mode (low speed: 20μs/CH) only)
(10)	Maximum value/minimum value hold function

• In the simultaneous conversion mode or inter-module synchronization mode



No.	Processing details
(1)	Input signal error detection function
(2)	The A/D conversion is executed in one of the following A/D conversion methods. • Sampling processing • Moving average
(3)	Warning output function (process alarm)
(4)	Continuous logging function
(5)	Maximum value/minimum value hold function

Digital output value

These values are the digital values after the sampling processing, each averaging processing, primary delay filter, or digital filter has been performed.

Digital operation value

These values are obtained by operating a digital output value using the digital clipping function, scaling function, shift function, or difference conversion function. When each function is not used, the same value as the digital output value is stored.

Maximum and minimum value

The maximum and minimum values of the following digital values are stored for each mode.

- In the normal mode (medium speed: 10μs/CH) and normal mode (low speed: 20μs/CH), the maximum and minimum values of the digital operation values are stored.
- In the simultaneous conversion mode or inter-module synchronization mode, the maximum and minimum values of the digital output values are stored.

Logging data area

When the logging function is used, digital output values or digital operation values are collected. The values to be collected change depending on the logging function used.

- Normal logging function: Digital output values or digital operation values
- High speed logging function: Digital operation values
- Continuous logging function: Digital output values
- High speed continuous logging function: Digital operation values

1.3 Range Switching Function

Common

This function switches the input range of an analog input for each channel.
Switching the range makes it possible to change the I/O conversion characteristics.

Setting procedure

Set the input range to be used in the "Input range setting".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Range switching function]

Input range setting	Digital output value
4 to 20mA	0 to 32000
0 to 20mA	
1 to 5V	
0 to 5V	
-10 to 10V	-32000 to 32000
0 to 10V	0 to 32000
4 to 20mA (Extension)	-8000 to 32000
1 to 5V (Extension)	
User range	-32000 to 32000

After the data is written, the range is switched when the programmable controller power supply is turned off and on or when the CPU module is reset.

Point

With the following buffer memory areas, the range switching and range setting can be monitored.
'CH1 Range setting' (Un\G598)
'CH1 Range setting monitor' (Un\G430)
For details on the buffer memory addresses, refer to the following.
☞ Page 267 CH1 Range setting
☞ Page 228 CH1 Range setting monitor

Precautions

The input range cannot be switched for the channel where A/D conversion disable is set. To switch the input range, set "A/D conversion enable/disable setting" to "A/D conversion enable".

1.4 A/D Conversion Enable/Disable Setting Function

Common

This function controls whether to enable or disable the A/D conversion for each channel.

Setting procedure

Set "A/D conversion enable/disable setting" to "A/D conversion enable" or "A/D conversion disable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion enable/disable setting function]

1.5 A/D Conversion Method

Common

An A/D conversion method can be set for each channel. The following lists available conversion methods.

- Sampling processing
- Averaging processing (time average, count average, moving average)
- Primary delay filter
- Digital filter (low pass filter, high pass filter, band pass filter)

Overview of A/D conversion

The A/D conversion can be executed as follows depending on the mode.

- In the normal mode, the A/D conversion is executed per channel. For example, when the A/D conversion is enabled for CH1, CH2, and CH3, the A/D conversion of CH2 is executed after the A/D conversion of CH1 is completed. The A/D conversion of CH3 is executed after the A/D conversion of CH2 is completed.
- In the simultaneous conversion mode or inter-module synchronization mode, the A/D conversion is executed simultaneously in all channels.

■Sampling cycle

Sampling cycle is the internal A/D conversion cycle. In the normal mode, this cycle varies depending on the setting of the number of conversion enabled channels. (☞ Page 24 A/D Conversion Enable/Disable Setting Function)

The following table lists the sampling cycles for the modes.

Mode		Sampling cycle
Normal mode	Normal mode (high speed: 1μs/CH)	1μs × Number of A/D conversion enabled channels
	Normal mode (medium speed: 10μs/CH)	10μs × Number of A/D conversion enabled channels
	Normal mode (low speed: 20μs/CH)	20μs × Number of A/D conversion enabled channels
Simultaneous conversion mode		5μs
Inter-module synchronization mode	Oversampling disable	Inter-module synchronization cycle
	Oversampling enable	5μs

■Conversion cycle

Digital output values are updated on the conversion cycle of sampling processing, averaging processing, primary delay filter, or digital filter. The following table lists the conversion cycles in each A/D conversion method.

A/D conversion method	Conversion cycle
Sampling processing	Sampling cycle
Time average*2	((The time set for Time average/Count average/Moving average/Primary delay filter constant setting) ÷ Sampling cycle)*1 × Sampling cycle
Count average*2	(The count set for Time average/Count average/Moving average/Primary delay filter constant setting) × Sampling cycle
Moving average	Sampling cycle
Primary delay filter*2	Sampling cycle
Low pass filter*2	Sampling cycle
High pass filter*2	Sampling cycle
Band pass filter*2	Sampling cycle

*1 Values after the decimal point are omitted.

*2 These methods cannot be used in the normal mode (high speed: 1μs/CH), simultaneous conversion mode, or inter-module synchronization mode.

Sampling processing

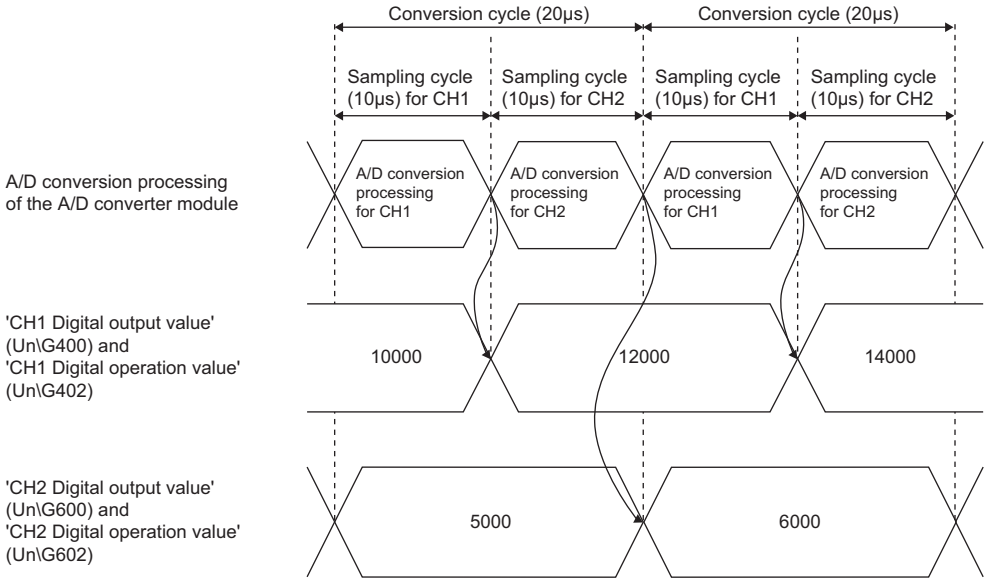
Common

Analog input values are converted at each sampling cycle and stored in the buffer memory as digital output values. The conversion cycle varies depending on the mode.

In the normal mode

The conversion cycle in the normal mode is the sampling cycle.
Whether to enable or disable the A/D conversion can be set for each channel. Disabling the A/D conversion for unused channels reduces the A/D conversion cycles.

Ex.
When the A/D conversion is enabled for CH1 and CH2 in the normal mode (medium speed: 10μs/CH), the conversion cycle is 20μs (10μs × 2). In this case, digital output values and digital operation values of CH1 and CH2 are updated every 10μs.



■Precautions for using the normal mode (high speed: 1μs/CH)

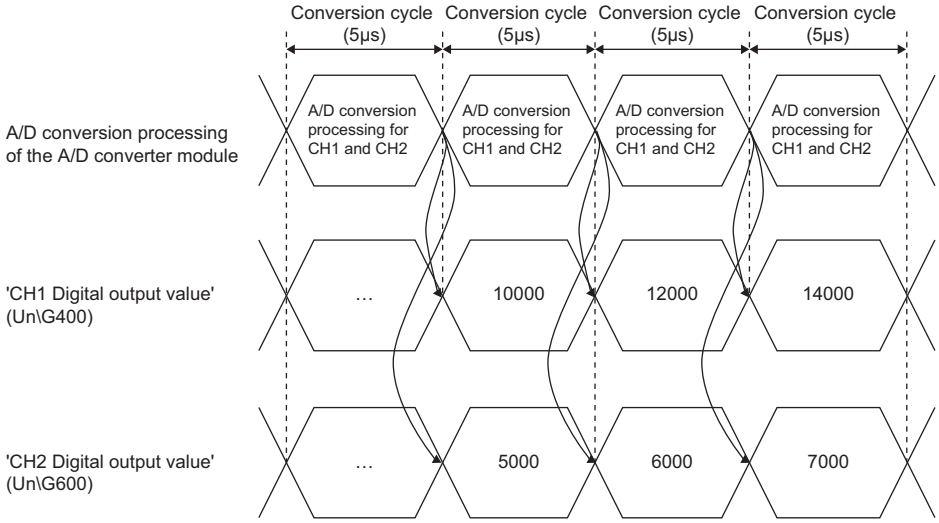
If CH□ Logging enable/disable setting is set to High speed continuous logging (2) or High speed logging (3) for any channel, the digital operation values are simultaneously updated in all channels at intervals of 5ms.

In the simultaneous conversion mode

In the simultaneous conversion mode, the conversion cycle is fixed to 5μs regardless of the number of conversion enabled channels. The A/D conversion is performed simultaneously in all channels.

Ex.

When the A/D conversion is enabled for CH1 and CH2 in the simultaneous conversion mode, digital output values of CH1 and CH2 are updated every 5μs.



Setting procedure

Set "Average processing setting" to "Sampling processing".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion method]

Averaging processing

Common

The A/D converter module performs the averaging processing on digital output values for each channel. The averaged values are stored in the buffer memory.

The following three types of averaging processing are provided.

- Time average
- Count average
- Moving average

Time average

Medium speed Low speed

The A/D conversion is performed for the setting time and the averaging processing is performed on the total value excluding the maximum and the minimum values. The averaged values are stored in the buffer memory.

■Setting time

The setting range of the time (for averaging) is 1 to 5000ms.

■Number of processing times

The number of processing times within the setting time changes depending on the number of channels where the A/D conversion is enabled.

- Number of processing times (times) = Setting time/Sampling cycle

Ex.

The following shows the number of processing times with the setting below.

Item	Setting
Operation mode	Normal mode (medium speed: 10μs/CH)
Number of channels where the A/D conversion is enabled	Four channels (CH1 to CH4)
Setting time	8ms

8 (ms)/(4 (CH) × 0.01 (ms)) = 200 (times)

Conversion is processed 200 times and the mean value is output.

Count average

Medium speed Low speed

The A/D conversion is performed for the set number of times and the averaging processing is performed on the total value excluding the maximum and the minimum values. The averaged values are stored in the buffer memory.
The time taken for the mean value calculated through the average processing to be stored in the buffer memory changes depending on the number of channels where the A/D conversion is enabled.

- Processing time = Set number of times × Sampling cycle

Ex.
The following shows the processing time with the setting below.

Item	Setting
Operation mode	Normal mode (medium speed: 10μs/CH)
Number of channels where the A/D conversion is enabled	Four channels (CH1 to CH4)
Set number of times	Five times

5 (times) × (4 (CH)) × 10 (μs)) = 200 (μs)
A mean value is output every 200μs.

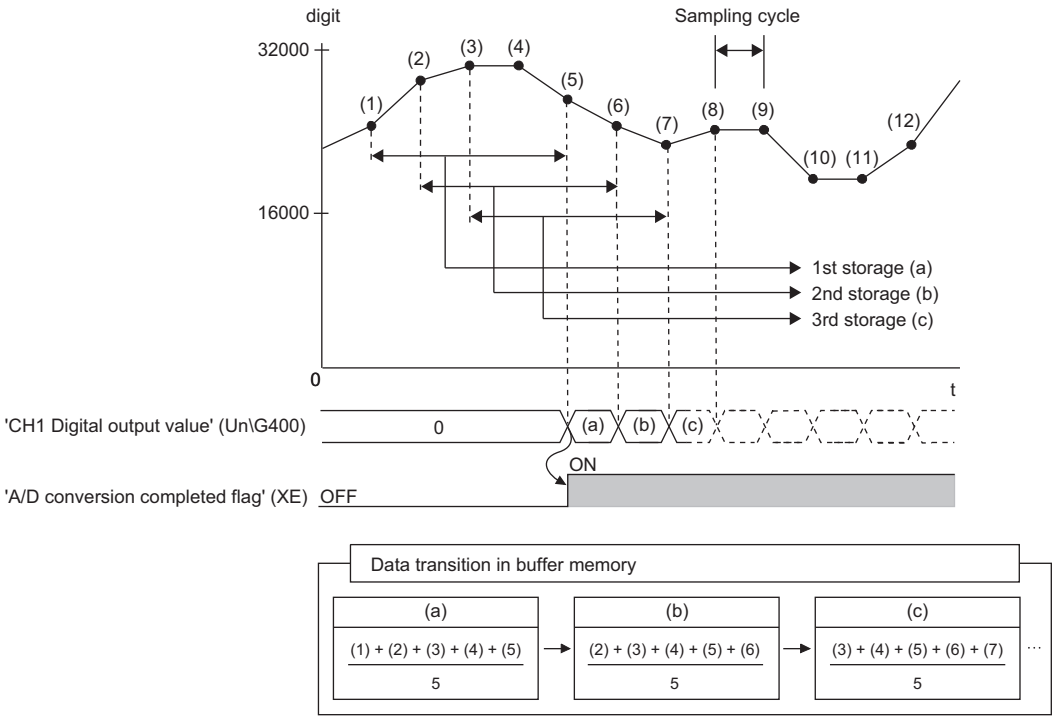
Point

Because the count average requires a sum of at least two converted values excluding the maximum and the minimum values, set four or more times as the set number of times.

Moving average

Common

The A/D converter module averages digital output values taken at every sampling cycle for a specified number of times, and stores a mean value in the buffer memory. Since the averaging processing is performed on a moving set of sampling, the latest digital output values can be obtained.
The following figure shows the moving average processing of when the set number of times is five.



digit: Digital output value
t: Time (μs)

Setting procedure

1. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)", "Normal mode (medium speed: 10μs/CH)", "Normal mode (high speed: 1μs/CH)", or "Simultaneous conversion mode (5μs/4CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "Average processing setting" to "Time average", "Count average", or "Moving average".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion method]

3. Set a value for "Time average/Count average/Moving average/Primary delay filter constant setting". The setting range varies depending on the "A/D conversion method".

A/D conversion method	Setting range
Time average	1 to 5000 (ms)
Count average	4 to 62500 (times)
Moving average	2 to 1000 (times)

Point

- Do not set "Time average" or "Count average" for "Average processing setting" in the normal mode (high speed: 1μs/CH), simultaneous conversion mode, or inter-module synchronization mode. Doing so causes an averaging process specification setting range error (error code: 191☐H) and the A/D conversion stops in all channels.
- In the simultaneous conversion mode or inter-module synchronization mode, set values so that the settings of "Average processing setting" and "Time average/Count average/Moving average/Primary delay filter constant setting" are the same in all channels where the A/D conversion is enabled. When the settings of the channels are different from one another, an across channels average setting error (error code: 19A0H) occurs and the A/D conversion stops in all channels. To specify different averaging processing settings for each channel, use the normal mode.

Primary delay filter

Medium speed Low speed

The A/D converter module smooths transient noise of an analog input according to the set time constant. The smoothed digital output value is stored in the buffer memory.

Time constant is the time taken for the digital output value to reach 63.2% of the steady-state value. The degree of smoothing changes depending on the setting of a time constant. The following shows the calculation formula of a time constant.

- Time constant = (Conversion cycle) × (Value set in 'CH1 Time average/Count average/Moving average/Primary delay filter constant setting' (Un\G502))

The following table shows the relational expressions of a time constant, digital output values, and current number of sampling (n).

Current number of sampling	Relational expression	Element
n = 1	$Y_n = 0$	Y_n: Current digital output value Y_{n-1}: Last digital output value n: Number of sampling X_n: Digital output value before smoothing X_{n-1}: Last digital output value before smoothing Δt: Sampling cycle TA: Time constant
n = 2	$Y_n = X_{n-1} + \frac{\Delta t}{\Delta t + TA}(X_n - X_{n-1})$	
n≥3	$Y_n = Y_{n-1} + \frac{\Delta t}{\Delta t + TA}(X_n - Y_{n-1})$	

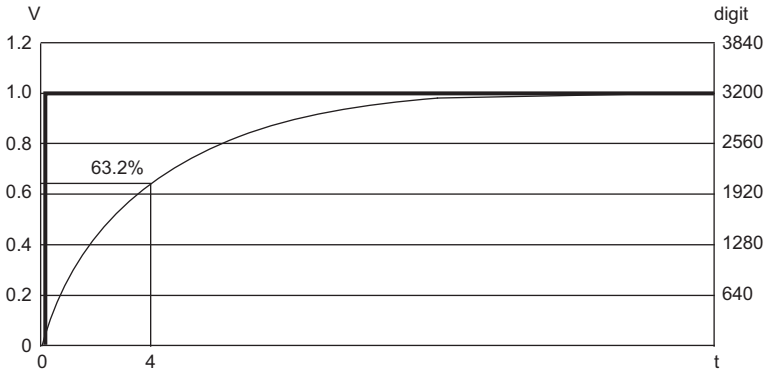
'A/D conversion completed flag' (XE) turns on when n ≥ 2.

Ex.

The following shows the digital output value of when an analog input value is changed from 0 to 1V.

Item	Setting
Operation mode	Normal mode (low speed: 20μs/CH)
Number of channels where the A/D conversion is enabled	Two channels
Primary delay filter constant setting	100

After 4ms from when the analog input value is changed to 1V, the digital output value reaches 63.2% of the digital output value of when the sampling processing is selected.



V: Analog input value (V)
t: Elapsed time (ms)
digit: Digital output value
: Change of the analog input value
: Change of the digital output value

Setting procedure

1. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)" or "Normal mode (medium speed: 10μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "Average processing setting" to "Primary delay filter".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion method]

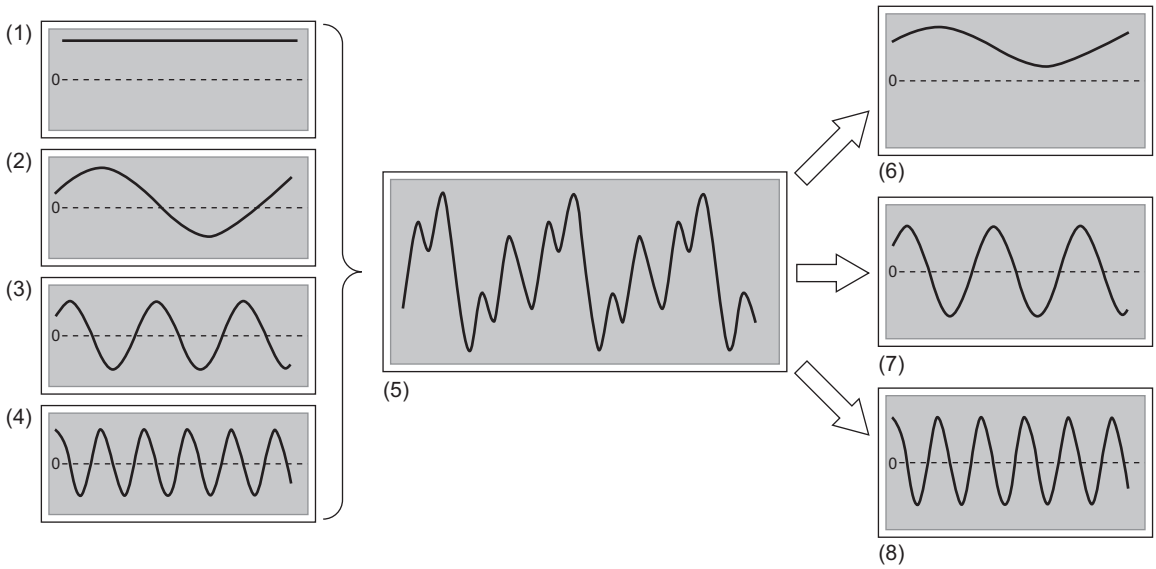
3. Set a value for "Time average/Count average/Moving average/Primary delay filter constant setting".

A/D conversion method	Setting range
Primary delay filter	1 to 500 (times)

Digital filter

Medium speed Low speed

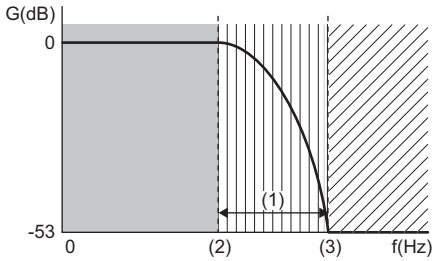
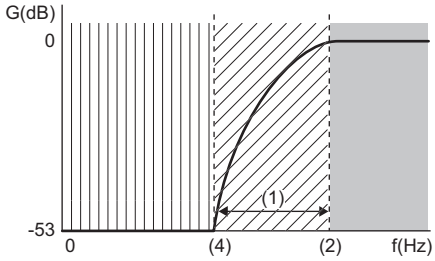
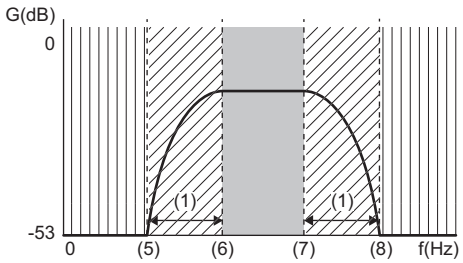
When data is obtained from a sensor connected with the A/D converter module, an analog input value may be output with unnecessary noise from the sensor. This function eliminates noise by attenuating unnecessary frequency data to obtain only digital values with target frequency data.
Select the low pass filter, high pass filter, or band pass filter depending on the sensor connected. When the high pass filter or band pass filter is used, direct signals are eliminated.



(1) Direct current
(2) Low frequency
(3) Medium frequency
(4) High frequency
(5) Wave including direct current, low frequency, medium frequency, and high frequency
(6) After filtering with the low pass filter
(7) After filtering with the band pass filter
(8) After filtering with the high pass filter

Characteristics and advantages of the digital filters

The following table lists the characteristics and advantages of the digital filters.

Filter type	Characteristic	Advantage
Low pass filter (low frequency pass filter)		• Analog input values are processed every conversion cycle. • This filter attenuates frequency signals between a pass band edge frequency and the pass band edge frequency + an attenuation band width to cut off frequency signals higher than the attenuation band. • The target frequency of the filtering should be the same as, or lower than 1/2 of the sampling frequency*1.
High pass filter (high frequency pass filter)		• Analog input values are processed every conversion cycle. • This filter attenuates frequency signals between a pass band edge frequency and the pass band edge frequency - an attenuation band width, cutting off frequency signals lower than the attenuation band. • The target frequency of the filtering should be the same as, or lower than 1/2 of the sampling frequency*1.
Band pass filter (band frequency pass filter)		• Analog input values are processed every conversion cycle. • Both the low pass filter and high pass filter are set simultaneously. As a result, only frequency within a specified bandwidth passes this filter. • The target frequency of the filtering should be the same as, or lower than 1/2 of the sampling frequency*1.

G: Attenuation rate (dB)
f: Frequency (Hz)
: Pass band*2
: Attenuation band*3
: Stopband*4

(1) Attenuation band width
(2) Pass band edge frequency
(3) Pass band edge frequency + Attenuation band width
(4) Pass band edge frequency - Attenuation band width
(5) Pass band edge frequency (Low) - Attenuation band width
(6) Pass band edge frequency (Low)
(7) Pass band edge frequency (High)
(8) Pass band edge frequency (High) + Attenuation band width

*1 Indicates the reciprocal number of the conversion cycle (1/conversion cycle).
*2 Indicates the frequency band where noise passes through the filter without being attenuated.
*3 Indicates the frequency band whose attenuation rate of the filter is in a transition state.
*4 Indicates the frequency band where noise is attenuated by the filter.

How to use the digital filters

To use the digital filters, configure the setting as shown below.

Filter type	Item	Setting and setting range	
Low pass filter	'CH1 Averaging process specification' (Un\G501)	Set Low pass filter (5).	
	'CH1 LPF Pass band edge frequency' (Un\G560)	Set a pass band edge frequency for the low pass filter. The setting range varies depending on the conversion cycle. The following shows the setting range of the frequency.	
		Conversion cycle	Setting range
		10μs	Pass band edge frequency + Attenuation band width ≤ 48000 Attenuation band width ≥ 1300 Pass band edge frequency ≥ 0
		20μs	Pass band edge frequency + Attenuation band width ≤ 24000 Attenuation band width ≥ 650 Pass band edge frequency ≥ 0
		30μs	Pass band edge frequency + Attenuation band width ≤ 16000 Attenuation band width ≥ 440 Pass band edge frequency ≥ 0
		40μs	Pass band edge frequency + Attenuation band width ≤ 12000 Attenuation band width ≥ 330 Pass band edge frequency ≥ 0
		60μs	Pass band edge frequency + Attenuation band width ≤ 8000 Attenuation band width ≥ 220 Pass band edge frequency ≥ 0
		80μs	Pass band edge frequency + Attenuation band width ≤ 6000 Attenuation band width ≥ 170 Pass band edge frequency ≥ 0
	'CH1 Attenuation band width' (Un\G568)	Set an attenuation band width for each channel. Set an attenuation band width so that the sum of an LPF pass band edge frequency and the attenuation band width becomes the boundary between the attenuation band and a stopband. Frequencies higher than the sum of the LPF pass band edge frequency and the attenuation band width are cut off. For the setting range, refer to 'CH1 LPF Pass band edge frequency' (Un\G560).	

<table>
<tr><th>Filter type</th><th>Item</th><th colspan="2">Setting and setting range</th></tr>
<tr><td rowspan="10">High pass filter</td><td>'CH1 Averaging process specification' (Un\G501)</td><td colspan="2">Set High pass filter (6).</td></tr>
<tr><td rowspan="8">'CH1 HPF Pass band edge frequency' (Un\G562)</td><td colspan="2">Set a pass band edge frequency for the high pass filter.
The setting range varies depending on the conversion cycle. The following shows the setting range of the frequency.</td></tr>
<tr><td>Conversion cycle</td><td>Setting range</td></tr>
<tr><td>10μs</td><td>Pass band edge frequency - Attenuation band width > 0
Attenuation band width ≥ 1300
Pass band edge frequency ≤ 48000</td></tr>
<tr><td>20μs</td><td>Pass band edge frequency - Attenuation band width > 0
Attenuation band width ≥ 650
Pass band edge frequency ≤ 24000</td></tr>
<tr><td>30μs</td><td>Pass band edge frequency - Attenuation band width > 0
Attenuation band width ≥ 440
Pass band edge frequency ≤ 16000</td></tr>
<tr><td>40μs</td><td>Pass band edge frequency - Attenuation band width > 0
Attenuation band width ≥ 330
Pass band edge frequency ≤ 12000</td></tr>
<tr><td>60μs</td><td>Pass band edge frequency - Attenuation band width > 0
Attenuation band width ≥ 220
Pass band edge frequency ≤ 8000</td></tr>
<tr><td>80μs</td><td>Pass band edge frequency - Attenuation band width > 0
Attenuation band width ≥ 170
Pass band edge frequency ≤ 6000</td></tr>
<tr><td>'CH1 Attenuation band width' (Un\G568)</td><td colspan="2">Set an attenuation band width for each channel.
Set an attenuation band width so that the difference between an HPF pass band edge frequency and the attenuation band width becomes the boundary between the attenuation band and a stopband.
Frequencies lower than the difference between the HPF pass band edge frequency and attenuation band width are cut off.
For the setting range, refer to 'CH1 HPF Pass band edge frequency' (Un\G562).</td></tr>
</table>

<table>
<tr><th>Filter type</th><th>Item</th><th colspan="2">Setting and setting range</th></tr>
<tr><td rowspan="9">Band pass filter</td><td>'CH1 Averaging process specification' (Un\G501)</td><td colspan="2">Set Band pass filter (7).</td></tr>
<tr><td>'CH1 BPF Pass band edge frequency (Low)' (Un\G564)
'CH1 BPF Pass band edge frequency (High)' (Un\G566)</td><td colspan="2">Set a pass band edge frequency for the band pass filter. Set the frequency that becomes the boundary between the lower pass band and an attenuation band and the one that becomes the boundary between the higher pass band and an attenuation band.
The setting range varies depending on the conversion cycle. The following shows the setting range of the frequency.</td></tr>
<tr><td rowspan="7"></td><td>Conversion cycle</td><td>Setting range</td></tr>
<tr><td>10μs</td><td>Pass band edge frequency (High) + Attenuation band width ≤ 48000
Pass band edge frequency (Low) - Attenuation band width > 0
Attenuation band width ≥ 1300
Pass band edge frequency (Low) < Pass band edge frequency (High)</td></tr>
<tr><td>20μs</td><td>Pass band edge frequency (High) + Attenuation band width ≤ 24000
Pass band edge frequency (Low) - Attenuation band width > 0
Attenuation band width ≥ 650
Pass band edge frequency (Low) < Pass band edge frequency (High)</td></tr>
<tr><td>30μs</td><td>Pass band edge frequency (High) + Attenuation band width ≤ 16000
Pass band edge frequency (Low) - Attenuation band width > 0
Attenuation band width ≥ 440
Pass band edge frequency (Low) < Pass band edge frequency (High)</td></tr>
<tr><td>40μs</td><td>Pass band edge frequency (High) + Attenuation band width ≤ 12000
Pass band edge frequency (Low) - Attenuation band width > 0
Attenuation band width ≥ 330
Pass band edge frequency (Low) < Pass band edge frequency (High)</td></tr>
<tr><td>60μs</td><td>Pass band edge frequency (High) + Attenuation band width ≤ 8000
Pass band edge frequency (Low) - Attenuation band width > 0
Attenuation band width ≥ 220
Pass band edge frequency (Low) < Pass band edge frequency (High)</td></tr>
<tr><td>80μs</td><td>Pass band edge frequency (High) + Attenuation band width ≤ 6000
Pass band edge frequency (Low) - Attenuation band width > 0
Attenuation band width ≥ 170
Pass band edge frequency (Low) < Pass band edge frequency (High)</td></tr>
<tr><td>'CH1 Attenuation band width' (Un\G568)</td><td colspan="2">Set an attenuation band width for each channel. This setting is common to both lower and higher sides.
• The difference between the BPF pass band edge frequency (Low) and the attenuation band width is the boundary between the lower attenuation band and the stopband. Frequencies lower than the difference between the BPF pass band edge frequency (Low) and the attenuation band width are cut off.
• The sum of the BPF pass band edge frequency (High) and attenuation band width is the boundary between the higher attenuation band and the stopband. Frequencies higher than the sum of the BPF pass band edge frequency (High) and the attenuation band width are cut off.</td></tr>
</table>

Attenuation characteristic and response time

The A/D converter module uses FIR filters as the digital filters. An FIR filter has linear phase response, provides system stability, and displays a steep attenuation characteristic, but takes time to respond.

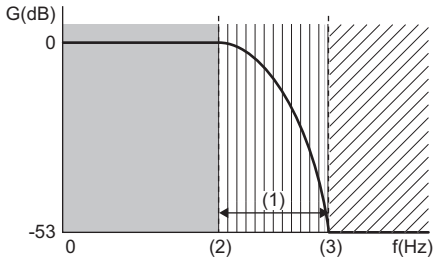
■Attenuation characteristic

For the digital filters of the A/D converter module, the frequency boundary (pass band edge frequency) between a pass band and an attenuation band is set. In addition, the frequency boundary (pass band edge frequency + attenuation band width) between the attenuation band and a stopband is set as well.

An attenuation characteristic is composed of the attenuation band and the attenuation rate (-53(dB)) shown with the pass band edge frequency and the pass band edge frequency + the attenuation band width.

Ex.

The following figure shows the attenuation characteristic (attenuation band and attenuation rate) of when the low pass filter is used.



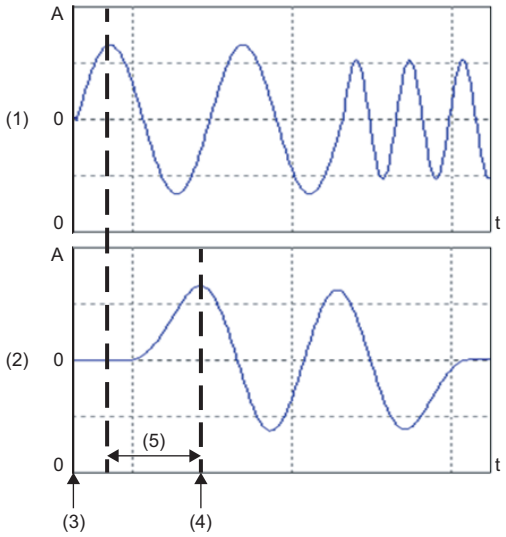
G: Attenuation rate (dB)
f: Frequency (Hz)
: Pass band
: Attenuation band
: Stopband
(1) Attenuation band width
(2) Pass band edge frequency
(3) Pass band edge frequency + Attenuation band width

■Response time

Response time is the time taken to obtain an attenuation characteristic (-53(dB)) after filter processing is started. The following figure shows the response time.

Ex.

The output waveform obtained after an input SIN wave passed through a digital filter.



A: Amplitude
t: Time (ms)
(1) Input waveform
(2) Waveform after the digital filtering
(3) Start of the filter processing
(4) Timing to obtain an attenuation characteristic
(5) Response time (Conversion cycle × Filter degree*1)

*1 The filter degree is calculated with the following formula.
= 3.3 × Sampling frequency ÷ Attenuation band width
= 3.3 × (1000000 ÷ Sampling cycle) ÷ Attenuation band width (Value after the decimal point is rounded up.)
When the calculation result of the formula above is an even value, add 1 to the value so that it becomes an odd value.

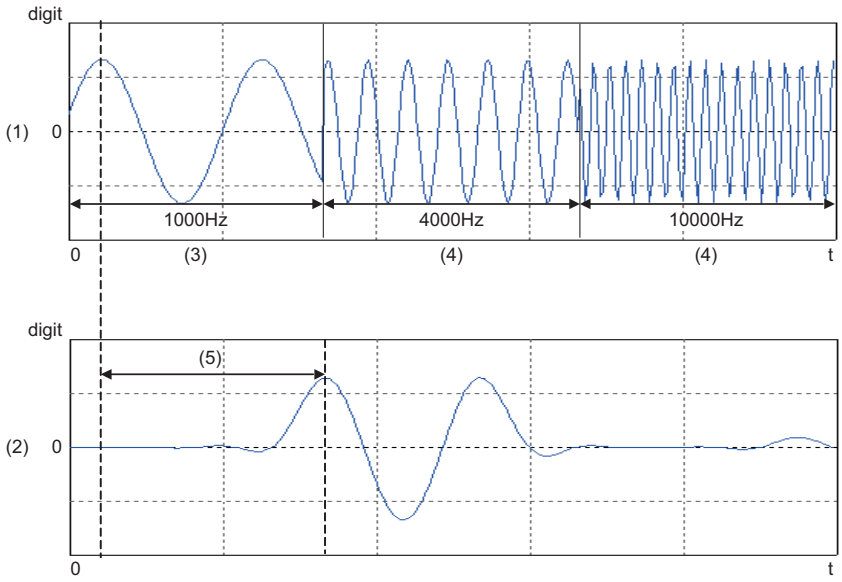
Setting example

The following shows the setting example of a digital filter.

■Example 1

The following describes an example under the following conditions with a low pass filter.

- Operation mode: Normal mode (medium speed: 10μs/CH)
- Channels to be used: CH1
- Conversion cycle: 10μs (Sampling frequency: 100kHz)
- 'CH1 LPF Pass band edge frequency' (Un\G560): 1400 (Hz)
- 'CH1 Attenuation band width' (Un\G568): 1300 (Hz)
- The frequency of analog inputs is changed from 1000Hz to 4000Hz, and 4000Hz to 10000Hz to input a SIN wave.



digit: Digital output value
t: Time (ms)
(1) Input waveform
(2) Waveform after the digital filtering
(3) Frequency that passes through
(4) Frequency to be attenuated
(5) Response time (Conversion cycle (10μs) × Filter degree (255)*1 = 2.55ms)

*1 The filter degree is calculated with the following formula.
= 3.3 × (1000000 ÷ 10) ÷ 1300
= 253.846···
= 254 (Value after the decimal point is rounded up.)
Because the calculation result is an even value, add 1 so that the value becomes an odd value.
= 254 + 1
= 255

1.6 Scaling Function

High speed | Medium speed | Low speed

This function performs the scale conversion on digital output values. The values are converted within a specified range between a scaling upper limit value and scaling lower limit value. This function reduces the time and effort to create a program of the scale conversion.

The converted values are stored in 'CH1 Digital operation value' (Un\G402).

Concept of scaling setting

Ex.

When the input range is set to -10 to 10V:

For the scaling lower limit value, set a value corresponding to the lower limit value of the input range (-32000).

For the scaling upper limit value, set a value corresponding to the upper limit value of the input range (32000).

Calculating the scaling value

The scale conversion is based on the following formula. (In the scale conversion, values are rounded to the nearest whole number.)

- Current: 0 to 20mA, 4 to 20mA, 4 to 20mA (extended mode)*1, user range setting (current)
- Voltage: 0 to 10V, 0 to 5V, 1 to 5V, 1 to 5V (extended mode)*1, user range setting (voltage)

$$D_Y = \frac{D_X \times (S_H - S_L)}{D_{Max}} + S_L$$

- Voltage: -10 to 10V

$$D_Y = \frac{D_X \times (S_H - S_L)}{D_{Max} - D_{Min}} + \frac{(S_H + S_L)}{2}$$

D_X : Digital output value
D_Y : Scaling value (Digital operation value)
D_{Max} : Maximum digital output value of the input range in use
D_{Min} : Minimum digital output value of the input range in use
S_H : Scaling upper limit value
S_L : Scaling lower limit value

*1 Although the range of the digital output value in the extended mode is -8000 to 32000, this function performs the scale conversion on digital output values within the range of 0 to 32000.

Setting procedure

1. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)", "Normal mode (medium speed: 10μs/CH)" or "Normal mode (high speed: 1μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "Scaling enable/disable setting" to "Enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Scaling function]

3. Set values for "Scaling upper limit value" and "Scaling lower limit value".

Item	Setting range
Scaling upper limit value	-32000 to 32000
Scaling lower limit value	

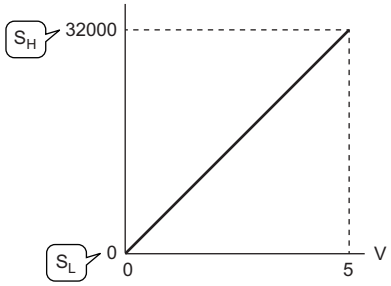
Point

- Even when the scaling upper limit value and the scaling lower limit value are set so that the change is greater than the resolution, the resolution will not increase.
- If the relation between the values is scaling lower limit value > scaling upper limit value, the scale conversion can be performed according to a negative slope.
- Set the scaling with the condition "Scaling upper limit value ≠ Scaling lower limit value".

Setting example

Ex.

When 20000 is set for the scaling upper limit value and 4000 is set for the scaling lower limit value for the module with the input range of 0 to 5V

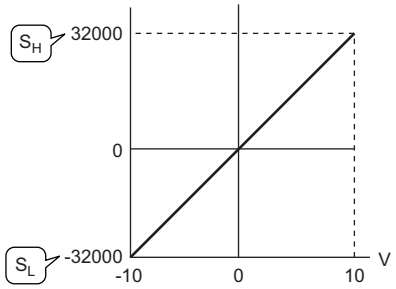


V: Analog input voltage (V)
S_H: Scaling upper limit value: 20000
S_L: Scaling lower limit value: 4000

Voltage input (V)	Digital output value	Scaling value (Digital operation value)
0	0	4000
1	6400	7200
2	12800	10400
3	19200	13600
4	25600	16800
5	32000	20000

Ex.

When 20000 is set for the scaling upper limit value and 4000 is set for the scaling lower limit value for the module with the input range of -10 to 10V

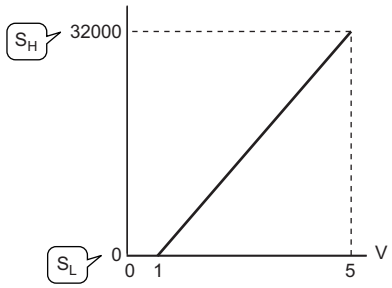


V: Analog input voltage (V)
S_H: Scaling upper limit value: 20000
S_L: Scaling lower limit value: 4000

Voltage input (V)	Digital output value	Scaling value (Digital operation value)
-10	-32000	4000
-5	-16000	8000
0	0	12000
5	16000	16000
10	32000	20000

Ex.

When 20000 is set for the scaling upper limit value and 4000 is set for the scaling lower limit value for the module with the input range of 1 to 5V (extended mode)



V: Analog input voltage (V)
S_H: Scaling upper limit value: 20000
S_L: Scaling lower limit value: 4000

Voltage input (V)	Digital output value	Scaling value (Digital operation value)
0	-8000	0
1	0	4000
2	8000	8000
3	16000	12000
4	24000	16000
5	32000	20000
5.096	32767	20384

Point

When the scaling function is used with the digital clipping function, the scale conversion is performed on the digital operation values after digital clipping.

1.7 Shift Function

Medium speed Low speed

This function adds (shifts) a set conversion value shift amount to a digital output value and stores the result in the buffer memory. The change in the conversion value shift amount is reflected on the digital operation value on a real-time basis. Therefore, fine adjustment can be easily performed when the system starts.

Operation

A set conversion value shift amount is added to the digital operation value. The digital operation value with shift addition is stored in 'CH1 Digital operation value' (Un\G402). The conversion value shift amount is added in every sampling cycle when sampling processing is performed, or the conversion value shift amount is added in every averaging process cycle when averaging processing is performed. The value after the addition is stored in 'CH1 Digital operation value' (Un\G402). If the conversion value shift amount is set, the value is added regardless of turning on and off of 'Operating condition setting request' (Y9).

Setting procedure

1. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)" or "Normal mode (medium speed: 10μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set a value for "Conversion value shift amount".

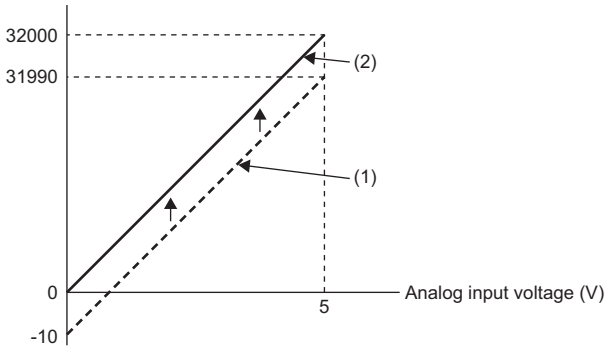
[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Shift function]

Item	Setting range
Conversion value shift amount	-32768 to 32767

Setting example

Ex.

When the I/O conversion characteristics are adjusted in a channel where the input range of 0 to 5V is set by the shift function

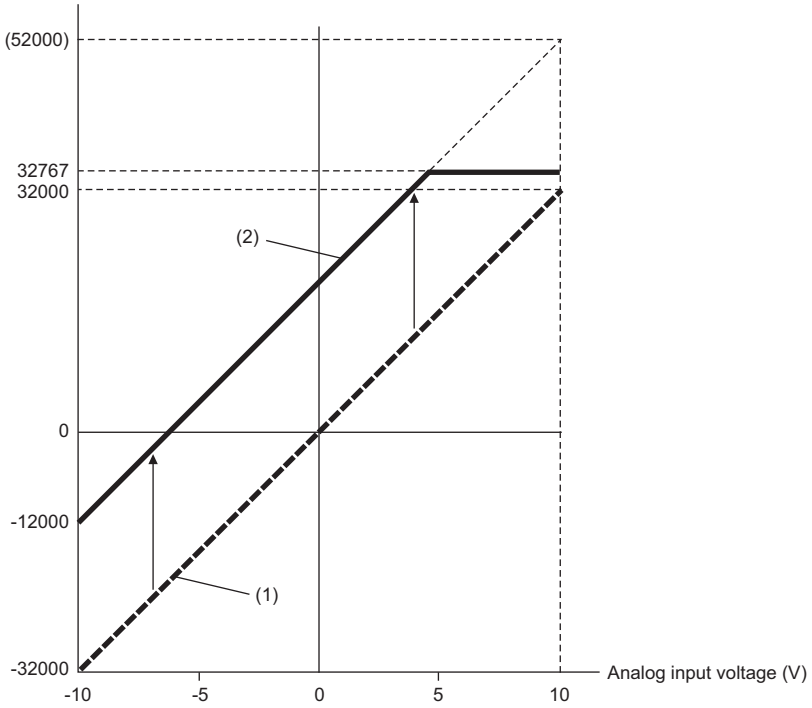


(1) 'CH1 Digital output value' (Un\G400)
+
'CH1 Conversion value shift amount' (Un\G472) "+10"
↓
(2) 'CH1 Digital operation value' (Un\G402)

Voltage input (V)	Digital output value	Digital operation value
0	-10	0
5	31990	32000

Ex.

When the I/O conversion characteristics are adjusted in a channel where the input range of -10 to 10V is set by the shift function



(1) 'CH1 Digital output value' (Un\G400)
+
'CH1 Conversion value shift amount' (Un\G472)
"+20000"
↓
(2) 'CH1 Digital operation value' (Un\G402)

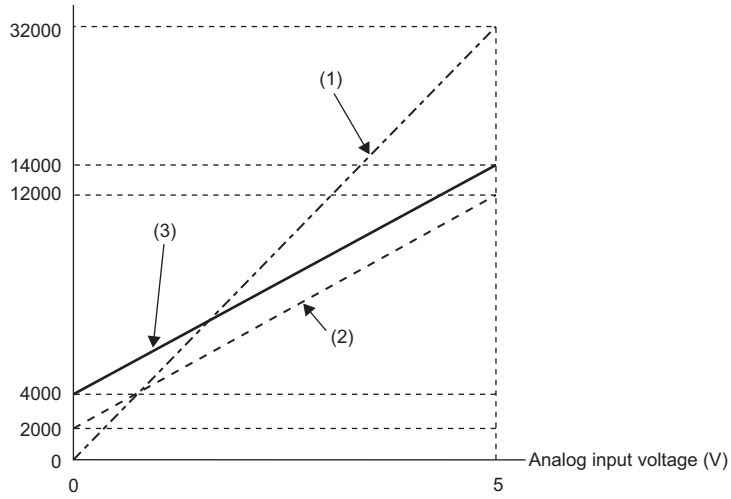
Voltage input (V)	Digital output value	Digital operation value
-10	-32000	-12000
-5	-16000	4000
0	0	20000
5	16000	32767*1
10	32000	32767*1

*1 Because the value exceeds the range of -32768 to 32767, the value is fixed to 32767 (the upper limit value).

Ex.

When the following values are set for the A/D converter module with the input range of 0 to 5V

- 'CH1 Scaling enable/disable setting' (Un\G504): Enable (0)
- 'CH1 Scaling upper limit value' (Un\G506): 12000
- 'CH1 Scaling lower limit value' (Un\G508): 2000
- 'CH1 Conversion value shift amount' (Un\G472): 2000



(1) 'CH1 Digital output value' (Un\G400)
Scaling
0 to 32000
↓
2000 to 12000

(2) Value after scaling
'CH1 Conversion value shift amount' (Un\G472) "+2000"
↓

(3) 'CH1 Digital operation value' (Un\G402)

Voltage input (V)	Digital output value	Value after scaling	Digital operation value
0	0	2000	4000
1	6400	4000	6000
2	12800	6000	8000
3	19200	8000	10000
4	25600	10000	12000
5	32000	12000	14000

Point

When the shift function is used with the digital clipping function and scaling function, shift-and-add is performed on the value obtained after digital clipping and scale conversion. Therefore, the range of the digital operation value is determined as -32768 to 32767.

For a setting example of when the digital clipping function, scaling function, and shift function are used together, refer to the following.

☞ Page 49 Setting example

1.8 Digital Clipping Function

Medium speed Low speed

This function fixes the digital operation value with the maximum digital output value and the minimum digital output value when the corresponding current or voltage exceeds the input range.

List of output ranges

The following table lists the output ranges of the digital operation values when the digital clipping function is enabled for each range.

Input range	Output range of digital operation values	
	Digital clipping function is enabled	Digital clipping function is disabled
4 to 20mA	0 to 32000	-768 to 32767
0 to 20mA		
1 to 5V		
0 to 5V		
0 to 10V		
-10 to 10V	-32000 to 32000	-32768 to 32767
User range setting		
4 to 20mA (extended mode)	-8000 to 32000	-8768 to 32767
1 to 5V (extended mode)		

Setting procedure

1. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)" or "Normal mode (medium speed: 10μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "Digital clipping enable/disable setting" to "Enable".

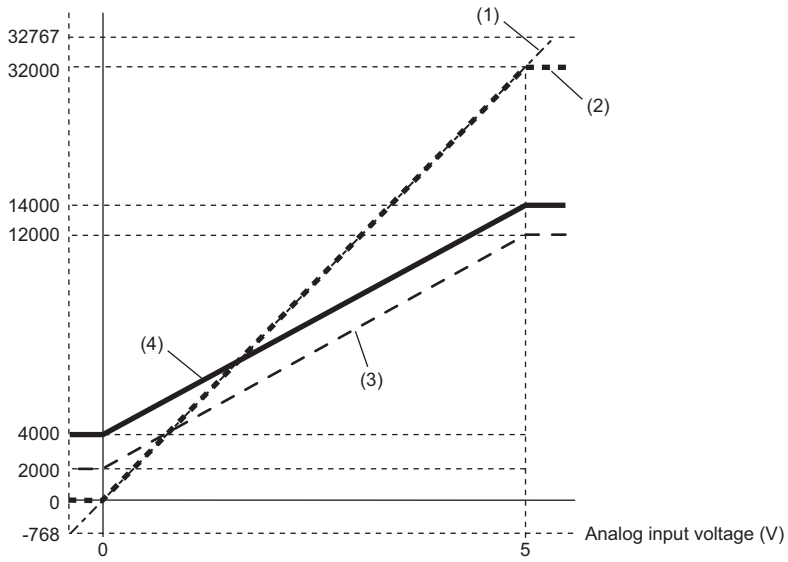
[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Digital clipping function]

Setting example

Ex.

When the following values are set for the A/D converter module with the input range of 0 to 5V

- 'CH1 Scaling enable/disable setting' (Un\G504): Enable (0)
- 'CH1 Scaling upper limit value' (Un\G506): 12000
- 'CH1 Scaling lower limit value' (Un\G508): 2000
- 'CH1 Conversion value shift amount' (Un\G472): 2000
- 'CH1 Digital clipping enable/disable setting' (Un\G510): Enable (0)



(1) 'CH1 Digital output value' (Un\G400)
Digital clipping
-768 to 32767
↓
0 to 32000

(2) Value after digital clipping
Scaling
0 to 32000
↓
2000 to 12000

(3) Value after scaling
'CH1 Conversion value shift amount' (Un\G472)
"+2000"
↓
4000 to 14000

(4) 'CH1 Digital operation value' (Un\G402)

Input voltage (V)	Digital output value	Digital operation value
-0.12	-768	4000
0	0	4000
1	6400	6000
2	12800	8000
3	19200	10000
4	25600	12000
5	32000	14000
5.096	32767	14000

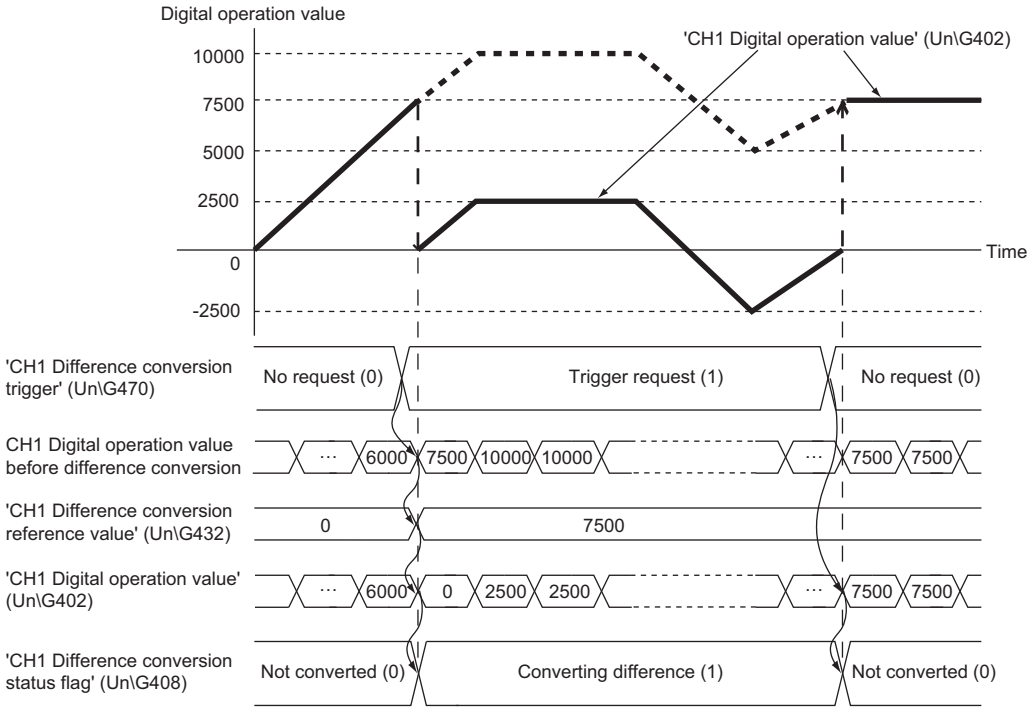
Point

When the digital clipping function is used with the scaling function, shift function, and difference conversion function, the scale conversion, shift-and-add, and difference conversion are performed on the value obtained after digital clipping.

1.9 Difference Conversion Function

Medium speed Low speed

This function subtracts the difference conversion reference value from a digital operation value and stores the acquired value in the buffer memory.
The digital operation value at the start of this function is treated as 0 (reference value). Thereafter, values that increased or decreased from the reference value are stored in the buffer memory.



Operation

The digital operation value at the start of the difference conversion (the data stored inside the A/D converter module before the difference conversion starts) is determined as a difference conversion reference value. The value acquired by subtracting the difference conversion reference value from the digital operation value is stored in 'CH1 Digital operation value' (Un\G402). At the start of this function, the digital operation value is 0 (because the digital operation value and the difference conversion reference value have the same value at the start).

- Digital operation value after difference conversion = (Digital operation value) - (Difference conversion reference value)

■Starting the difference conversion

1. Change 'CH1 Difference conversion trigger' (Un\G470) from No request (0) to Trigger request (1).

The rise of No request (0) → Trigger request (1) is detected as a trigger. When the trigger is detected, the digital operation value at the start is output to the difference conversion reference value. The value acquired by subtracting the difference conversion reference value from the digital operation value is stored in 'CH1 Digital operation value' (Un\G402). After the value is stored, 'CH1 Difference conversion status flag' (Un\G408) turns to Converting difference (1).

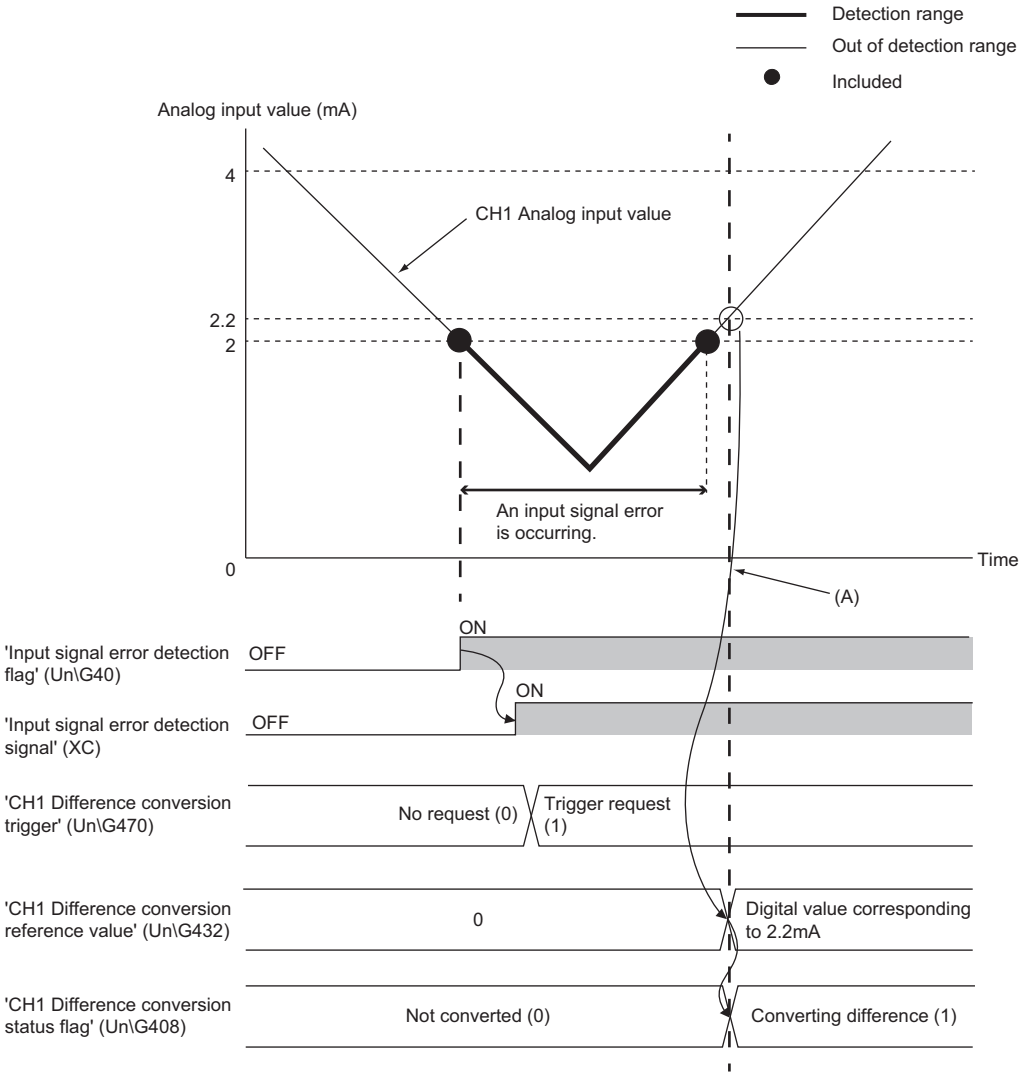
■Stopping the difference conversion

1. Change 'CH1 Difference conversion trigger' (Un\G470) from Trigger request (1) to No request (0).

The fall of Trigger request (1) → No request (0) is detected as a trigger. When the trigger is detected, the difference conversion stops, and 'CH1 Difference conversion status flag' (Un\G408) turns to Not converted (0). Thereafter, the digital operation value is stored as it is in 'CH1 Digital operation value' (Un\G402).

■Operations of when an input signal error has occurred

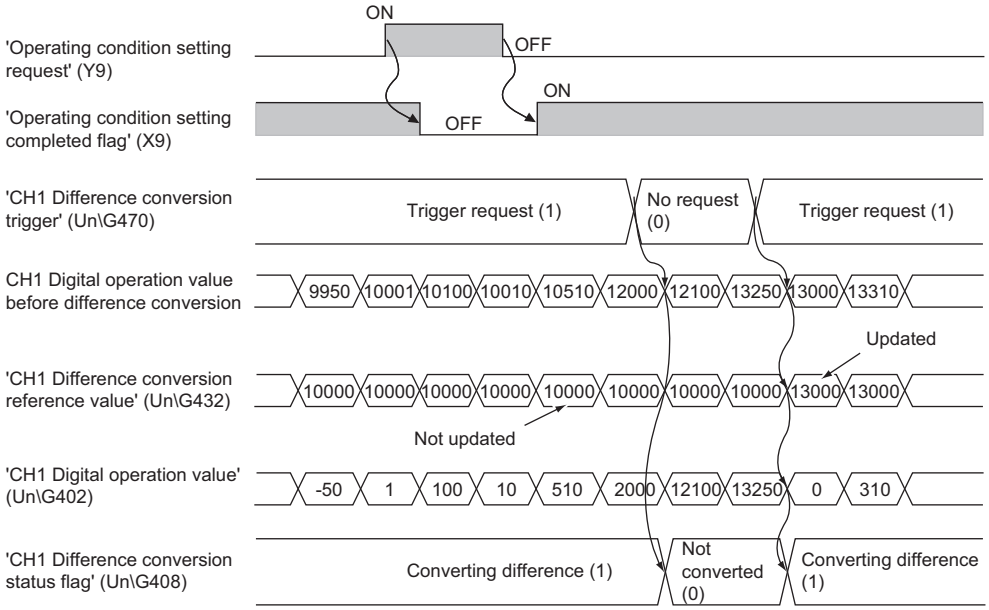
When an input signal error has occurred, even if 'CH1 Difference conversion trigger' (Un\G470) changes from No request (0) to Trigger request (1), the difference conversion does not start, and 'CH1 Difference conversion status flag' (Un\G408) and 'CH1 Difference conversion reference value' (Un\G432) are not updated. After the value in the input signal error range returns to the normal value, change 'CH1 Difference conversion trigger' (Un\G470) from No request (0) to Trigger request (1) again. If an input signal error has occurred in the status of Trigger request (1), the difference conversion starts at the timing when the error value returns to the normal value, treating the digital operation value at that timing as the difference conversion reference value.



(A) Timing when the error value returns to the normal value

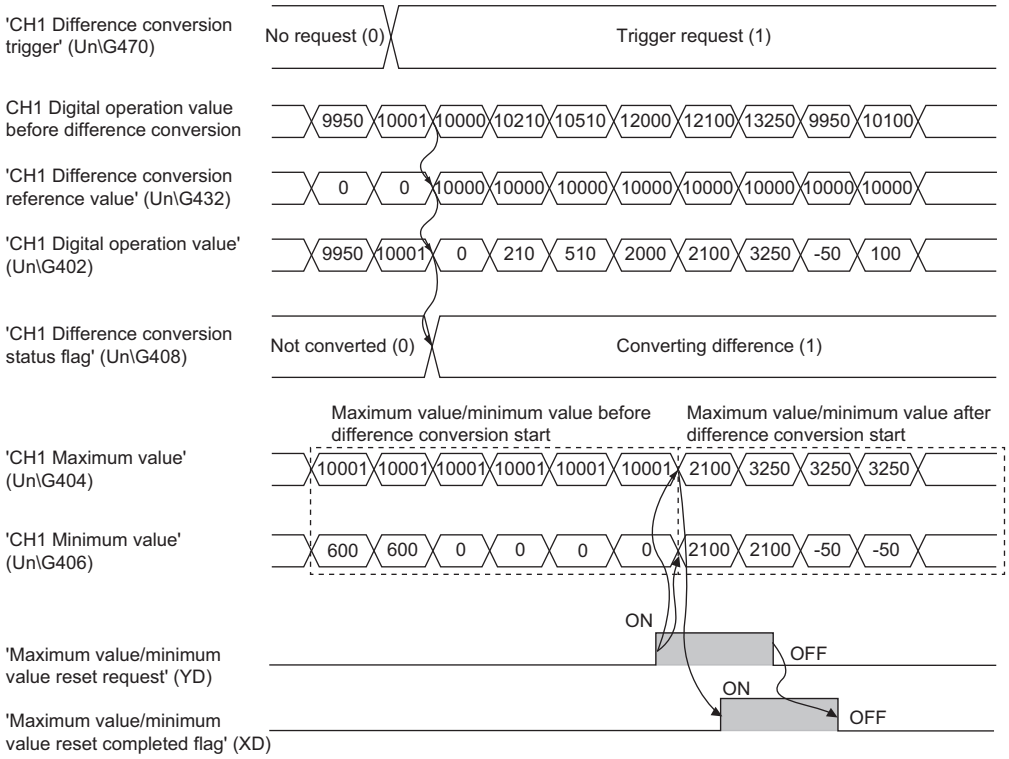
■Operations of when 'Operating condition setting request' (Y9) is turned on and off

- During the difference conversion, even when 'Operating condition setting request' (Y9) is turned on and off, the difference conversion continues without updating the difference conversion reference value. To update the difference conversion reference value, restart the difference conversion by changing 'CH1 Difference conversion trigger' (Un\G470) from Trigger request (1) to No request (0), and Trigger request (1) again.
- Difference conversion trigger is not enabled even though the trigger changes from No request (0) to Trigger request (1) while 'Operating condition setting request' (Y9) is on. After turning on and off 'Operating condition setting request' (Y9), change 'CH1 Difference conversion trigger' (Un\G470) from No request (0) to Trigger request (1) again.



■Operations of Maximum value and Minimum value

Once the difference conversion is started, the maximum value and the minimum value of the values acquired by the difference conversion are stored in 'CH1 Maximum value' (Un\G404) and 'CH1 Minimum value' (Un\G406). By turning on 'Maximum value/minimum value reset request' (YD), the maximum value and the minimum value after the start of the difference conversion can be checked. When 'Maximum value/minimum value reset request' (YD) is not turned on, the maximum values and minimum values before and after the difference conversion are mixed.



■Operation of when the averaging processing is set

If the difference conversion starts after the averaging processing is set, the digital operation value at the completion of the averaging processing is determined as 'CH1 Difference conversion reference value' (Un\G432). 'CH1 Difference conversion status flag' (Un\G408) turns to Converting difference (1).

Point

- The difference conversion function can be started at any timing.
- When the difference conversion function is used with the digital clipping function, scaling function, and shift function, each digital operation value is used as a difference conversion reference value for the difference conversion.
- Even though the digital clipping function, scaling function, and shift function are enabled during the difference conversion, the value in 'CH1 Difference conversion reference value' (Un\G432) is not updated. To update the value in 'CH1 Difference conversion reference value' (Un\G432), stop the difference conversion and restart it again.

1.10 Maximum Value/Minimum Value Hold Function

Medium speed | Low speed | Simultaneous conversion | Synchronization

This function stores the maximum and minimum values of digital operation values for each channel in the buffer memory.

Point

In the simultaneous conversion mode or inter-module synchronization mode, the maximum and minimum values of the digital output values are stored.

Resetting the maximum value and the minimum value

The maximum value and the minimum value can be reset either for all channels at once or for each channel separately.

■Resetting values for all channels at once

The following two methods can be used.

- Turning on and off 'Maximum value/minimum value reset request' (YD) (☞ Page 202 Maximum value/minimum value reset request)
- Turning on and off 'Operation condition setting request' (Y9) (☞ Page 202 Maximum value/minimum value reset request)

Either method updates the maximum value and minimum value to the current values. Turning on 'Maximum value/minimum value reset request' (YD) turns on 'Maximum value/minimum value reset completed flag' (XD).

■Resetting values for each channel separately

The following methods reset the maximum value and minimum value for each channel separately.

- Changing 'CH1 Maximum value reset request' (Un\G480) from No request (0) to Reset request (1) updates 'CH1 Maximum value' (Un\G404) to the current value, and stores No request (0) in 'CH1 Maximum value reset request' (Un\G480).
- Changing 'CH1 Minimum value reset request' (Un\G481) from No request (0) to Reset request (1) updates 'CH1 Minimum value' (Un\G406) to the current value, and stores No request (0) in 'CH1 Minimum value reset request' (Un\G481).

Point

To reset CH☐ Maximum value and CH☐ Minimum value at the same time, set Reset request (1) for CH☐ Maximum value reset request and CH☐ Minimum value reset request at the same time by writing in double word unit.

Values to be the maximum value and the minimum value

The maximum and minimum values of digital operation values are stored in the buffer memory.

When the digital clipping function, scaling function, shift function, or difference conversion function is used, the maximum value and minimum value obtained after the operation processing of each function are stored.

1.11 Warning Output Function

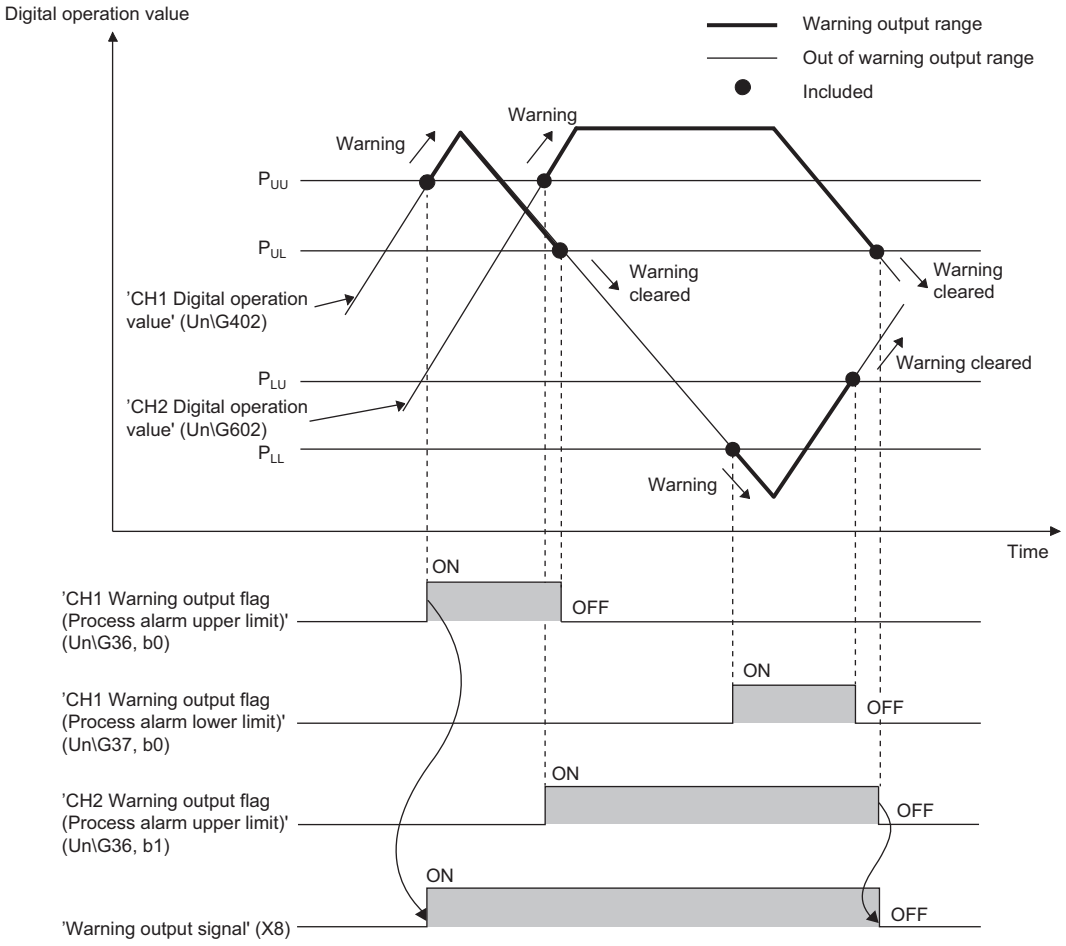
Medium speed | Low speed | Simultaneous conversion | Synchronization

This function has process alarms and rate alarms. The following sections describe process alarms and rate alarms.

Process alarm

Medium speed | Low speed | Simultaneous conversion | Synchronization

This function outputs a warning when a digital operation value enters the preset warning output range.



P_{UU}: Process alarm upper upper limit value

P_{UL}: Process alarm upper lower limit value

P_{LU}: Process alarm lower upper limit value

P_{LL}: Process alarm lower lower limit value

Operation

■Operation performed when a warning is output

When a digital operation value is equal to or greater than 'CH1 Process alarm upper upper limit value' (Un\G514), or the value is equal to or smaller than 'CH1 Process alarm lower lower limit value' (Un\G520) and thus the value enters the warning output range, a warning is output as follows.

- Alarm ON (1) is stored in 'Warning output flag (Process alarm upper limit)' (Un\G36) or 'Warning output flag (Process alarm lower limit)' (Un\G37).
- 'Warning output signal' (X8) turns on.
- The ALM LED turns on.

In addition, an alarm code is stored in 'Latest alarm code' (Un\G2).

For details on the alarm codes, refer to the following.

☞ Page 190 List of Alarm Codes

Point

- The A/D conversion on a channel where a warning was output continues.
- In the simultaneous conversion mode or inter-module synchronization mode, whether to output a warning is judged with a digital output value.

■Operation after a warning was output

After a warning was output, if the digital operation value does not satisfy the warning output condition due to being smaller than 'CH1 Process alarm upper lower limit value' (Un\G516) or being greater than 'CH1 Process alarm lower upper limit value' (Un\G518), Normal (0) is stored in a bit corresponding to the channel number of 'Warning output flag (Process alarm upper limit)' (Un\G36) or 'Warning output flag (Process alarm lower limit)' (Un\G37).

In addition, when all 'Warning output flag (Process alarm upper limit)' (Un\G36) and 'Warning output flag (Process alarm lower limit)' (Un\G37) return to Normal (0), 'Warning output signal' (X8) turns off and the ALM LED turns off. However, the alarm code stored in 'Latest alarm code' (Un\G2) is not cleared. To clear the alarm code, turn on and off 'Error clear request' (YF) after all the bits of 'Warning output flag (Process alarm upper limit)' (Un\G36) and 'Warning output flag (Process alarm lower limit)' (Un\G37) return to Normal (0).

Detection cycle

When time average is specified, the function works at every interval of the time (for averaging). When count average is specified, the function works at every count (for averaging).

When the sampling processing, moving average, primary delay filter, or digital filter is specified, this function works at every sampling cycle.

Detection target for outputting a warning

When the digital clipping function, scaling function, shift function, or difference conversion function is used, the digital operation value obtained after digital clipping, scale conversion, shift-and-add, or difference conversion is performed is the detection target for outputting a warning. Set values for 'CH1 Process alarm upper upper limit value' (Un\G514), 'CH1 Process alarm upper lower limit value' (Un\G516), 'CH1 Process alarm lower upper limit value' (Un\G518), and 'CH1 Process alarm lower lower limit value' (Un\G520) while considering the digital clipping, scale conversion, shift-and-add, and difference conversion.

Setting procedure

1. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)", "Normal mode (medium speed: 10μs/CH)", "Normal mode (high speed: 1μs/CH)", or "Simultaneous conversion mode (5μs/4CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "Warning output setting (Process alarm)" to "Enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Warning output function (Process alarm)]

3. Set values for "Process alarm upper upper limit value", "Process alarm upper lower limit value", "Process alarm lower upper limit value", and "Process alarm lower lower limit value".

Item	Setting range
Process alarm upper upper limit value	-32768 to 32767
Process alarm upper lower limit value	
Process alarm lower upper limit value	
Process alarm lower lower limit value	

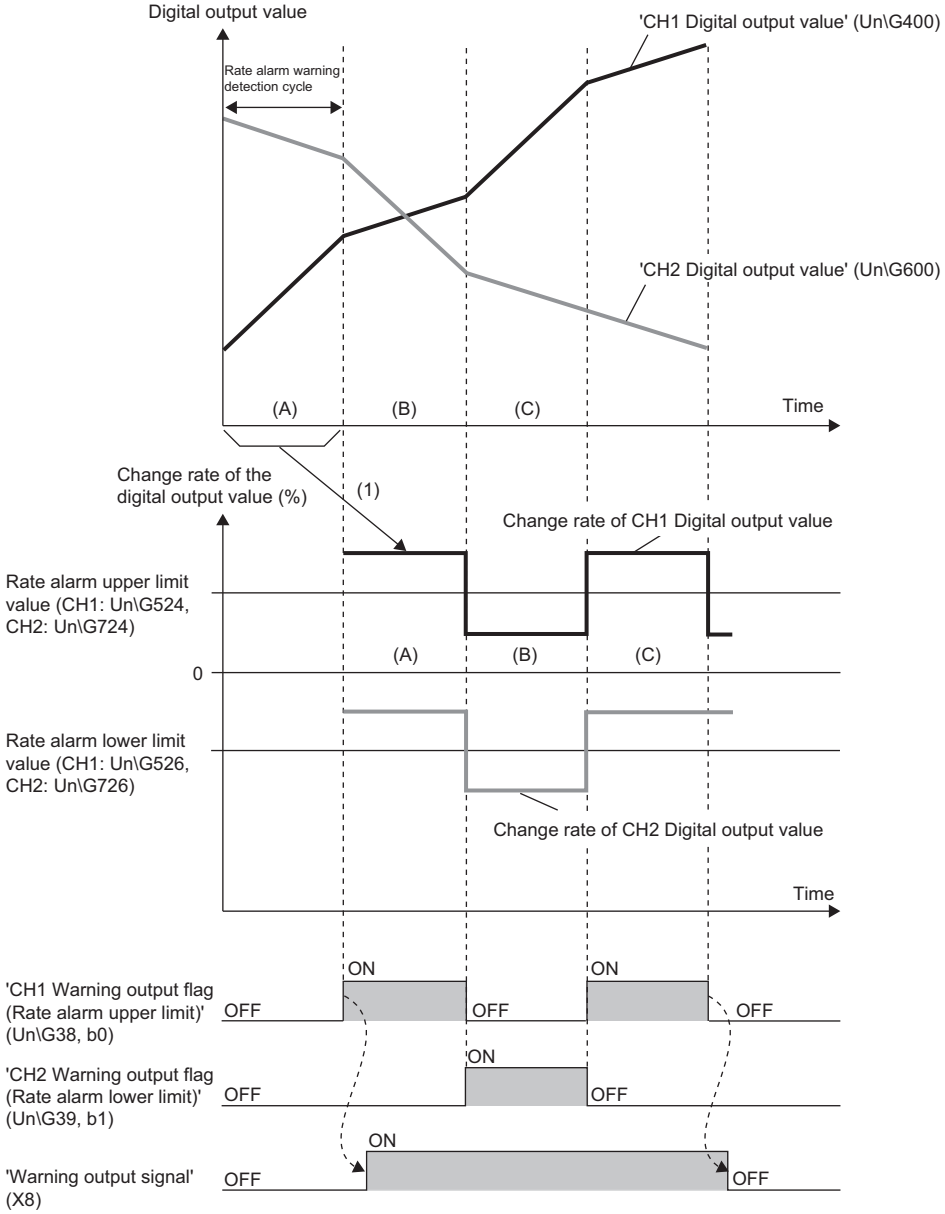
Point

Set values within the range satisfying the condition "Process alarm upper upper limit value ≥ Process alarm upper lower limit value ≥ Process alarm lower upper limit value ≥ Process alarm lower lower limit value".

Rate alarm

Medium speed Low speed

This function outputs a warning when the change rate of a digital output value is equal to or greater than the rate alarm upper limit value, or the rate is equal to or smaller than the rate alarm lower limit value.



---------▶ Performed by the A/D converter module.

(1) The change amount of a digital output value is converted into the change rate at every rate alarm warning detection cycle. When the change amount increases, the change rate is greater than 0. When the change amount decreases, the change rate is smaller than 0.

Operation

■Operation performed when a warning is output

Digital output values are monitored every rate alarm warning detection cycle. When a change rate of a digital output value (from a previous value) is equal to or greater than the rate alarm upper limit value, or the rate is equal to or smaller than the rate alarm lower limit value, a warning is output as follows.

- Alarm ON (1) is stored in 'Warning output flag (Rate alarm upper limit)' (Un\G38) or 'Warning output flag (Rate alarm lower limit)' (Un\G39).
- 'Warning output signal' (X8) turns on.
- The ALM LED turns on.

In addition, an alarm code is stored in 'Latest alarm code' (Un\G2).

For details on the alarm codes, refer to the following.

☞ Page 190 List of Alarm Codes

Point

The A/D conversion on a channel where a warning was output continues.

■Operation after a warning was output

After a warning was output, if the change rate of a digital output value does not satisfy the warning output conditions due to being smaller than the rate alarm upper limit value or being greater than the rate alarm lower limit value, Normal (0) is stored in a bit corresponding to the channel number of 'Warning output flag (Rate alarm upper limit)' (Un\G38) or 'Warning output flag (Rate alarm lower limit)' (Un\G39).

In addition, when all 'Warning output flag (Rate alarm upper limit)' (Un\G38) and 'Warning output flag (Rate alarm lower limit)' (Un\G39) return to Normal (0), 'Warning output signal' (X8) turns off and the ALM LED turns off. However, the alarm code stored in 'Latest alarm code' (Un\G2) is not cleared. To clear the alarm code, turn on and off 'Error clear request' (YF) after all the bits of 'Warning output flag (Rate alarm upper limit)' (Un\G38) and 'Warning output flag (Rate alarm lower limit)' (Un\G39) return to Normal (0).

Detection cycle

Set the rate alarm warning detection cycle in 'CH1 Rate alarm warning detection cycle setting' (Un\G522).

The rate alarm warning detection cycle is the value calculated by multiplying the set value by the conversion cycle.

Ex.

The rate alarm warning detection cycle under the following conditions

- Operation mode: Normal mode (low speed: 20μs/CH)
- A/D conversion-enabled channels: CH1 to CH3
- 'CH1 Rate alarm warning detection cycle setting' (Un\G522): 5 (times)

The rate alarm warning detection cycle is 300μs. (20μs × 3 (CH) × 5 (times))

Digital output values are compared in 300μs intervals to check the change rate.

Judgment of rate alarm

A change rate is judged with digital values per rate alarm warning detection cycle, which are calculated using values in 'CH1 Rate alarm upper limit value' (Un\G524) and 'CH1 Rate alarm lower limit value' (Un\G526).

The following shows the conversion formulas to obtain judgment values (Unit: digit) per rate alarm warning detection cycle.

- $D_H = (R_H/1000) \times D_{Max}$
- $D_L = (R_L/1000) \times D_{Max}$

Item	Description
D_H*1	Upper limit value used for judgment on the rate alarm warning detection cycle (Unit: digit)
D_L*1	Lower limit value used for judgment on the rate alarm warning detection cycle (Unit: digit)
R_H	Rate alarm upper limit value (Unit: 0.1%)
R_L	Rate alarm lower limit value (Unit: 0.1%)
D_{Max}	Maximum digital output value of the input range (32000)

*1 Values after the decimal point are omitted.

Ex.

The judgment value under the following conditions

- Operation mode: Normal mode (low speed: 20μs/CH)
- Input range: 4 to 20mA
- A/D conversion-enabled channel: CH1
- 'CH1 Averaging process specification' (Un\G501): Sampling processing (0)
- 'CH1 Rate alarm warning detection cycle setting' (Un\G522): 5 (times)
- 'CH1 Rate alarm upper limit value' (Un\G524): 250 (25.0%)
- 'CH1 Rate alarm lower limit value' (Un\G526): 50 (5.0%)

$$D_H: \frac{250}{1000} \times 32000 = 8000 \text{ (digit)}$$

$$D_L: \frac{50}{1000} \times 32000 = 1600 \text{ (digit)}$$

The current value is compared with the previous value on the rate alarm warning detection cycle of 100μs (Sampling cycle 20μs × 5). A digital value is judged if it increases 8000 digits (25.0%) or more, or judged if the increase is 1600 digits (5.0%) or less from the previous value.

Use the following formula to calculate a change rate to be set based on the change amount of voltage and current to detect a warning.

$$RC = \frac{V/I_X}{V/I_G - V/I_O} \times 1000$$

Item	Description
RC*2	Change rate to be set (Unit: 0.1%)
V/I_X	Change amount of the voltage (current) to detect a warning (V (mA))
V/I_G	Gain voltage (current) (V (mA))
V/I_O	Offset voltage (current) (V (mA))

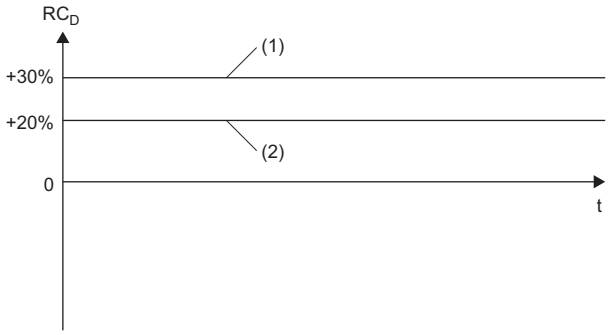
*2 Values after the decimal point are omitted.

Application examples of rate alarms

A rate alarm serves to monitor that the change rate of a digital output value lies in a limited range as shown below:

Ex.

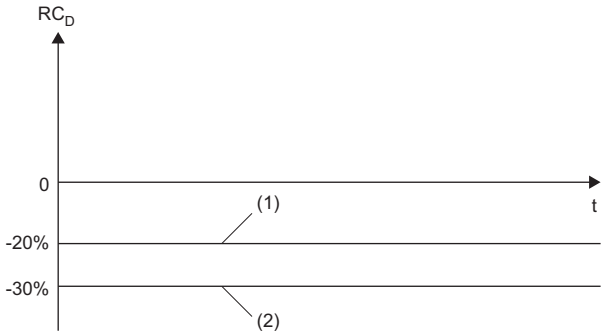
To monitor that a rising rate of a digital output value is within the specified range



RC_D: Change rate of the digital output value (%)
t: Time
(1) Rate alarm upper limit value
(2) Rate alarm lower limit value

Ex.

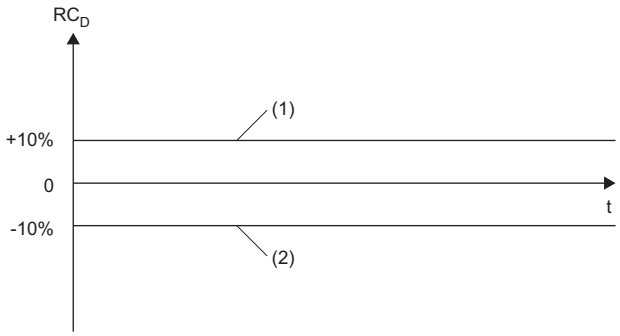
To monitor that a drop rate of a digital output value is within the specified range



RC_D: Change rate of the digital output value (%)
t: Time
(1) Rate alarm upper limit value
(2) Rate alarm lower limit value

Ex.

To monitor that a change rate of a digital output value is within the specified range



RC_D: Change rate of the digital output value (%)
t: Time
(1) Rate alarm upper limit value
(2) Rate alarm lower limit value

Setting procedure

1. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)" or "Normal mode (medium speed: 10μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "Warning output function (Rate alarm)" to "Enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Warning output function (Rate alarm)]

3. Set a warning detection cycle of rate alarms.

Set the cycle in "Rate alarm detection cycle setting".

Item	Setting range
Rate alarm detection cycle setting	1 to 32000 (times)

4. Set values for "Rate alarm upper limit value" and "Rate alarm lower limit value".

Set a value to the maximum value (32000) of the digital output value in increments of 0.1%.

Item	Setting range
Rate alarm upper limit value	-3276.8 to 3276.7 (%)
Rate alarm lower limit value	

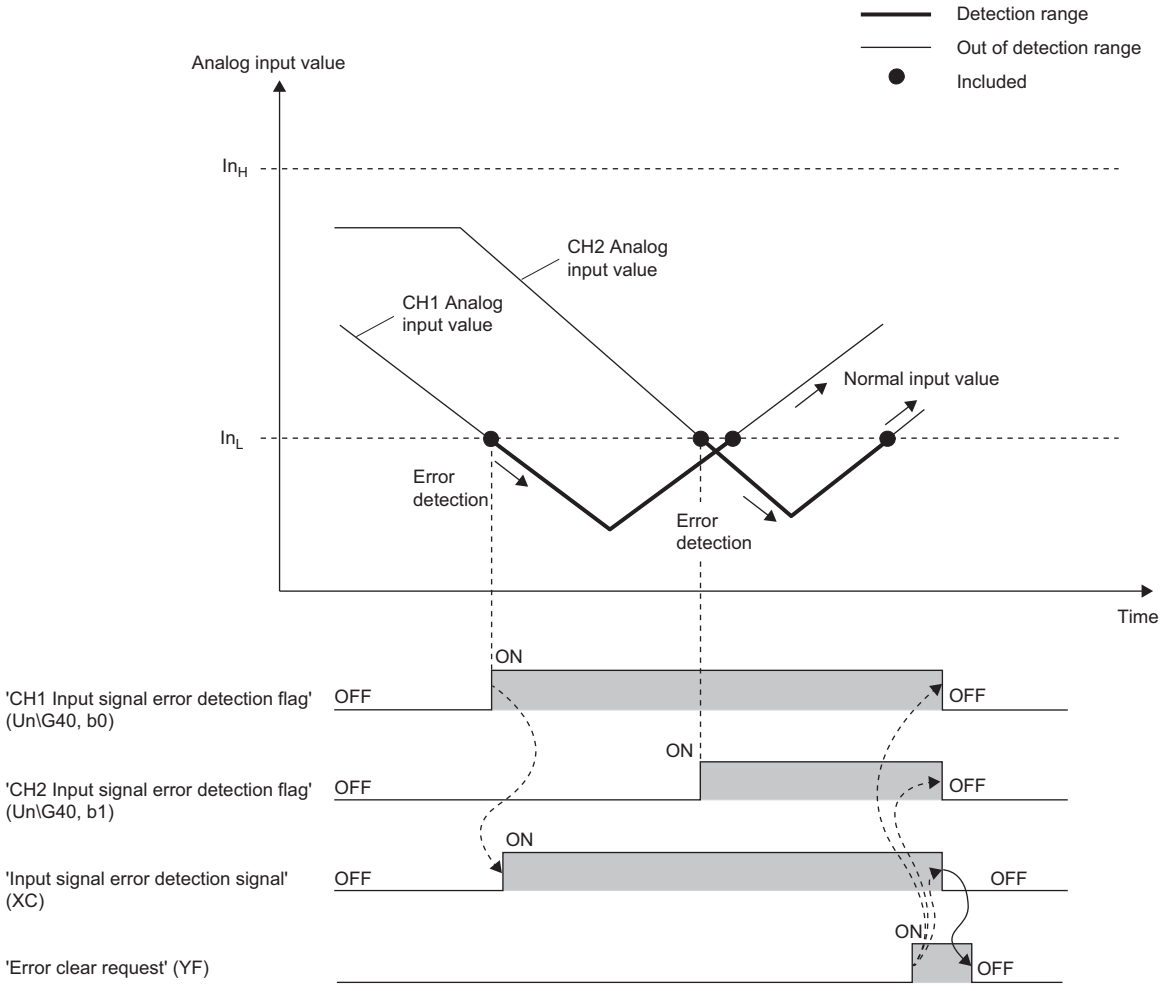
Point

Set values within the range satisfying the condition "Rate alarm upper limit value > Rate alarm lower limit value".

1.12 Input Signal Error Detection Function

Medium speed | Low speed | Simultaneous conversion | Synchronization

This function outputs an alarm when an analog input value exceeds the preset range.



Performed by the A/D converter module.

Performed by a program.

In_H: Input signal error detection upper limit value

In_L: Input signal error detection lower limit value

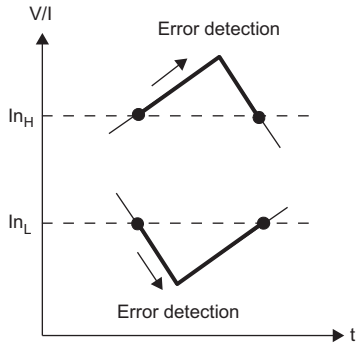
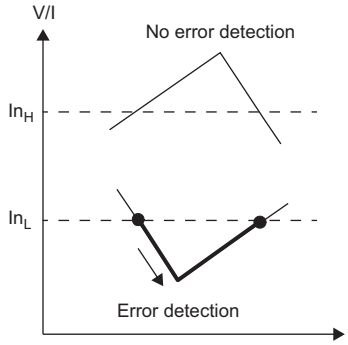
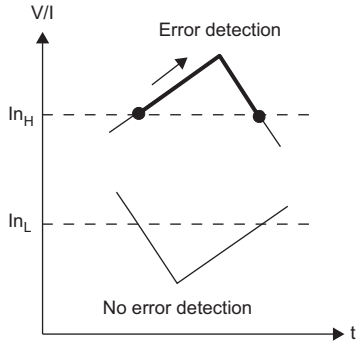
Point

How to clear the input signal error varies depending on 'Input signal error detection auto-clear enable/disable setting' (Un\G302). For details, refer to the following.

☞ Page 66 Clearing input signal errors

Detection method

Select a detection method from the following table.

Detection method	Detection condition	
0: Disable	Input signal errors are not detected.	—
1: Upper and lower limit detection	An input signal error is detected when the analog input value is equal to or greater than the input signal error detection upper limit value, or when the analog input value is equal to or smaller than the input signal error detection lower limit value.	
2: Lower limit detection	An input signal error is detected when the analog input value is equal to or smaller than the input signal error detection lower limit value.	
3: Upper limit detection	An input signal error is detected when the analog input value is equal to or greater than the input signal error detection upper limit value.	
4: Simple disconnection detection	Simple disconnection detection is performed. For details, refer to the following. ☞ Page 65 Simple disconnection detection	

V/I: Analog input value
t: Time
In_H: Input signal error detection upper limit value
In_L: Input signal error detection lower limit value

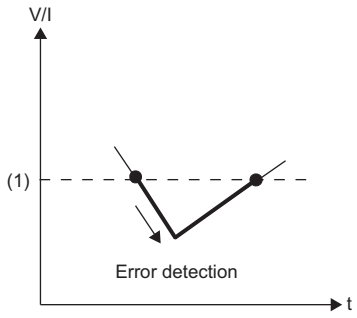
■Simple disconnection detection

An alarm is output when an analog input value is 0.5V or lower or 2mA or lower.

By combining this function with the extended mode in the input range setting, simple disconnection detection is enabled.

When an analog input value satisfies either of the following conditions, it is regarded as a disconnection and 'Input signal error detection flag' (Un\G40) turns on.

Input range	Disconnection detection value
4 to 20mA (extended mode)	Analog input value ≤ 2mA
1 to 5V (extended mode)	Analog input value ≤ 0.5V



V/I: Analog input value
t: Time
(1) 0.5V or 2mA

The settings of 'CH1 Input signal error detection lower limit setting value' (Un\G529) and 'CH1 Input signal error detection upper limit setting value' (Un\G530) are ignored.

Notification

When an input signal error is detected, an error is notified as follows.

- Input signal error (1) is stored in the corresponding bit of 'Input signal error detection flag' (Un\G40).
- 'Input signal error detection signal' (XC) turns on.
- The ALM LED flashes.

In addition, an alarm code is stored in 'Latest alarm code' (Un\G2). Alarm codes are stored whenever the analog input satisfies the condition for the input signal error detection.

For details on the alarm codes, refer to the following.

☞ Page 190 List of Alarm Codes

Operation

On the channel where an error is detected, the digital output value and digital operation value just before the detection of the error are stored.

When an analog input value falls within the set range, the A/D conversion is restarted regardless of whether 'Input signal error detection flag' (Un\G40) and 'Input signal error detection signal' (XC) are reset or not. (The ALM LED remains flashing.)

Point

- The values in 'CH1 Digital output value' (Un\G400) and 'CH1 Digital operation value' (Un\G402) are not updated during the occurrence of an input signal error.
- The A/D conversion continues on the channel where no input signal error is detected.
- Whether an input signal error has occurred or not is judged with the value of when the A/D conversion is completed. Thus, the corresponding bit of 'A/D conversion completed flag' (Un\G42) turns on even when an input signal error is detected.

Detection cycle

This function works at every sampling cycle.

Clearing input signal errors

How to clear the input signal error can be selected from the following depending on the setting of 'Input signal error detection auto-clear enable/disable setting' (Un\G302).

■When 'Input signal error detection auto-clear enable/disable setting' (Un\G302) is Enable (0)

After the analog input value falls within the set range, the A/D converter module automatically arranges the following status.
After the analog input value falls within the set range, turning on and off 'Error clear request' (YF) is not required.

- 'Input signal error detection flag' (Un\G40) is cleared.
- 'Input signal error detection signal' (XC) turns off.
- The ALM LED turns off.

Point

'Latest alarm code' (Un\G2) is not cleared.
To clear 'Latest alarm code' (Un\G2), turn on and off 'Error clear request' (YF) after the analog input value falls within the set range.

■When 'Input signal error detection auto-clear enable/disable setting' (Un\G302) is Disable (1)

After the analog input value falls within the set range, turn on and off 'Error clear request' (YF).
The A/D converter module arranges the following status when an input signal error is cleared.

- 'Input signal error detection flag' (Un\G40) is cleared.
- 'Input signal error detection signal' (XC) turns off.
- The ALM LED turns off.
- 'Latest alarm code' (Un\G2) is cleared.

Setting of the input signal error detection upper/lower limit value

■Input signal error detection upper limit value

Set the input signal error detection upper limit value in increments of 1 (0.1%) using the input signal error detection upper limit setting value.

This value is calculated by adding "Analog input range width (Gain value - Offset value) × Input signal error detection upper limit setting value (%)" to the gain value. Only a value that is equal to or greater than the gain value can be set.

To calculate the input signal error detection upper limit setting value based on the input signal error detection upper limit value, use the following formula.

• Input signal error detection upper limit setting value = $((In_H - V/I_G) \div (V/I_G - V/I_O)) \times 1000$

Item	Description
In_H	Input signal error detection upper limit value
V/I_G	Gain value of each range
V/I_O	Offset value of each range

■Input signal error detection lower limit value

Set the input signal error detection lower limit value in increments of 1 (0.1%) using the input signal error detection lower limit setting value.

This value is calculated by subtracting "Analog input range width (Gain value - Offset value) × Input signal error detection lower limit setting value (%)" from the lower limit value of each range. Only the value that is equal to or smaller than the lower limit value of the range can be set.

To calculate the input signal error detection lower limit setting value based on the input signal error detection lower limit value, use the following formula.

• Input signal error detection lower limit setting value = $((V/I_L - In_L) \div (V/I_G - V/I_O)) \times 1000$

Item	Description
V/I_L	Lower limit value of each range
In_L	Input signal error detection lower limit value
V/I_G	Gain value of each range
V/I_O	Offset value of each range

The following table lists the lower limit value, offset value, and gain value for each range.

Input range		Lower limit value	Offset value	Gain value
Voltage	0 to 10V	0V		10V
	0 to 5V	0V		5V
	1 to 5V	1V		5V
	1 to 5V (extended mode)	1V		5V
	-10 to 10V	-10V	0V	10V
	User range setting	Analog input value equivalent to the digital output value of -32000	Analog input value set as an offset value	Analog input value set as a gain value
Current	0 to 20mA	0mA		20mA
	4 to 20mA	4mA		20mA
	4 to 20mA (extended mode)	4mA		20mA
	User range setting	Analog input value equivalent to the digital output value of -32000	Analog input value set as an offset value	Analog input value set as a gain value

Setting procedure

1. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)", "Normal mode (medium speed: 10μs/CH)", "Normal mode (high speed: 1μs/CH)", or "Simultaneous conversion mode (5μs/4CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Select a detection method in "Input signal error detection setting".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Input signal error detection function]

3. Set values for "Input signal error detection lower limit setting value" and "Input signal error detection upper limit setting value".

Item	Setting range
Input signal error detection lower limit setting value	0.0 to 25.0 (%)
Input signal error detection upper limit setting value	

4. Set "Input signal error detection auto clear enable/disable setting" to "Enable" or "Disable".

Setting example of the input signal error detection

The following shows a setting example for detecting an input signal error when an analog input value is greater than 21.6mA or is smaller than 0.4mA in the channel set as shown below.

Item	Setting value
Input range	4 to 20mA
'Input signal error detection auto-clear enable/disable setting' (Un\G302)	Disable (1)
'CH1 Input signal error detection setting' (Un\G528)	Upper and lower limit detection (1)

Assign the following values in the formula for calculating the input signal error detection lower limit setting value and the input signal error detection upper limit setting value.

- Input signal error detection lower limit value: 0.4mA
- Input signal error detection upper limit value: 21.6mA
- Lower limit value of the range: 4.0mA
- Offset value: 4.0mA
- Gain value: 20.0mA

■Input signal error detection lower limit setting value

Input signal error detection lower limit setting value = ((4.0 - 0.4) ÷ (20.0 - 4.0)) × 1000 = 225 (22.5%)

Thus, set 'CH1 Input signal error detection lower limit setting value' (Un\G529) to 225 (22.5%).

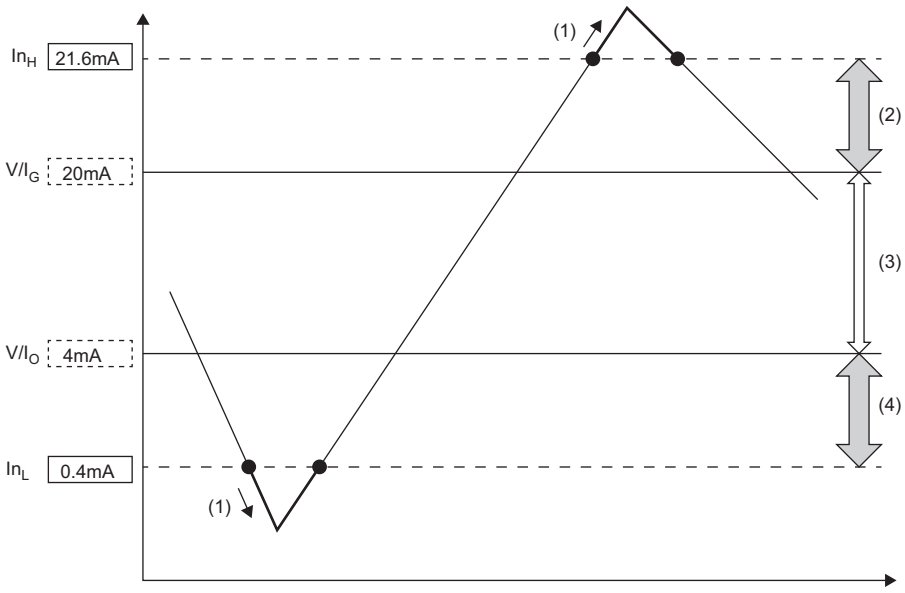
■Input signal error detection upper limit setting value

Input signal error detection upper limit setting value = ((21.6 - 20.0) ÷ (20.0 - 4.0)) × 1000 = 100 (10.0%)

Thus, set 'CH1 Input signal error detection upper limit setting value' (Un\G530) to 100 (10.0%).

■Operation

The following graph shows the operation of the input signal error detection.



In_H: Input signal error detection upper limit value
V/I_G: Gain value
V/I_O: Offset value (Lower limit value of the input range)
In_L: Input signal error detection lower limit value
(1) Error detection
(2) 1.6mA (10.0% of 16mA)
(3) 16mA (Gain value - Offset value)
(4) 3.6mA (22.5% of 16mA)

1.13 Using One of the Logging Functions Depending on the Intended Use

High speed | Low speed | Simultaneous conversion | Synchronization

As logging functions, the normal logging function, high speed logging function, continuous logging function, and high speed continuous logging function are provided.
Each logging function has different logging methods of data. Check the features of each logging function and select one of the logging functions depending on the intended use.

Features of the normal logging function

This function operates in the normal mode (low speed: 20μs/CH).
Data can be logged under various conditions with the logging hold processing, level trigger, logging read function, and others.
For the normal logging function, refer to the following.
☞ Page 74 Normal Logging Function

Features of the high speed logging function

This function operates in the normal mode (high speed: 1μs/CH). The A/D conversion performed at 1μs cycle (shortest cycle) enables the module to log minute state changes of external devices that cannot be obtained with the conversion speed of the normal logging function.
For the high speed logging function, refer to the following.
☞ Page 98 High Speed Logging Function

Features of the continuous logging function

This function operates in the simultaneous conversion mode or the inter-module synchronization mode. This function continuously collects data where A/D conversion has been performed for four channels simultaneously at high speed (with a maximum cycle time of 5μs). Thus, when the module is connected with a sensor that has input characteristics of the high-frequency band, this function can collect data for signal analysis.
For the continuous logging function, refer to the following.
☞ Page 112 Continuous Logging Function

Features of the high speed continuous logging function

This function operates in the normal mode (high speed: 1μs/CH). This function logs digital operation values at 1μs cycle, which is the shortest cycle, and continuously transfers logging data to the CPU module without stopping logging. Compared to the continuous logging function, this function is more suitable for measurement since it can obtain analog values that are changing at high speed.
For the high speed continuous logging function, refer to the following.
☞ Page 131 High Speed Continuous Logging Function

Differences of each logging function

The following tables list differences between the normal logging function and the continuous logging function.

• Combination with each function

○: Available, △: Restricted use, ×: Not available

Function	Logging function				
	Normal logging function	High speed logging function	Continuous logging function (simultaneous conversion mode)	Continuous logging function (inter-module synchronization mode)	High speed continuous logging function
Conversion cycle	Depends on the A/D conversion method	1μs/CH	5μs/4CH	■Oversampling disable Inter-module synchronization cycle/ 4CH ■Oversampling enable 5μs/4CH	1μs/CH
A/D conversion method	○	△ (Only sampling processing and moving average)			
Scaling function	○	○	×	×	○
Digital Clipping Function	○	×	×	×	×
Shift function	○	×	×	×	×
Difference conversion function	○	×	×	×	×
Warning output function	○	×	△ (Only process alarms)		×
Input signal error detection function	○	×	○	○	×
Logging read function	○	×	×	×	×
Interrupt function	○	×	△ (Only continuous logging data storage)	×	△ (Only continuous logging data storage)

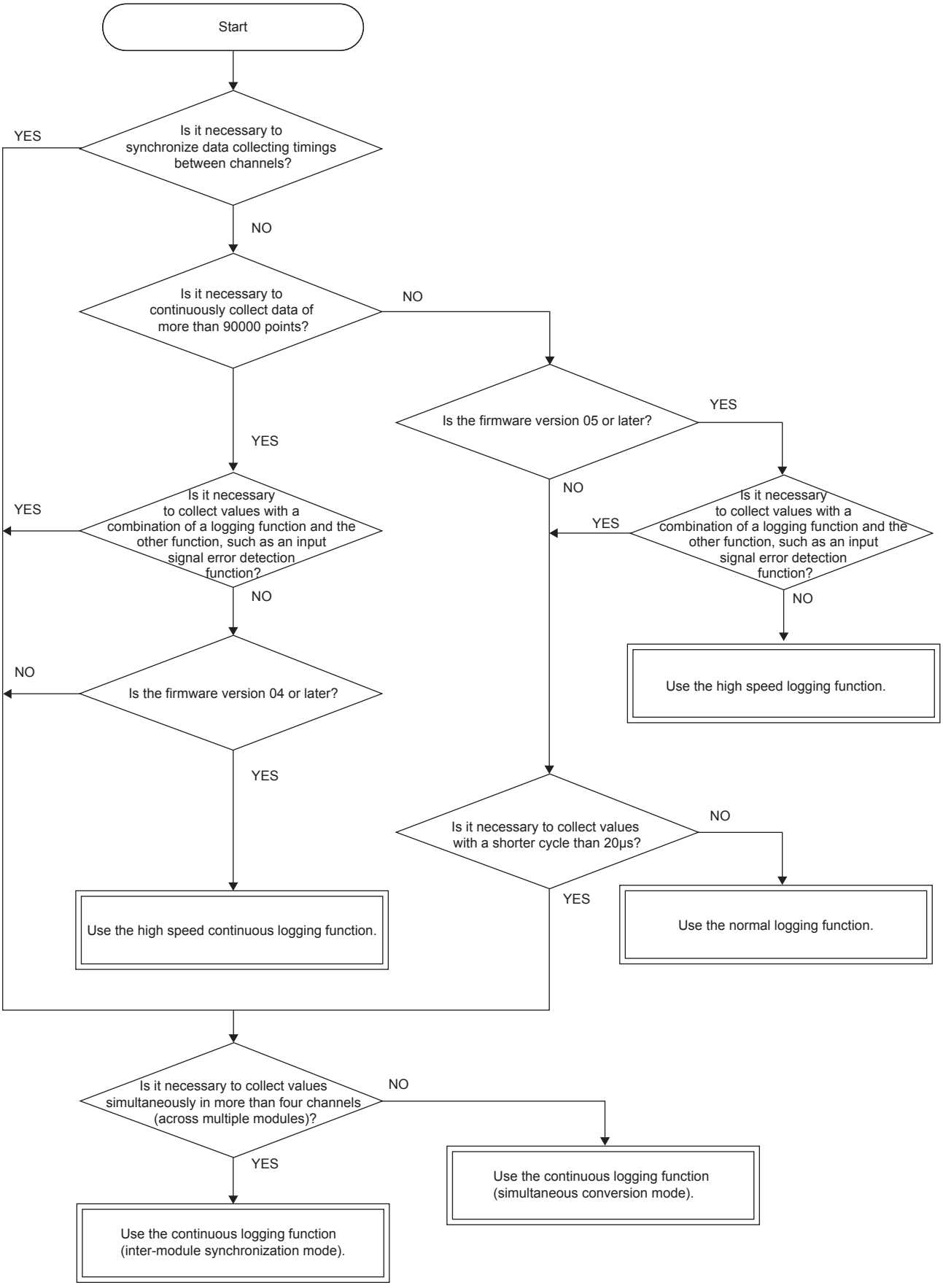
• Specifications of each logging function

Specifications of a logging function	Logging function				
	Normal logging function	High speed logging function	Continuous logging function (simultaneous conversion mode)	Continuous logging function (inter-module synchronization mode)	High speed continuous logging function
Logging start timing	• When 'Operating condition setting request' (Y9) is turned on and off after 'CH1 Logging enable/ disable setting' (Un\G535) is set to Normal logging (0) or High speed logging (3) • When 'CH1 Logging hold request' (Y1) is turned off (when the logging is stopped due to a hold trigger generation)		When the next conversion cycle has come after 'Continuous logging start/stop request' (Un\G100) is changed from Stop (0) to Start (1)	When the second inter-module synchronization cycle has come after 'Continuous logging start/stop request' (Un\G100) is changed from Stop (0) to Start (1)	Within 40μs after 'CH1 High speed continuous logging start/stop request' (Un\G478) is set from Stop (0) to Start (1)
Logging stop timing	• When data collection for the preset number of logging data points is completed after a hold trigger generation • When 'Operating condition setting request' (Y9) is turned on		When the next conversion cycle has come after 'Continuous logging start/stop request' (Un\G100) is changed from Start (1) to Stop (0)	• When the second inter-module synchronization cycle has come after 'Continuous logging start/stop request' (Un\G100) is changed from Start (1) to Stop (0) • When the state of CPU module is changed from RUN to STOP	Within 40μs after 'CH1 High speed continuous logging start/stop request' (Un\G478) is set from Start (1) to Stop (0)
Number of logging data points	Collects data of 0 to 90000 points for each channel		Collects data of 10000 points for each channel		Collects data of 20000 points for each channel

Specifications of a logging function	Logging function				
	Normal logging function	High speed logging function	Continuous logging function (simultaneous conversion mode)	Continuous logging function (inter-module synchronization mode)	High speed continuous logging function
Storage of logging data	Stores data of 1 point at every set logging cycle	Stores data collectively in the logging data areas after post-trigger logging completion	Stores data of 5000 points collectively in the logging data areas after logging all the data (5000 points)	Stores data at every inter-module synchronization cycle from the next cycle after data logging is started by a synchronous signal	Stores data of 10000 points collectively in the logging data areas after logging all the data (10000 points)
Reading of logging data	Reads data into a CSV file or file registers after logging is stopped		Reads data by 5000 points into file registers without stopping the logging		Reads data by 10000 points into file registers without stopping the logging
Logging hold flag	Turns on after logging of data for the number of post-trigger logging points is completed	Turns on after storing the data to the logging data area is completed	No logging hold flag		
Logging pointer	Updates the pointer at every conversion cycle	Updates the pointer collectively when the logging hold flag turns on	No pointer		
Number of logging data	90000 points in total in all channels		Depends on the capacity of file registers in the CPU module		
Trigger generation time	Stores the generation time of a logging hold request		Stores the start time of continuous logging		Stores the start time of high speed continuous logging
Updating the digital value during logging	Updates the value at every conversion cycle	Updates the value at every 5ms cycle	Updates the value every time data of 5000 points are logged	Updates the value at every inter-module synchronization cycle	Updates the value at every 5ms cycle

Procedure for selecting logging functions

The following figure shows an example of how to select a logging function to be used. Select a suitable function considering intended applications of the A/D converter module and features of each logging function.



1.14 Normal Logging Function

Low speed

This function logs (records) digital output values or digital operation values for up to 90000 points. Logged data are stored in the buffer memory. In addition, the data collection can be stopped by using the status change of the data as a trigger. This function also helps the error analysis since the data before and after the occurrence of an error is held.
Using function blocks (FBs) enables saving the data stored in the buffer memory as a CSV file.

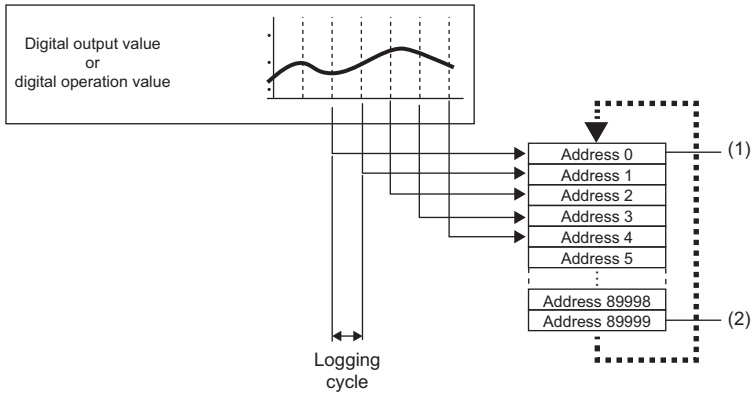
Normal logging function

■Collecting logging data

Logging data is collected as follows.

- The latest digital output values or digital operation values can be always collected for each channel. The number of logging data points to be collected can be set for each channel. (☞ Page 76 Logging data)
- The data can be collected at intervals of 20μs at a minimum and of 3600s at a maximum.

An address where the latest/oldest data is stored can be checked with the latest/head pointer.



(1) Head pointer
The address of the oldest data in logging data can be checked.

(2) Latest pointer
The address of the latest data in logging data can be checked.

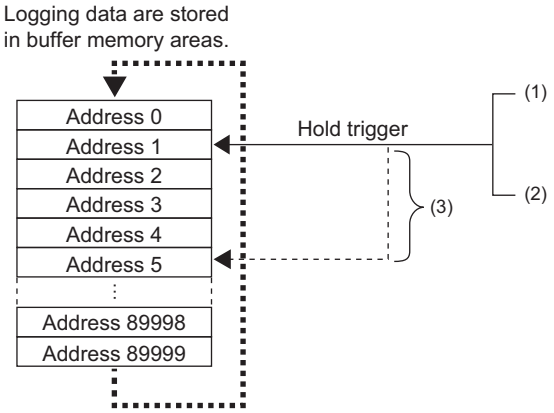
Logging data is stored in the buffer memory. After the number of stored data points reaches the maximum point, data is sequentially overwritten from address 0 with new data.

■Stopping the logging operation

Logging data is updated at a high speed during the logging. Stop logging when the logging data needs to be referred to without paying attention to the updating cycle.

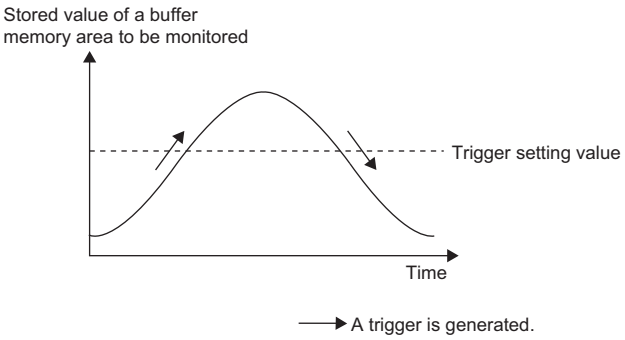
Logging can be stopped by the hold trigger.

- A hold trigger allows two options: Logging hold request or Level trigger.
- The number of data points to be collected after a hold trigger occurs can be set.



(1) Logging hold request
A hold trigger is generated from a program at any timing.

(2) Level trigger
A hold trigger is generated when a stored value in a buffer memory area is monitored and the set condition is satisfied as follows.
Example: When the stored value exceeds or falls below the set value, a hold trigger is generated.



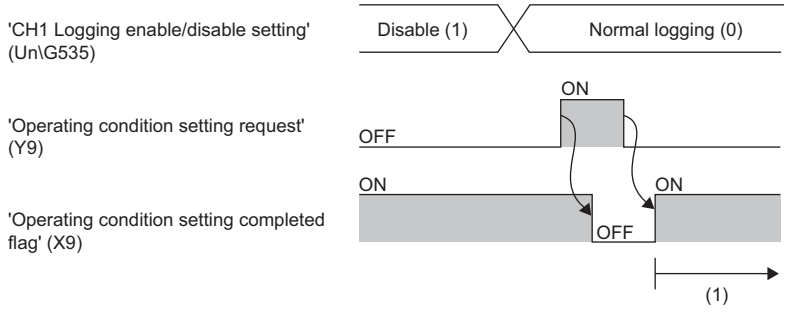
(3) Post-trigger logging points
When data for the set number of data points are collected after a hold trigger is generated, the logging operation is stopped.

Operation of logging

■Starting logging data collection

Logging data collection starts when 'CH1 Logging enable/disable setting' (Un\G535) is set to Normal logging (0) and 'Operating condition setting request' (Y9) is turned on and off. For the channels where the normal logging function is not used, set 'CH1 Logging enable/disable setting' (Un\G535) to Disable (1). If High speed continuous logging (2) or High speed logging (3) is set for any channels, a logging enable/disable setting range error (error code: 1D0□H) occurs. In this case, normal logging does not start.

Collecting is performed at the preset logging cycle.



(1) Logging is started.

■Logging data

The areas of 90000 points for logging data storage are prepared in all channels.

To distribute the areas to each channel, set a value in Logging data points setting in increments of 100 points.

Ex.

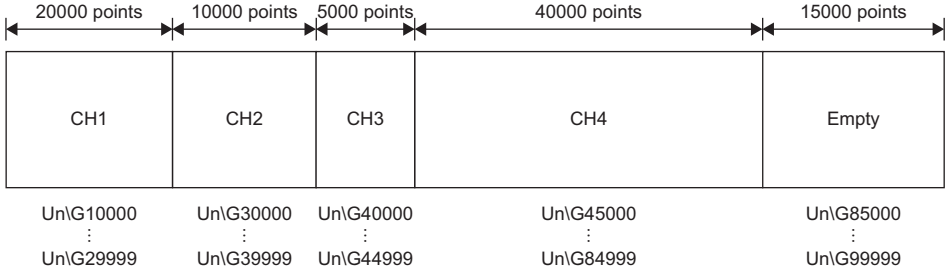
When setting the number of points for logging data areas to be used by each channel as follows

Item	Setting value*1*2
'CH1 Logging data points setting' (Un\G536)	200 (20000 points)
'CH2 Logging data points setting' (Un\G736)	100 (10000 points)
'CH3 Logging data points setting' (Un\G936)	50 (5000 points)
'CH4 Logging data points setting' (Un\G1136)	400 (40000 points)

*1 Set a value in increments of 1 (100 points).

*2 Set the number of logging data points for each channel so that the total of values set in this area does not exceed 900 (90000 points). If the total of the values is greater than 900 (90000 points), a logging data points setting total range error (error code: 1DB0H) occurs. In this case, logging is not started in any channel.

Logging data area (Un\G10000 to Un\G99999) is distributed to each channel as follows.



After the number of stored data points reaches the maximum point, data is overwritten with new data from the start address of Logging data area of the corresponding channel.

All the logging data areas are cleared to 0 at the timing when 'Operating condition setting request' (Y9) is turned on. Save the necessary logging data before turning on 'Operating condition setting request' (Y9). (☞ Page 97 Saving to a CSV file)

Point

- Because the logging data areas are reserved automatically by the setting, refer to 'CH1 Logging start address monitor' (Un\G434, Un\G435) to find the logging start position.
- Setting 0 in Logging data points setting of the channel that is not used for logging allows users to set wide logging areas of the channel used for logging.

Logging data setting

Select a type of the data to be collected with 'CH1 Logging data setting' (Un\G537).

- Digital output value (0)
- Digital operation value (1)

Logging cycle

■Logging cycle setting

Set the logging cycle with 'CH1 Logging cycle setting value' (Un\G538) and 'CH1 Logging cycle unit setting' (Un\G539).
The following table lists the setting range for each cycle unit.

Setting value of CH1 Logging cycle unit setting	Setting range of CH1 Logging cycle setting value
μs(0)	20 to 32767
ms(1)	1 to 32767
s(2)	1 to 3600

The logging cycle must be an integral multiple of the conversion cycle. Even if the setting is not an integral multiple, the actual logging cycle is adjusted to an integral multiple of the conversion cycle within a limit of the set logging cycle.
For the conversion cycle of each A/D conversion method, refer to the following.
☞ Page 25 Conversion cycle

Ex.
With the following settings, the conversion cycle is 80μs and the actual logging is performed every 6960μs (integral multiple of 80μs).

- Operation mode: Normal mode (low speed: 20μs/CH)
- A/D conversion enabled channels: CH1 to CH4
- A/D conversion method: Sampling processing
- 'CH1 Logging cycle setting value' (Un\G538): 7000
- 'CH1 Logging cycle unit setting' (Un\G539): μs (0)

The following values are stored in 'CH1 Logging cycle monitor value' (Un\G450 to Un\G452).

Address	Item		Stored value
450	CH1 Logging cycle monitor value	s	0
451		ms	6
452		μs	960

Point

When 'Operating condition setting request' (Y9) is turned on and off under the condition in which the logging cycle determined by 'CH1 Logging cycle setting value' (Un\G538) and 'CH1 Logging cycle unit setting' (Un\G539) is shorter than the conversion cycle, a logging cycle setting disable error (error code: 1D2☐H) occurs.

■When the normal logging function becomes disabled

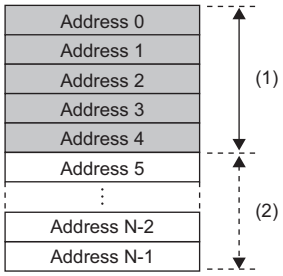
The logging is not performed when even one of the following errors occurs after the normal logging function is enabled and 'Operating condition setting request' (Y9) is turned on and off.

- Error code (190☐H to 198☐H): Setting errors related to the range setting and A/D conversion method
- Error code (1D0☐H to 1D6☐H, 1DA☐H to 1DD☐H): Setting errors of the logging functions
- Error code (1D8☐H and 1D9☐H): Setting errors of the logging read function

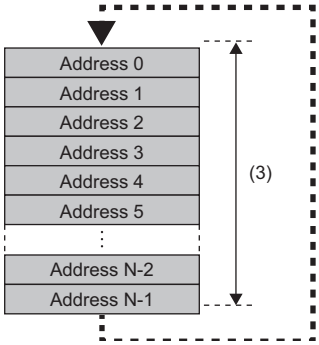
Number of logging data

With 'CH1 Number of logging data' (Un\G440, Un\G441), the number of valid data points in Logging data area (Un\G10000 to Un\G99999) can be checked.

When the number of collected data points is less than the number of points (N) set in 'CH1 Logging data points setting' (Un\G536)



When the number of collected data points reaches the number of points (N) set in 'CH1 Logging data points setting' (Un\G536)



(1) Valid data (CH1 Number of logging data = 5)
(2) Invalid data (The content of the data is not guaranteed.)
(3) Valid data (CH1 Number of logging data = N)

The number of logging data points increases by one every time new data is stored.

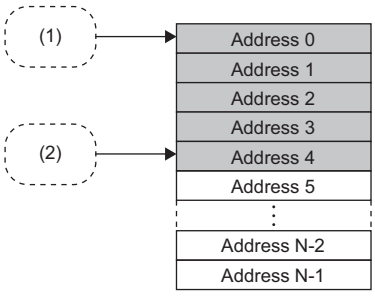
When the logging data area distributed to each channel is filled, the next data is stored in the start address of Logging data area. The logging operation continues overwriting the existing data. In this case, the number of logging data points is fixed to the number of points set in 'CH1 Logging data points setting' (Un\G536).

Head pointer and latest pointer

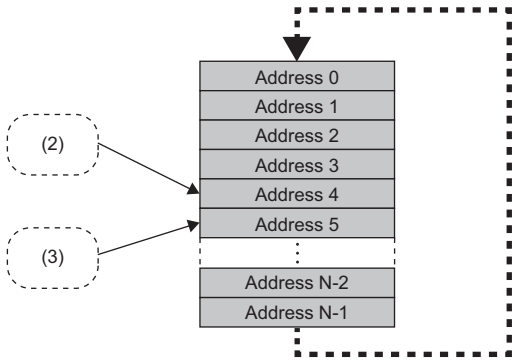
The storage locations of the oldest data and the latest data of each channel in Logging data area (Un\G10000 to Un\G99999) can be checked with the following buffer memory areas.

Buffer memory area	Description
'CH1 Head pointer' (Un\G436, Un\G437)	Out of the logging data area distributed to each channel, the buffer memory address of the oldest data can be checked with this buffer memory area. The offset value counted from the start address of each channel is stored.
'CH1 Latest pointer' (Un\G438, Un\G439)	Out of the logging data area distributed to each channel, the buffer memory address of the latest data can be checked with this buffer memory area. The offset value counted from the start address of each channel is stored.

When the number of collected data points is less than the number of points (N) set in 'CH1 Logging data points setting' (Un\G536)



When the number of collected data points reaches the number of points (N) set in 'CH1 Logging data points setting' (Un\G536)



(1) Storage location of the oldest data CH1 Head pointer = 0
(2) Storage location of the latest data CH1 Latest pointer = 4
(3) Storage location of the oldest data CH1 Head pointer = 5

'CH1 Head pointer' (Un\G436, Un\G437) does not change (fixed to 0) until logging data for the number of the points set in 'CH1 Logging data points setting' (Un\G536) is completed after the logging start.

'CH1 Head pointer' (Un\G436, Un\G437) changes by one point when logging data for the number of the points set in 'CH1 Logging data points setting' (Un\G536) is completed and overwriting the data starts from the start address of Logging data area (Un\G10000 to Un\G99999).

Logging status monitor value

The execution status of logging can be checked with 'CH1 Logging status monitor value' (Un\G458).

Stored value of 'CH1 Logging status monitor value' (Un\G458)	Execution status of logging
FH	Stop (disabled)
0H	Logging hold request waiting (during logging)
1H	Level trigger waiting (during logging)
2H	Trigger existing (during logging)
3H	Logging hold completed (stop)

Checking logging data without stopping the logging operation

Logging data can be checked during the logging operation with 'CH1 Head pointer' (Un\G436, Un\G437), 'CH1 Latest pointer' (Un\G438, Un\G439), and 'CH1 Number of logging data' (Un\G440, Un\G441).

To check logging data during the logging operation, follow the precautions below because logging data may be updated while data is being read.

- Set the cycle to 'CH1 Logging cycle setting value' (Un\G538) so that checking and reading of data surely is completed before logging data is updated. If the logging cycle is short, logging data may be updated during checking and reading of data.
- After obtaining the logging data which needs to be checked, monitor the change of 'CH1 Head pointer' (Un\G436, Un\G437) or 'CH1 Number of logging data' (Un\G440, Un\G441), and obtain logging data just after the stored value has changed.
- If the updated data and the data being checked do not synchronize due to the relationship between the logging cycle and the scan time of the CPU module, adjust the logging cycle.

Stop the logging operation when the logging data needs to be checked without paying attention to the logging cycle. (☞ Page 80 Stopping the logging operation)

Stopping the logging operation

Logging operation stops (holds) when the preset trigger condition is satisfied and data is collected for the set number of data points.

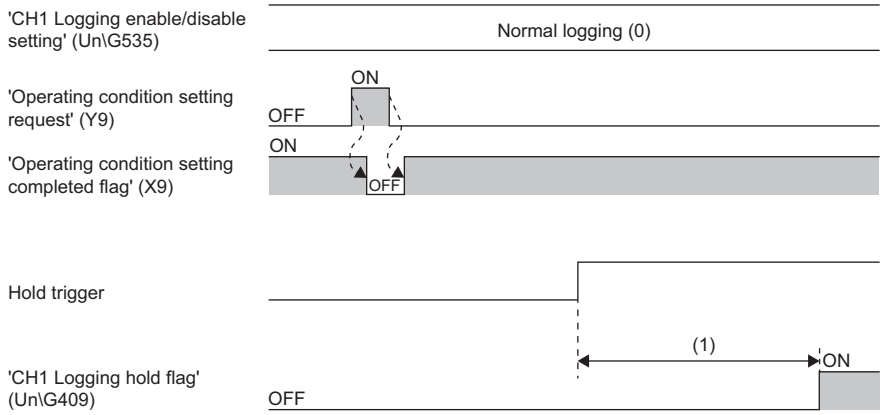
A trigger that is generated when the condition is satisfied is called a hold trigger.

To generate a hold trigger, the following two methods are available.

☞ Page 83 Logging hold request

☞ Page 84 Level trigger

When a hold trigger is detected during data collection, the logging operation stops after data is collected for the number of data points set in 'CH1 Post-trigger logging points' (Un\G540, Un\G541).



(1) Data is collected for the number of the points set in 'CH1 Post-trigger logging points' (Un\G540, Un\G541).

Post-trigger logging points

Set the number of points of data to be collected in the period from the detection of a hold trigger to when the logging operation stops in 'CH1 Post-trigger logging points' (Un\G540, Un\G541).

Checking that the logging has stopped

Check that 'CH1 Logging hold flag' (Un\G409) has changed to ON (1).

Checking data when a hold trigger has occurred

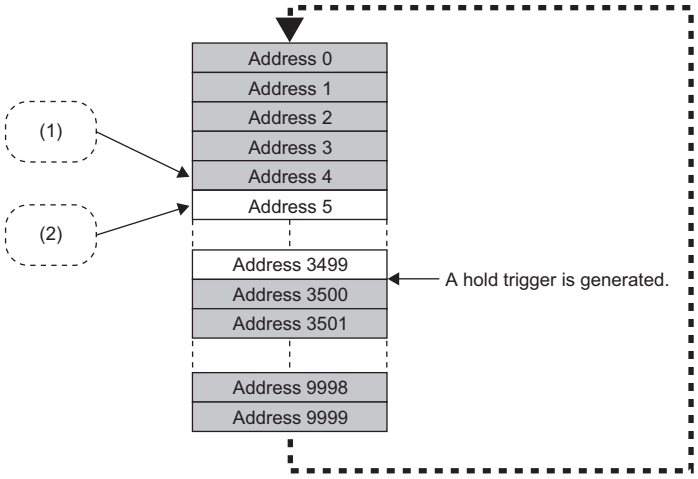
The storage location of the data of when a hold trigger has occurred can be checked with 'CH1 Trigger pointer' (Un\G442, Un\G443).

The offset value counted from the start address is stored in 'CH1 Trigger pointer' (Un\G442, Un\G443).

Ex.

The value to be stored in 'CH1 Trigger pointer' (Un\G442, Un\G443) when the logging operation stops under the following conditions

- 'CH1 Logging data points setting' (Un\G536): 10000 points
- 'CH1 Post-trigger logging points' (Un\G540, Un\G541): 6505 points
- The data location where a hold trigger has occurred: 3500th data



(1) Storage location of the latest data CH1 Latest pointer = 4
(2) Storage location of the oldest data CH1 Head pointer = 5
(3) CH1 Trigger pointer = 3500

■Checking the trigger generation time

The trigger generation time can be checked with 'CH1 Trigger generation time' (Un\G453 to Un\G457).

Ex.

For 'CH1 Trigger generation time' (Un\G453 to Un\G457)

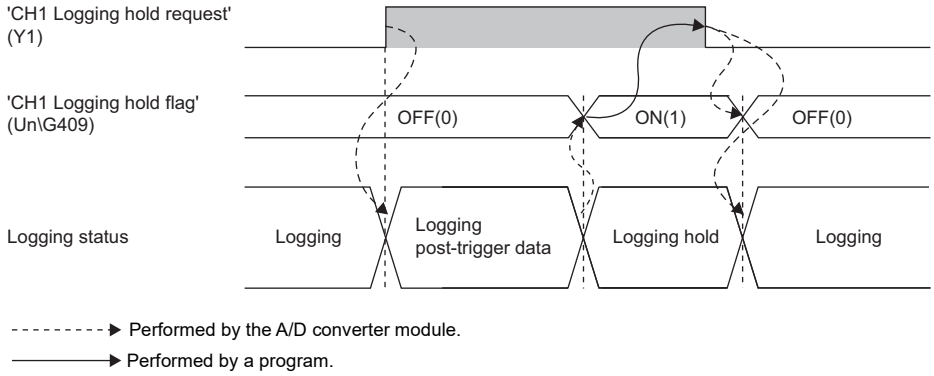
	b15 ... b8	b7 ... b0
Un\G453	First two digits of the year	Last two digits of the year
Un\G454	Month	Day
Un\G455	Hour	Minute
Un\G456	Second	Day of the week
Un\G457	Millisecond (higher-order digits)	Millisecond (lower-order digits)

Item		Storage contents
First two digits of the year	Last two digits of the year	Stored in BCD code.
Month	Day	
Hour	Minute	
Second		
Day of the week		One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3 Thursday: 4, Friday: 5, Saturday: 6
Millisecond (upper)		Stored in BCD code.
Millisecond (lower)		

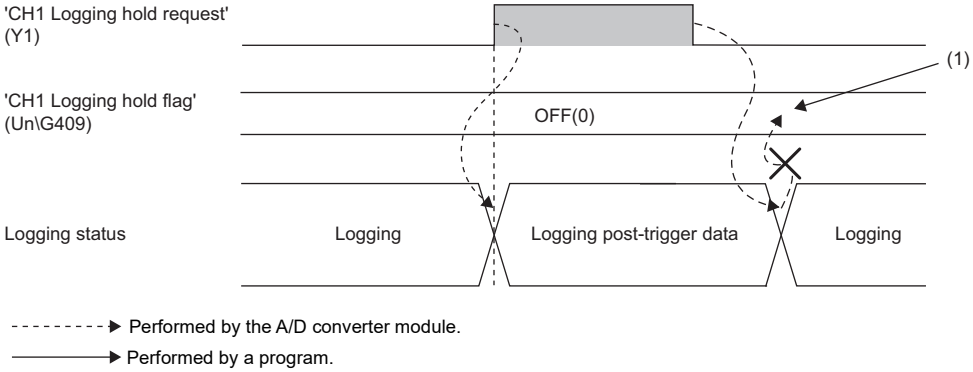
Restarting the logging

To restart logging, check that ON (1) is stored in 'CH1 Logging hold flag' (Un\G409) and turn off 'CH1 Logging hold request' (Y1). After logging is restarted, a value is stored from the start buffer memory area of Logging data area (Un\G10000 to Un\G99999). In addition, OFF (0) is stored in 'CH1 Logging hold flag' (Un\G409).

It may take time until ON (1) is stored in 'CH1 Logging hold flag' (Un\G409) after 'CH1 Logging hold request' (Y1) is turned on.



Logging does not stop when 'CH1 Logging hold request' (Y1) is turned off before ON (1) is stored in 'CH1 Logging hold flag' (Un\G409). The post-trigger logging stops and logging restarts.



(1) Logging does not stop.

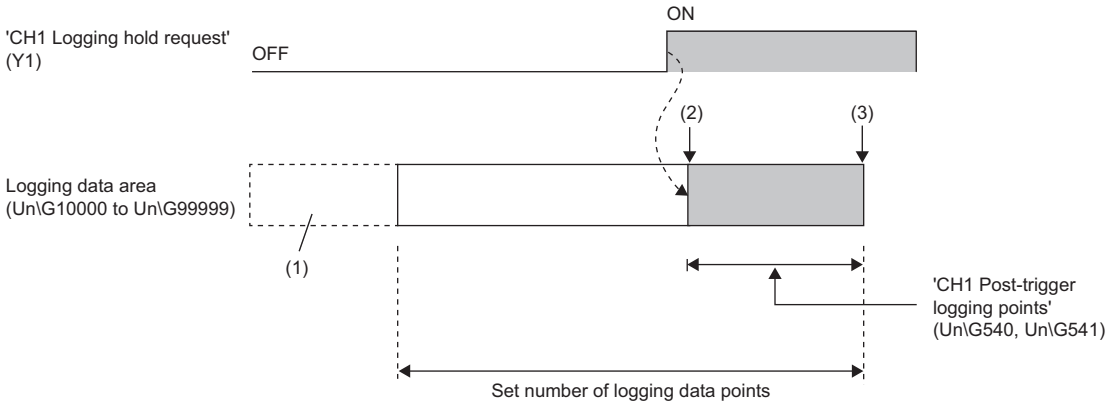
■Buffer memory area status when logging is restarted

The following table shows the status of each buffer memory area when logging is restarted.

Buffer memory area	Value status
'CH1 Head pointer' (Un\G436, Un\G437)	Values are initialized.
'CH1 Latest pointer' (Un\G438, Un\G439)	
'CH1 Number of logging data' (Un\G440, Un\G441)	
'CH1 Trigger pointer' (Un\G442, Un\G443)	
'CH1 Trigger generation time' (Un\G453 to Un\G457)	
Logging data area (Un\G10000 to Un\G99999)	The values before logging is restarted are not initialized. After logging is restarted, values are stored in the start address and later of each channel. To refer to the logging data, check for valid data with 'CH1 Number of logging data' (Un\G440, Un\G441).

Logging hold request

A hold trigger is generated from a program at any timing.
Logging stops when data collection for the preset number of post-trigger logging points is completed after 'CH1 Logging hold request' (Y1) is turned on.



- - - - - - - - - ▶ Performed by the A/D converter module.

(1) The data before the setting value of 'CH1 Logging data points setting' (Un\G536) is discarded.

(2) Generation of a hold trigger

(3) Logging is held

Point

- The following delay time occurs until the A/D converter module receives a hold trigger after 'CH1 Logging hold request' (Y1) is turned on.

Trigger delay = Logging cycle (Cycle at which logging is actually performed) + Scan time of the CPU module

- When 'CH1 Logging hold request' (Y1) is turned off before 'CH1 Logging hold flag' (Un\G409) is set to ON (1), the data collection for the number of data points set in 'CH1 Post-trigger logging points' (Un\G540, Un\G541) stops and logging restarts without hold.

Checking that the logging has stopped

Check that 'CH1 Logging hold flag' (Un\G409) has changed to ON (1).

Level trigger

When a value in the monitored buffer memory area of the A/D converter module satisfies a preset condition, a hold trigger is generated.

A level trigger is monitored on the updating cycle of a digital output value or a digital operation value.

Initial setting of a level trigger

■Setting a target to be monitored

As a condition to generate a hold trigger, set the buffer memory address to be monitored in 'CH1 Trigger data' (Un\G543).

Item	Setting range
'CH1 Trigger data' (Un\G543)	0 to 9999

To monitor a device value of a module other than the A/D converter module such as a device of the CPU module, set as follows.

- Set a value between 90 and 99 (Level data☐ (Un\G90 to Un\G99)) in 'CH1 Trigger data' (Un\G543).
- Write a value of the device to be monitored in Level data☐ (Un\G90 to Un\G99) with the MOV instruction.

Item	Setting range
Level data☐ (Un\G90 to Un\G99)	-32768 to 32767

Ex.

Application example of Level data☐ (Un\G90 to Un\G99)

To monitor the data register D100 in the CPU module and operate the level trigger in CH1, create a program as follows.

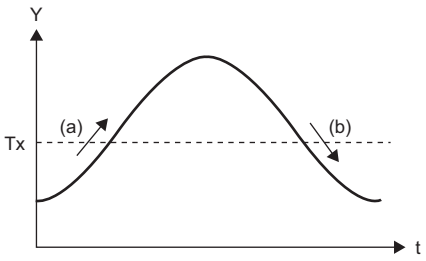
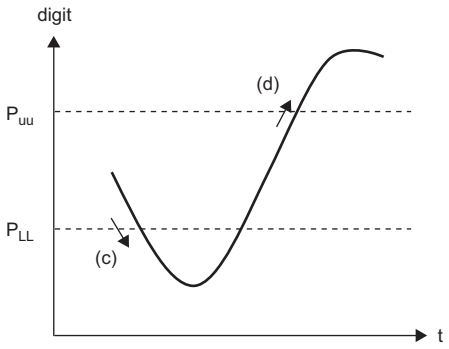
1. Set 91 (buffer memory address of Level data 1) in 'CH1 Trigger data' (Un\G543) (when Level data 1 is used).
2. Store the storage data of D100 in 'Level data 1' (Un\G91) with a program continuously.

Point

- Specify appropriate monitor data such as 'CH1 Digital output value' (Un\G400), 'CH1 Digital operation value' (Un\G402), or Level data☐ (Un\G90 to Un\G99) in 'CH1 Trigger data' (Un\G543). When a setting area or a system area is specified, the normal operation is not guaranteed.
- When Process alarm (upper limit warning) (4), Process alarm (lower limit warning) (5), or Process alarm (upper limit warning/lower limit warning) (6) is set in 'CH1 Level trigger condition setting' (Un\G542), setting 'CH1 Trigger data' (Un\G543) and Level data☐ (Un\G90 to Un\G99) is not required.

■Setting the condition to be monitored

- Set a condition to generate a hold trigger in 'CH1 Level trigger condition setting' (Un\G542).

Setting value	Description	
Level trigger (Rise) (1)	 Y: Stored value of a device to be monitored t: Time Tx: Trigger setting value (a) The relation between the values changes from "Stored value of a buffer memory area to be monitored ≤ Trigger setting value" to "Stored value of a buffer memory area to be monitored > Trigger setting value". (b) The relation between the values changes from "Stored value of a buffer memory area to be monitored ≥ Trigger setting value" to "Stored value of a buffer memory area to be monitored < Trigger setting value".	A hold trigger is generated under the condition (a).
Level trigger (Fall) (2)		A hold trigger is generated under the condition (b).
Level trigger (Rise and fall) (3)		A hold trigger is generated under the condition (a) or (b).
Process alarm (upper limit warning) (4)	 digit: Digital operation value t: Time P_{UU}: Process alarm upper upper limit value P_{LL}: Process alarm lower lower limit value (c) A lower limit warning of the process alarm is issued. (d) An upper limit warning of the process alarm is issued.	A hold trigger is generated under the condition (d).
Process alarm (lower limit warning) (5)		A hold trigger is generated under the condition (c).
Process alarm (upper limit warning/lower limit warning) (6)		A hold trigger is generated under the condition (c) or (d).

- Set a value to generate a hold trigger in 'CH1 Trigger setting value' (Un\G544). When Process alarm (upper limit warning) (4), Process alarm (lower limit warning) (5), or Process alarm (upper limit warning/lower limit warning) (6) is set in 'CH1 Level trigger condition setting' (Un\G542), setting this area is not required.

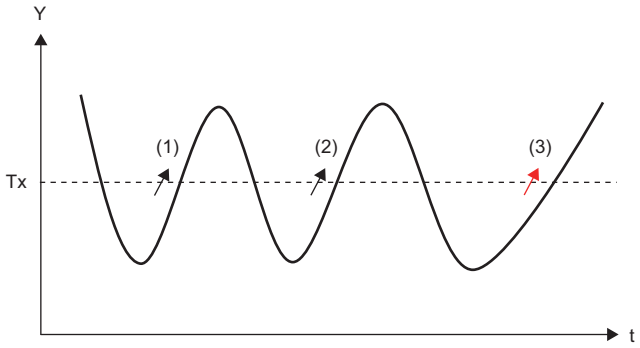
Item	Setting range
'CH1 Trigger setting value' (Un\G544)	-32768 to 32767

■Setting of the hold trigger generation timing

Set the timing of detecting a hold trigger after the number of the generated level triggers is counted in 'CH1 Trigger judgment count setting value' (Un\G545). When level triggers are generated for the set number of level triggers, a hold trigger is generated.

Ex.

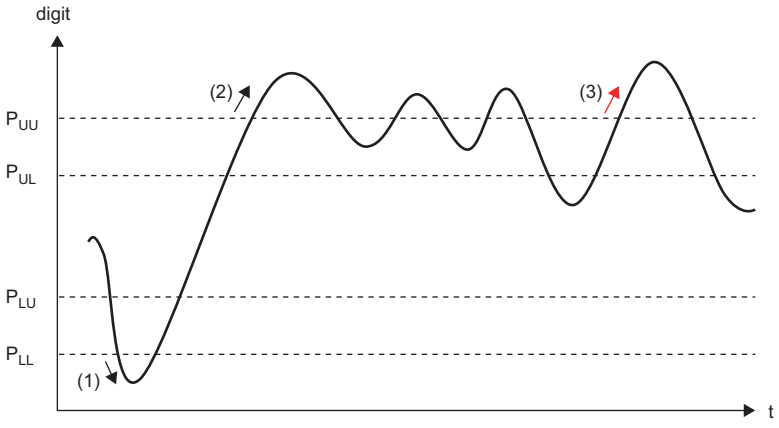
When 'CH1 Level trigger condition setting' (Un\G542) is set to Level trigger (Rise) (1) and 'CH1 Trigger judgment count setting value' (Un\G545) is set to 3 (times), the following operation is performed.



Y: Stored value of a device to be monitored
t: Time
Tx: Trigger setting value
(1) Level trigger generation (first time)
(2) Level trigger generation (second time)
(3) Hold trigger generation due to level trigger generation (third time)

Ex.

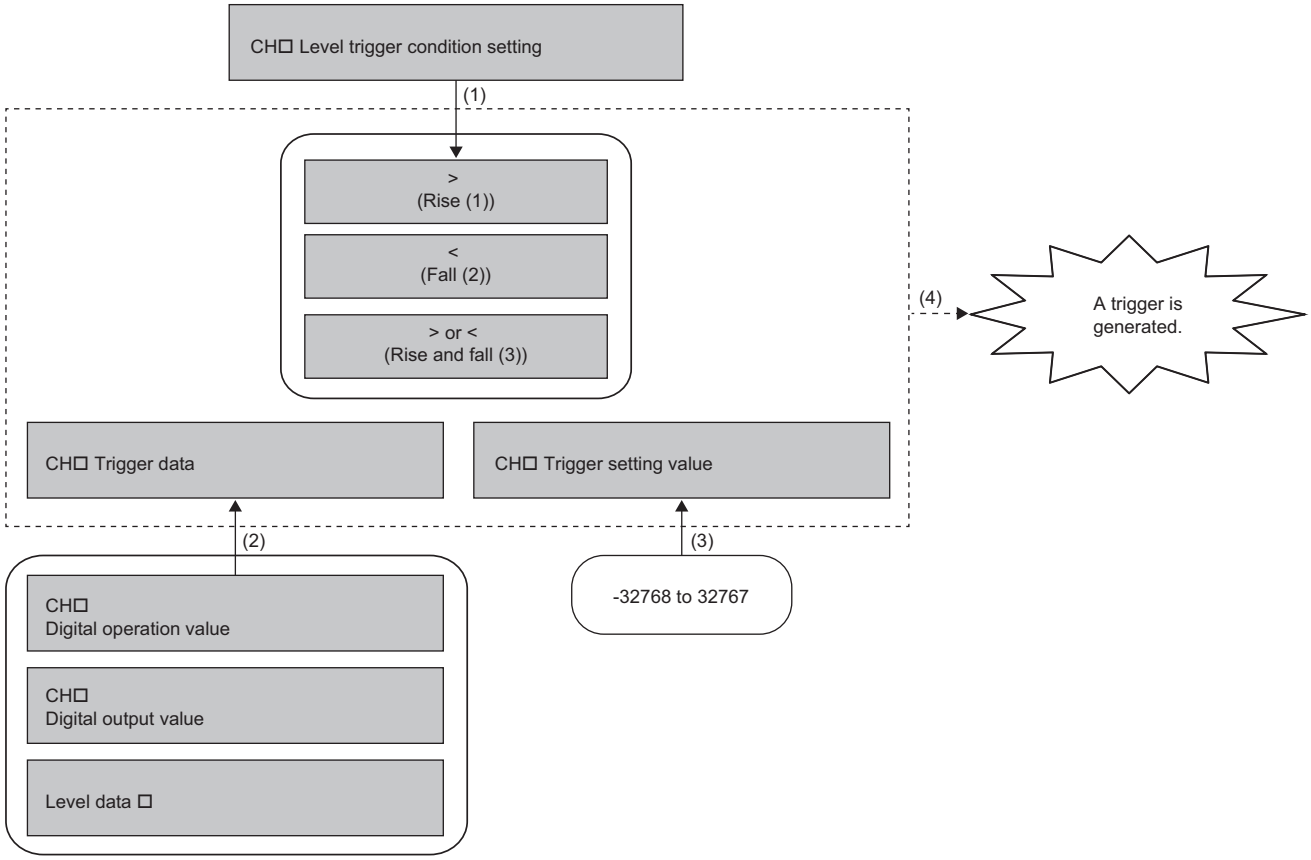
When 'CH1 Level trigger condition setting' (Un\G542) is set to Process alarm (upper limit warning/lower limit warning) (6) and 'CH1 Trigger judgment count setting value' (Un\G545) is set to 3 (times), the following operation is performed.



digit: Digital operation value
t: Time
P_{UU}: Process alarm upper upper limit value
P_{UL}: Process alarm upper lower limit value
P_{LU}: Process alarm lower upper limit value
P_{LL}: Process alarm lower lower limit value
(1) Level trigger generation (first time)
(2) Level trigger generation (second time)
(3) Hold trigger generation due to level trigger generation (third time)

■Relation between items

The following figure shows the relation between items to be set in the initial setting of a level trigger.



(1) Set a condition.

(2) Set a buffer memory address to be monitored.

(3) Set a standard value of the trigger generation.

(4) When the condition is satisfied, a trigger is generated.

Ex.

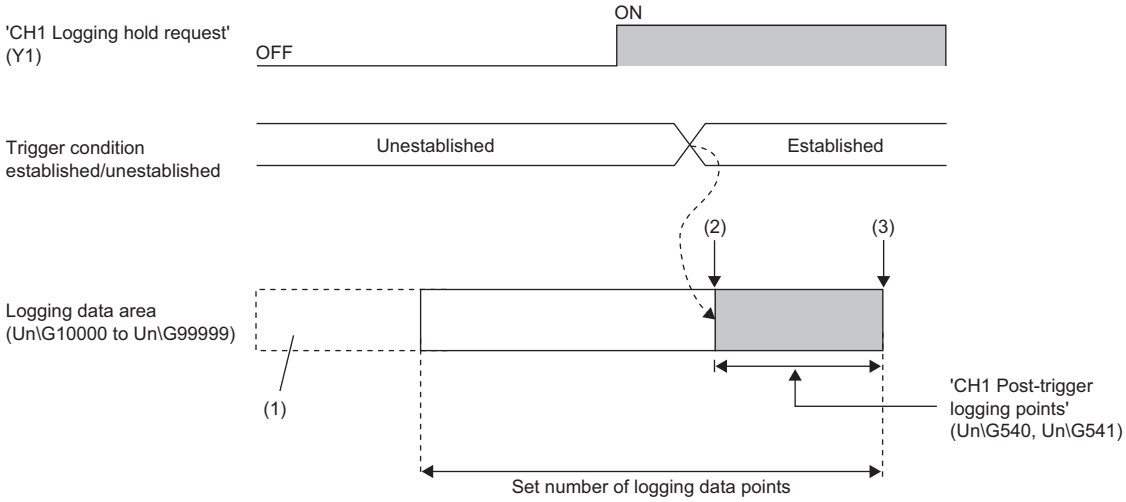
To generate a hold trigger when a value in 'CH1 Digital output value' (Un\G400) is greater than 10000, set as follows.

- 'CH1 Level trigger condition setting' (Un\G542): Level trigger (Rise) (1)
- 'CH1 Trigger data' (Un\G543): 400
- 'CH1 Trigger setting value' (Un\G544): 10000

Operation of a level trigger

To use a level trigger, turn on 'CH1 Logging hold request' (Y1) in advance. At the point where 'CH1 Logging hold request' (Y1) is turned on, the module becomes the trigger condition wait status.

The logging stops when data collection for the set number of data points is completed after the trigger condition is satisfied.



Performed by the A/D converter module.

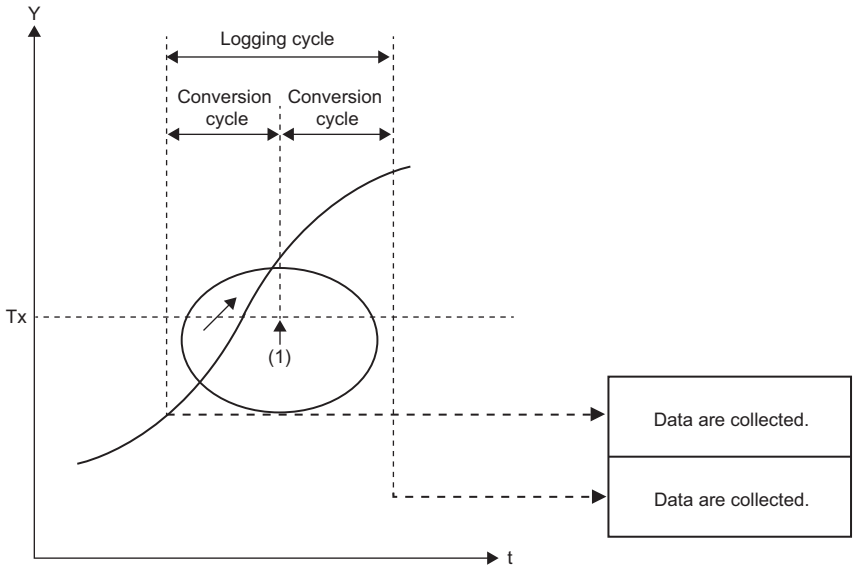
(1) The data before the setting value of 'CH1 Logging data points setting' (Un\G536) is discarded.

(2) Generation of a hold trigger

(3) Logging is held

■Precautions

A level trigger is detected on the updating cycle of a digital output value or digital operation value. Therefore, the data when a hold trigger is generated may not be stored in Logging data area (Un\G10000 to Un\G99999) depending on the setting of the logging cycle. To store the data at the timing when a hold trigger is generated in Logging data area (Un\G10000 to Un\G99999), arrange related settings so that the conversion cycle of the target value to be monitored (a trigger data) and the logging cycle (actual logging cycle) have the same time period.



Y: Stored value of a device to be monitored

t: Time

Tx: Trigger setting value

(1) Although a trigger is generated, the data at the timing when a trigger is generated is not stored in the buffer memory area.

■Checking that the logging has stopped

Check that 'CH1 Logging hold flag' (Un\G409) has changed to ON (1).

Initial settings of the normal logging function

The following describes the initial setting procedure to use the normal logging function.

Setting procedure

Select one of the following setting procedures depending on the setting of "Level trigger condition setting".

■When setting "Level trigger (Condition: Rise)", "Level trigger (Condition: Fall)", or "Level trigger (Condition: Rise and fall)" for "Level trigger condition setting"

1. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "A/D conversion enable/disable setting" to "A/D conversion enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion enable/disable setting function]

3. Set "Logging enable/disable setting" to "Normal logging".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function]

4. Set the number of points of the logging data areas to be used by each channel in "Logging data points setting".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function] ⇨ [Normal logging function/High speed logging function]

5. Set the target data to be logged in "Logging data setting". Set either of "Digital output value" or "Digital operation value" for each channel.
6. Set the cycle to store the logging data in "Logging cycle setting value".
7. Select a unit of the logging cycle setting value in "Logging cycle unit setting".
8. Set a condition to generate a hold trigger in "Level trigger condition setting". Set "Level trigger (Condition: Rise)", "Level trigger (Condition: Fall)", or "Level trigger (Condition: Rise and fall)".
9. Set the judgment count of a level trigger in "Trigger judgment count setting value".
10. Set the number of points of data to be collected in the time period from the occurrence of a hold trigger to when logging stops in "Logging points after trigger".
11. Set a buffer memory address to be monitored for a level trigger in "Trigger data".
12. Set whether to enable or disable the logging read function in "Logging loading enable/disable setting".
13. Set a level where a level trigger operates in "Trigger setting value".

■When setting "Process alarm (Upper limit warning)", "Process alarm (Lower limit warning)", or "Process alarm (Upper limit warning and lower limit warning)" in "Level trigger condition setting"

1. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "A/D conversion enable/disable setting" to "A/D conversion enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion enable/disable setting function]

3. Set "Warning output setting (Process alarm)" to "Enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Warning output function (Process alarm)]

4. Set values for "Process alarm upper upper limit value", "Process alarm upper lower limit value", "Process alarm lower upper limit value", and "Process alarm lower lower limit value".

Item	Setting range
Process alarm upper upper limit value	-32768 to 32767
Process alarm upper lower limit value	
Process alarm lower upper limit value	
Process alarm lower lower limit value	

5. Set "Logging enable/disable setting" to "Normal logging".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function]

6. Set the number of points of the logging data areas to be used by each channel in "Logging data points setting".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function] ⇨ [Normal logging function/High speed logging function]

7. Set the target data to be logged in "Logging data setting". Set either of "Digital output value" or "Digital operation value" for each channel.

8. Set the cycle to store the logging data in "Logging cycle setting value".

9. Select a unit of the logging cycle setting value in "Logging cycle unit setting".

10. Set a condition to generate a hold trigger in "Level trigger condition setting". Set "Process alarm (Upper limit warning)", "Process alarm (Lower limit warning)", or "Process alarm (Upper limit warning and lower limit warning)".

11. Set the judgment count of a level trigger in "Trigger judgment count setting value".

12. Set the number of points of data to be collected in the time period from the occurrence of a hold trigger to when logging stops in "Logging points after trigger".

13. Set whether to enable or disable the logging read function in "Logging loading enable/disable setting".

■When setting "Disable" for "Level trigger condition setting"

1. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "A/D conversion enable/disable setting" to "A/D conversion enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion enable/disable setting function]

3. Set "Logging enable/disable setting" to "Normal logging".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function]

4. Set the number of points of the logging data areas to be used by each channel in "Logging data points setting".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function] ⇨ [Normal logging function/High speed logging function]

5. Set the target data to be logged in "Logging data setting". Set either of "Digital output value" or "Digital operation value" for each channel.
6. Set the cycle to store the logging data in "Logging cycle setting value".
7. Select a unit of the logging cycle setting value in "Logging cycle unit setting".
8. Set "Level trigger condition setting" to "Disable".
9. Set the number of points of data to be collected in the time period from the occurrence of a hold trigger to when logging stops in "Logging points after trigger".
10. Set whether to enable or disable the logging read function in "Logging loading enable/disable setting".

Logging read function

More than 90000 points of logging data can be stored by transferring the device data to the file register of the CPU module without stopping logging. This function reduces the takt time in a test demanding high-speed sampling.

Overview of the logging read function

After logging starts, an interrupt request is sent to the CPU module and an interrupt program is executed every time data is logged for the preset number of logging read points.
The A/D converter module has 16 points of interrupt factors (SI) corresponding to the logging reading of each channel.

Setting interrupt pointers

Assign the interrupt factors (SI) of the A/D converter module and interrupt pointers of the CPU module in the interrupt pointer setting of the engineering tool.
The interrupt function must be set when the logging read function is used.

Starting the logging read function

To use the logging read function, set 'CH1 Loading interrupt enable/disable setting' (Un\G546) to Enable (0) and set the number of logging points to generate an interrupt in 'CH1 Logging read points setting value' (Un\G547). This function starts when 'Operating condition setting request' (Y9) is turned on and off.

■The number of logging read points

Set a value that satisfies the following condition in 'CH1 Logging read points setting value' (Un\G547). (The following N shows an integer value.)

• 'CH1 Logging data points setting' (Un\G536) = 'CH1 Logging read points setting value' (Un\G547) × N

When the condition above is not satisfied, the set value is regarded as the value closest to 'CH1 Logging read points setting value' (Un\G547) (but smaller than 'CH1 Logging read points setting value' (Un\G547)) among divisors of the setting value of 'CH1 Logging data points setting' (Un\G536).

Ex.

Relation of the number of logging read points when 'CH1 Logging data points setting' (Un\G536) is set to 800 (80000 points)

Logging read points setting value	Actual number of logging read points	Logging read points monitor value
10 (1000 points)	1000 points	1000
9 (900 points)	800 points	800
11 (1100 points)	1000 points	1000
65 (6500 points)	5000 points	5000
600 (60000 points)	40000 points	40000

Data checking method

■Current logging read pointer

- The head pointer read from Logging data area (Un\G10000 to Un\G99999) with the interrupt processing is stored in 'CH1 Current logging read pointer' (Un\G444, Un\G445).
- The default value of 'CH1 Current logging read pointer' (Un\G444, Un\G445) is -1.
- Every time data is logged for the number of data points set in 'CH1 Logging read points monitor value' (Un\G448, Un\G449), a value calculated by the following formula is stored in 'CH1 Current logging read pointer' (Un\G444, Un\G445).

CH1 Current logging read pointer = CH1 Latest pointer - CH1 Logging read points monitor value + 1

■Previous logging read pointer

- The value of 'CH1 Current logging read pointer' (Un\G444, Un\G445) at the timing when the previous read pointer detection interrupt occurs is stored in 'CH1 Previous logging read pointer' (Un\G446, Un\G447).
- The default value of 'CH1 Previous logging read pointer' (Un\G446, Un\G447) is -1.
- 'CH1 Previous logging read pointer' (Un\G446, Un\G447) is used to detect the overlap of the logging read pointer detection interrupt processing.

Ex.

The values to be stored in each pointer at every detection interrupt when the logging read detection starts with the setting below

- 'CH1 Logging data points setting' (Un\G536): 100 (10000 points)
- 'CH1 Logging read points setting value' (Un\G547): 10 (1000 points)

Occurrence of read pointer detection interrupts	Buffer memory area		
	Previous logging read pointer	Current logging read pointer	Latest pointer
When an interrupt has not occurred	-1 (default value)	-1 (default value)	0 (default value)
First time	-1	0	999
Second time	0	1000	1999
Third time	1000	2000	2999
⋮	⋮	⋮	⋮
10th time	8000	9000	9999
11th time	9000	0	999
12th time	0	1000	1999

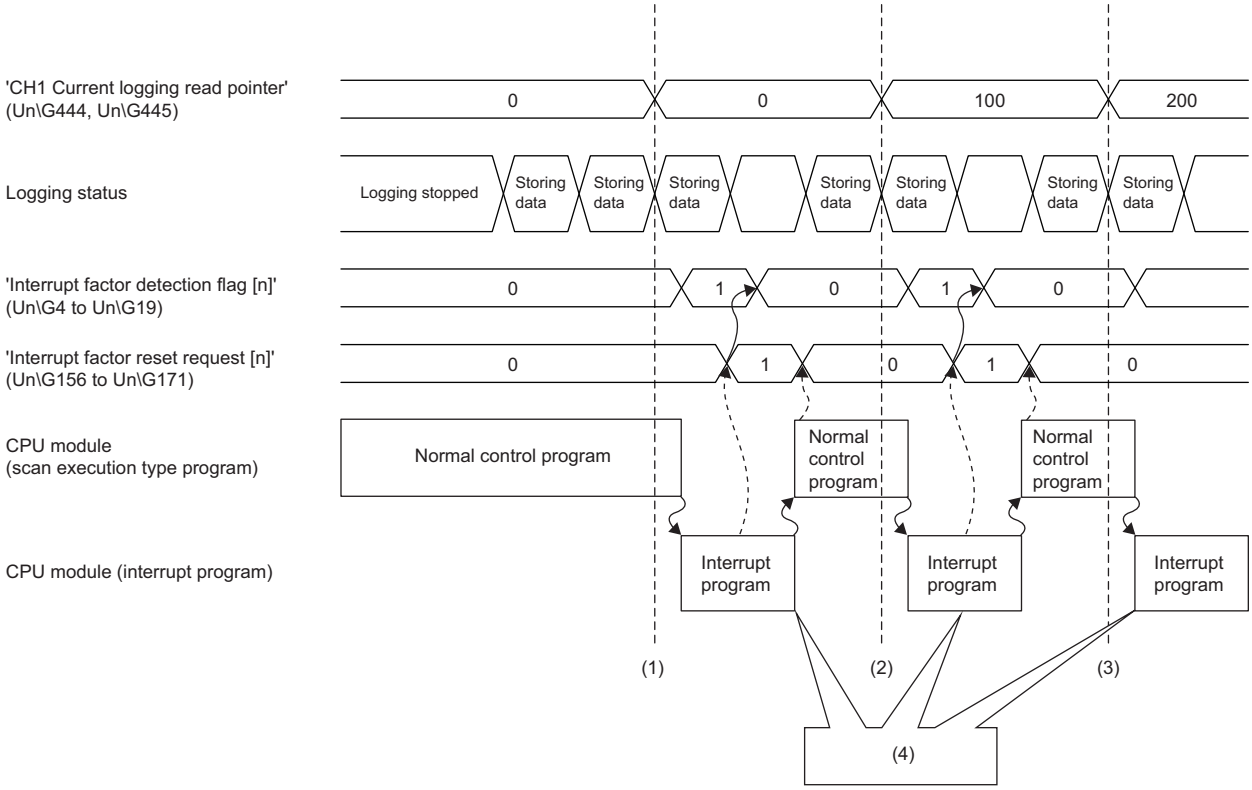
Operation

The logging read function starts after interrupt pointers are set and 'Operating condition setting request' (Y9) is turned on and off. This function repeats its operation every time data is logged for the amount equivalent to the logging read points monitor value.

Ex.

The following figure shows the operation when the logging read function is used under the following conditions.

- A/D conversion-enabled channel: CH1
- 'CH1 Logging read points setting value' (Un\G547): 1 (100 points)



(1) The timing when the first interrupt processing occurs

(2) The timing when the second interrupt processing occurs

(3) The timing when the third interrupt processing occurs

(4) The CPU module receives a logging read interrupt and read logging data from the logging read start address for the amount equivalent to the logging read points setting value.

Setting procedure

To use the logging read function, both the logging read function and the interrupt setting must be set.

1. Set "Condition target setting" to "Logging read".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Interrupt setting]

2. Set "Operation mode setting" to "Normal mode (low speed: 20μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

3. Set "A/D conversion enable/disable setting" to "A/D conversion enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion enable/disable setting]

4. Set "Logging enable/disable setting" to "Normal logging".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function]

5. Set the target data to be logged in "Logging data setting".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function] ⇨ [Normal logging function/High speed logging function]

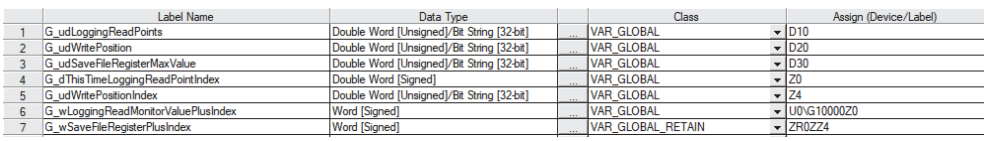
6. Set the cycle to store the logging data in "Logging cycle setting value".
7. Select a unit of the logging cycle setting value in "Logging cycle unit setting".
8. Set "Logging loading enable/disable setting" to "Enable".
9. Set the number of logging points to generate a read interrupt in "Logging read points setting value".

Setting example

Ex.

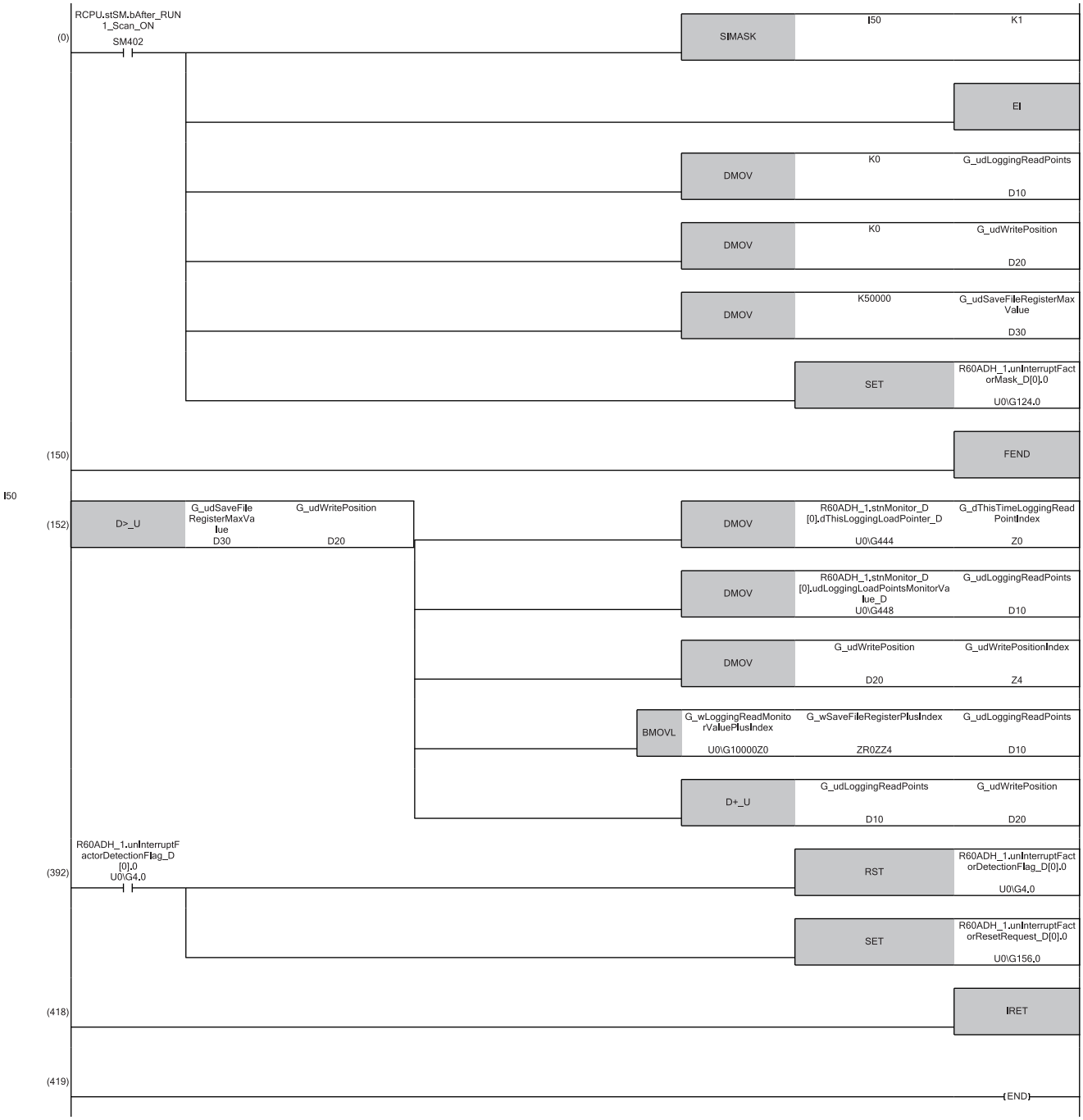
When an interrupt program that is executed when data is logged for CH1 Logging read points monitor value is assigned to the interrupt pointer I50

• Label settings

Classification	Label name	Description	Device
Module label	RCPU.stSM.bAfter_RUN1_Scan_ON	Turning on for one scan after RUN	SM402
	R60ADH_1.unInterruptFactorMask_D[0].0	Interrupt factor mask [1]	U0\G124
	R60ADH_1.unInterruptFactorDetectionFlag_D[0].0	Interrupt factor detection flag [1]	U0\G4
	R60ADH_1.unInterruptFactorResetRequest_D[0].0	Interrupt factor reset request [1]	U0\G156
	R60ADH_1.stnMonitor_D[0].dThisLoggingLoadPointer_D	CH1 Current logging read pointer	U0\G444, U0\G445
	R60ADH_1.stnMonitor_D[0].udLoggingLoadPointsMonitorValue_D	CH1 Logging read points monitor value	U0\G448, U0\G449
Labels to be defined	Define global labels as shown below:  Set the class of 'G_wSaveFileRegisterPlusIndex' to VAR_GLOBAL_RETAIN. If the class is set to VAR_GLOBAL, the program operates normally. However, if the option in global label consistency check is set to "Yes", a conversion error occurs. "Tool" ⇨ "Options" ⇨ "Convert" ⇨ "Basic Setting" ⇨ "Operational Setting" ⇨ "Check the Consistency of Global Label"		

	Label Name	Data Type		Class	Assign (Device/Label)
1	G_udLoggingReadPoints	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D10
2	G_udWritePosition	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D20
3	G_udSaveFileRegisterMaxValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D30
4	G_dThisTimeLoggingReadPointIndex	Double Word [Signed]	...	VAR_GLOBAL	Z0
5	G_udWritePositionIndex	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	Z4
6	G_wLoggingReadMonitorValuePlusIndex	Word [Signed]	...	VAR_GLOBAL	U0\G10000Z0
7	G_wSaveFileRegisterPlusIndex	Word [Signed]	...	VAR_GLOBAL_RETAIN	ZR0ZZ4

• Program example



(0) Enable only the interrupt pointer I50.
Initialize the variable for storing the logging read points monitor value (double word [unsigned]) and the write position of the save destination file register.
Set the maximum number of storage data points of the save destination file register.
Clear 'Interrupt factor mask [1]' (U0\G124).

(152) Store the value in 'CH1 Current logging read pointer' (U0\G444, U0\G445) in an index register.
Store the value in 'CH1 Logging read points monitor value' (U0\G448, U0\G449) in a register.
Store the write position of the save destination file register in an index register.
Store data for the amount equivalent to the logging read points monitor value from 'Logging data area' (U0\G10000 to U0\G99999) in the save destination file register.
Add the points of the logging read points monitor value to the write position of the save destination file register and store the obtained value as the write position for the next logging.

(392) Turn off 'Interrupt factor detection flag [1]' (U0\G4) when it turns on.
Turn on 'Interrupt factor reset request [1]' (U0\G156).

Saving to a CSV file

The logging data stored in the buffer memory areas can be saved to a CSV file by using function blocks (FBs). The save data is sorted in a time series, where the logging data can be easily checked.
However, function blocks (FBs) can be executed only when the logging operation is stopped. During the logging operation, the execution of function blocks (FBs) is disabled.

Saving a CSV file

To save a CSV file, an SD memory card is required.
CSV files are saved in an SD memory card installed in the CPU module. CSV files cannot be saved in the built-in memory of the CPU module.

Saving procedure

1. Check that ON (1) is stored in 'CH1 Logging hold flag' (Un\G409).
2. Execute the function block (FB).

Point

If the execution state of the function block (FB) is maintained, logging data can be saved in the CSV file every time logging stops.

Data to be saved in a CSV file

The logging data stored in the buffer memory areas is saved.
For how to check the logging data, refer to the following.
☞ Page 81 Checking data when a hold trigger has occurred

CSV file name

CSV files where data was saved with the function block (FB) are named as follows.

- AD□□△○○○.CSV

□□: First two digits of the start I/O number of the A/D converter module (when the number is displayed in four digits in hexadecimal)
△: Target channel
○○○: Consecutive number*1

*1 The maximum number of the consecutive numbers can be set with the input label i_uMaxNumber (maximum number of saving files) of the function block (FB).

Ex.
The CSV file name under the following condition is AD453006.CSV.

- Start I/O number of the A/D converter module: 0450H
- Target channel: 3
- Saving to a CSV file: 6th time

1.15 High Speed Logging Function

High speed

This function logs (records) digital operation values for up to 90000 points. The A/D conversion performed at 1μs cycle (shortest cycle) enables the module to log minute state changes of external devices that cannot be obtained with the conversion speed of the normal logging function.
Using function blocks (FBs) enables saving the data stored in the buffer memory as a CSV file.

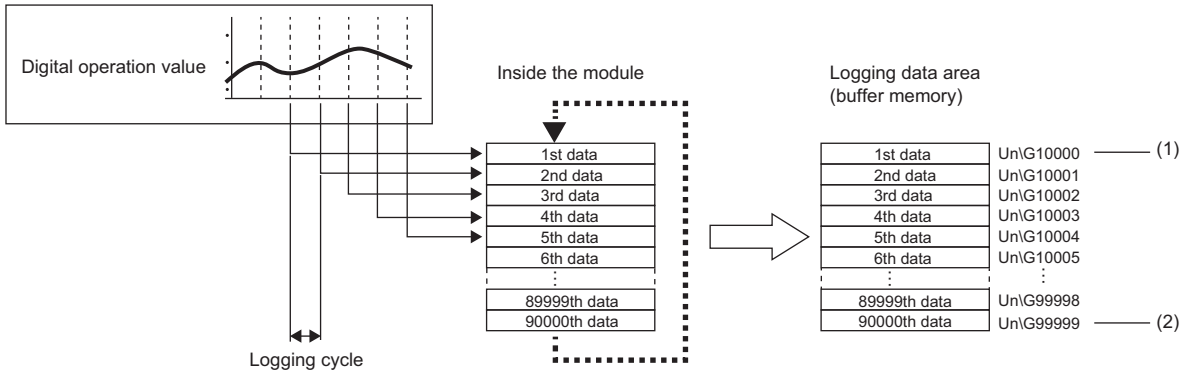
High speed logging function

■Collecting logging data

Logging data is collected as follows.

- The latest digital operation values can be always collected for each channel. The number of logging data points to be collected can be set for each channel. (☞ Page 100 Logging data)
- The data can be collected at intervals of 1μs at a minimum.

An address where the latest/oldest data is stored can be checked with the latest/head pointer.



(1) Head pointer
The address of the oldest data in logging data can be checked.

(2) Latest pointer
The address of the latest data in logging data can be checked.

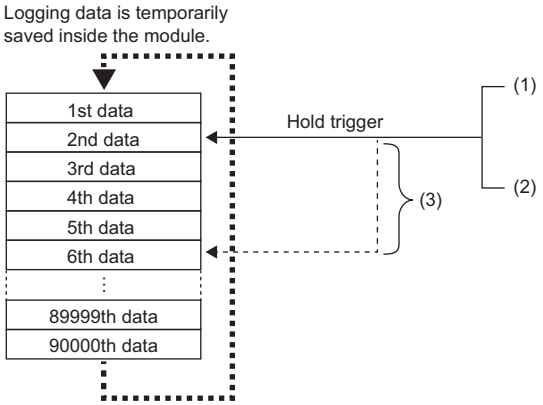
Logging data is temporarily stored inside the module, and after high speed logging stops, the data is stored collectively into buffer memory areas.

■Stopping high speed logging

During high speed logging, logging data is not stored into buffer memory areas. Thus, stop the high speed logging when the logging data needs to be referred to.

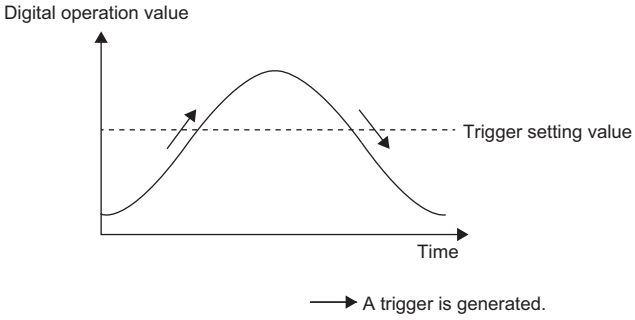
High speed logging can be stopped by the hold trigger.

- A hold trigger allows two options: Logging hold request or Level trigger.
- The number of data points to be collected after a hold trigger occurs can be set.



(1) Logging hold request
A hold trigger is generated from a program at any timing.

(2) Level trigger
A hold trigger is generated when a digital operation value is monitored and the set condition is satisfied as follows.
Example: When the digital operation value exceeds or falls below the set value, a hold trigger is generated.

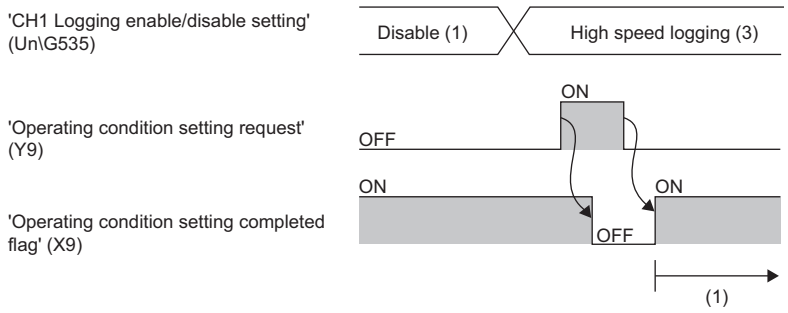


(3) Post-trigger logging points
When data for the set number of data points are collected after a hold trigger is generated, the high speed logging operation is stopped.

Operation of high speed logging

■Starting logging data collection

Logging data collection starts when 'CH1 Logging enable/disable setting' (Un\G535) is set to High speed logging (3) and 'Operating condition setting request' (Y9) is turned on and off. For the channels where the high speed logging function is not used, set 'CH1 Logging enable/disable setting' (Un\G535) to Disable (1). If Normal logging (1) or High speed continuous logging (2) is set for any channels, a logging enable/disable setting range error (error code: 1D0☐H) or an across channels logging setting error (error code: 1DE0H) occurs. In this case, A/D conversion is stopped in all channels.
Collecting is performed at the preset logging cycle.



(1) High speed logging is started.

Point

If high speed logging function is used for any channel, CH☐ Digital operation value is updated in all channels at 5ms cycle. However, the A/D conversion is performed at every conversion cycle inside the module. High speed logging collects the digital operation value obtained from this A/D conversion inside the module.
Refer to the value of 'CH1 Digital operation value' (Un\G402), which is updated every 5ms, as an indication to check that external devices (such as sensors) are operating.

■Logging data

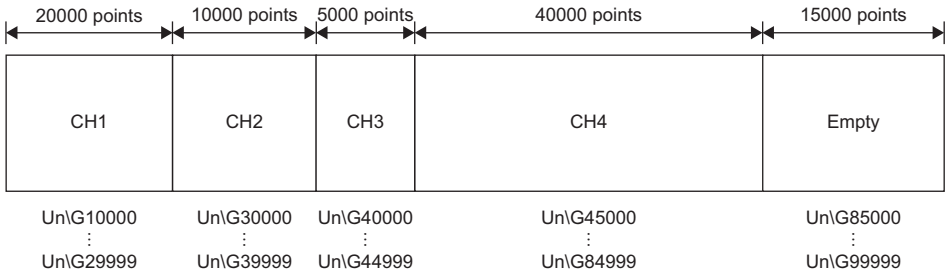
The areas of 90000 points for logging data storage are prepared in all channels.
To distribute the areas to each channel, set a value in Logging data points setting in increments of 100 points.

Ex.
When setting the number of points for logging data areas to be used by each channel as follows

Item	Setting value*1*2
'CH1 Logging data points setting' (Un\G536)	200 (20000 points)
'CH2 Logging data points setting' (Un\G736)	100 (10000 points)
'CH3 Logging data points setting' (Un\G936)	50 (5000 points)
'CH4 Logging data points setting' (Un\G1136)	400 (40000 points)

*1 Set a value in increments of 1 (100 points).
*2 Set the number of logging data points for each channel so that the total of values set in this area does not exceed 900 (90000 points). If the total of the values is greater than 900 (90000 points), a logging data points setting total range error (error code: 1DB0H) occurs. In this case, high speed logging is not started in all channels.

Logging data area (Un\G10000 to Un\G99999) is distributed to each channel as follows.



All the logging data areas are cleared to 0 at the timing when 'Operating condition setting request' (Y9) is turned on. Save the necessary logging data before turning on 'Operating condition setting request' (Y9). (☞ Page 111 Saving to a CSV file)

Point

- Because the logging data areas are reserved automatically by the setting, refer to 'CH1 Logging start address monitor' (Un\G434, Un\G435) to find the logging start position.
- Setting 0 in Logging data points setting of the channel that is not used for high speed logging allows users to set wide logging areas of the channel used for logging.

■Storing to Logging data area (Un\G10000 to Un\G99999)

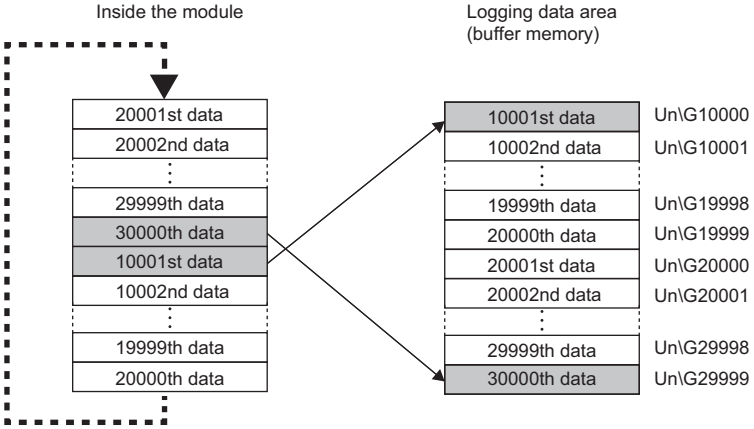
When logging data is stored in Logging data area (Un\G10000 to Un\G99999), the data is sorted in chronological order of collection so that the oldest data is stored in start address.

Ex.

The following figure shows how the data is sorted and stored in Logging data area (Un\G10000 to Un\G99999) under the following conditions.

- 'CH1 Logging data points setting' (Un\G536) is set to 200
- Data of 30000 points are collected inside the module before high speed logging stops

The 10001st data is stored to the start address (Un\G10000) and 30000th data is stored to the end address (Un\G29999). In addition, 0 is stored in 'CH1 Head pointer' (Un\G436, Un\G437) and 19999 is stored in 'CH1 Latest pointer' (Un\G438, Un\G439).



Point

Storing data to Logging data area (Un\G10000 to Un\G99999) takes 100ms at a maximum. Before referring to logging data, check that 'CH1 Logging hold flag' (Un\G409) is turned on.

Logging cycle

Set the logging cycle in 'CH1 Logging cycle setting value' (Un\G538).

The actual logging cycle is obtained from Conversion cycle × Value set in 'CH1 Logging cycle setting value' (Un\G538). Therefore, the range of actual logging cycle differs as follows depending on the number of A/D conversion enabled channels.

Number of A/D conversion enabled channels	'CH1 Logging cycle setting value' (Un\G538)	Actual logging cycle
1	1 to 1000	1 to 1000μs
2	1 to 1000	2 to 2000μs
3	1 to 1000	3 to 3000μs
4	1 to 1000	4 to 4000μs

When the high speed logging function becomes disabled

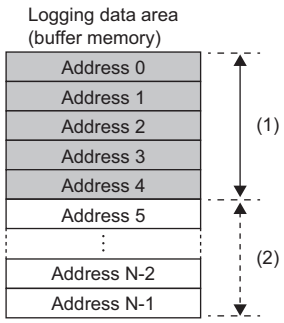
When the following error occurs in any channel, the A/D conversion stops in all channels.

- Logging enable/disable setting range error (error code: 1D0□H)
- Logging cycle setting value range error (error code: 1D1□H)
- Post-trigger logging points setting range error (error code: 1D4□H)
- Level trigger condition setting range error (error code: 1D5□H)
- Logging data points setting range error (error code: 1DA□H)
- Logging data points setting total range error (error code: 1DB0H)
- Logging enable error (logging points setting 0) (error code: 1DC□H)
- Across channels logging setting error (error code: 1DE0H)

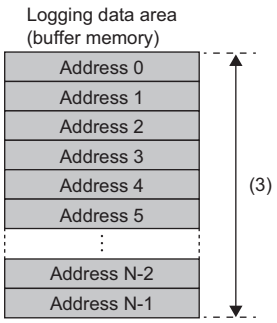
Number of logging data

With 'CH1 Number of logging data' (Un\G440, Un\G441), the number of valid data points in Logging data area (Un\G10000 to Un\G99999) can be checked.

When the number of collected data points is less than the number of points (N) set in 'CH1 Logging data points setting' (Un\G536)



When the number of collected data points reaches the number of points (N) set in 'CH1 Logging data points setting' (Un\G536)



(1) Valid data (CH1 Number of logging data = 5)
(2) Invalid data (The content of the data is not guaranteed.)
(3) Valid data (CH1 Number of logging data = N)

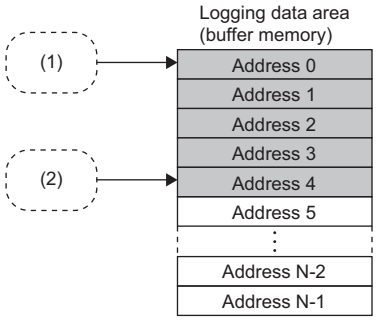
'CH1 Number of logging data' (Un\G440, Un\G441) is not updated during high speed logging. 'CH1 Number of logging data' (Un\G440, Un\G441) is updated when 'CH1 Logging hold flag' (Un\G409) is turned on with the stop of high speed logging after turning on of 'CH1 Logging hold request' (Y1).

Head pointer and latest pointer

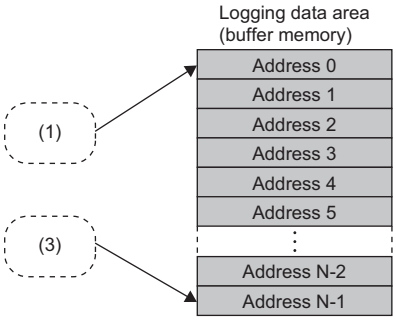
The storage locations of the oldest data and the latest data of each channel in Logging data area (Un\G10000 to Un\G99999) can be checked with the following buffer memory areas.

Buffer memory area	Description
'CH1 Head pointer' (Un\G436, Un\G437)	Out of the logging data area distributed to each channel, the buffer memory address of the oldest data can be checked with this buffer memory area. When the high speed logging function is used, the oldest data is always stored to the start address assigned to each channel. Thus, the value of 'CH1 Head pointer' (Un\G436, Un\G437) is fixed to 0.
'CH1 Latest pointer' (Un\G438, Un\G439)	Out of the logging data area distributed to each channel, the buffer memory address of the latest data can be checked with this buffer memory area. The offset value counted from the start address of each channel is stored. The latest data is stored to buffer memory address of Start address assigned to each channel + Logging points.

When the number of collected data points is less than the number of points (N) set in 'CH1 Logging data points setting' (Un\G536)



When the number of collected data points reaches the number of points (N) set in 'CH1 Logging data points setting' (Un\G536)



(1) Storage location of the oldest data CH1 Head pointer = 0
(2) Storage location of the latest data CH1 Latest pointer = 4
(3) Storage location of the latest data CH1 Latest pointer = N-1

'CH1 Head pointer' (Un\G436, Un\G437) and 'CH1 Latest pointer' (Un\G438, Un\G439) are not updated during high speed logging. 'CH1 Head pointer' (Un\G436, Un\G437) and 'CH1 Latest pointer' (Un\G438, Un\G439) are updated when 'CH1 Logging hold flag' (Un\G409) is turned on with the stop of high speed logging after turning on of 'CH1 Logging hold request' (Y1).

Logging status monitor value

The execution status of high speed logging can be checked with 'CH1 Logging status monitor value' (Un\G458).

Stored value of 'CH1 Logging status monitor value' (Un\G458)	Execution status of high speed logging
FH	Stop (disabled)
0H	Logging hold request waiting (during logging)
1H	Level trigger waiting (during logging)
2H	Trigger existing (during logging)
3H	Logging hold completed (stop)

'CH1 Logging status monitor value' (Un\G458)' is updated during high speed logging.

Stopping high speed logging

High speed logging operation stops (holds) when the preset trigger condition is satisfied and data is collected for the set number of data points.

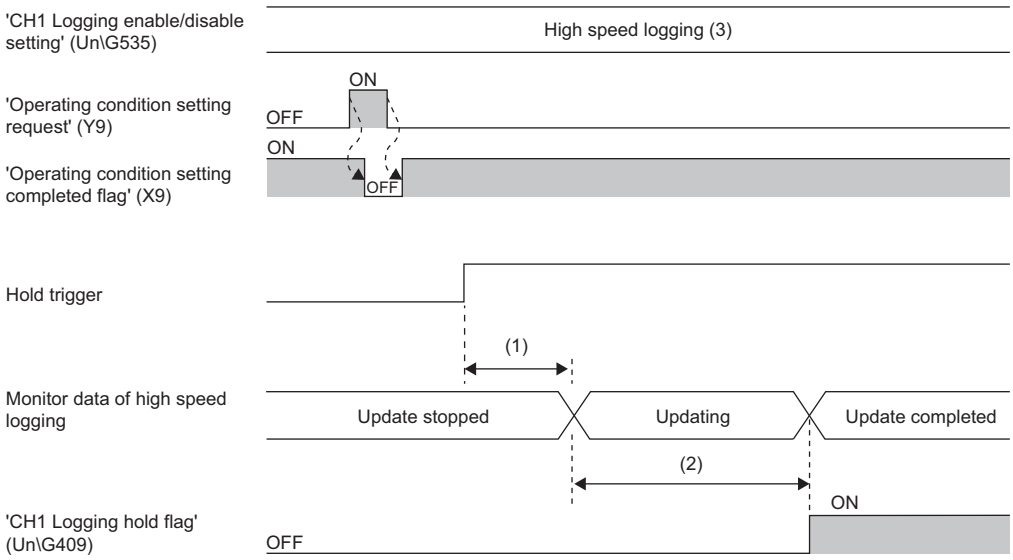
A trigger that is generated when the condition is satisfied is called a hold trigger.

To generate a hold trigger, the following two methods are available.

☞ Page 107 Logging hold request

☞ Page 108 Level trigger

When a hold trigger is detected during data collection, the high speed logging operation stops after data is collected for the number of data points set in 'CH1 Post-trigger logging points' (Un\G540, Un\G541).



(1) Data is collected for the number of the points set in 'CH1 Post-trigger logging points' (Un\G540, Un\G541).

(2) After the post-trigger logging is completed, the following monitor data is updated, and 'CH1 Logging hold flag' (Un\G409) changes to ON (1).

- 'CH1 Head pointer' (Un\G436, Un\G437)
- 'CH1 Latest pointer' (Un\G438, Un\G439)
- 'CH1 Number of logging data' (Un\G440, Un\G441)
- 'CH1 Trigger pointer' (Un\G442, Un\G443)
- 'CH1 Trigger generation time' (Un\G453 to Un\G457)
- Logging data area (Un\G10000 to Un\G99999)

Post-trigger logging points

Set the number of points of data to be collected in the period from the detection of a hold trigger to when the logging operation stops in 'CH1 Post-trigger logging points' (Un\G540, Un\G541).

Checking that the high speed logging has stopped

Check that 'CH1 Logging hold flag' (Un\G409) has changed to ON (1).

Checking data when a hold trigger has occurred

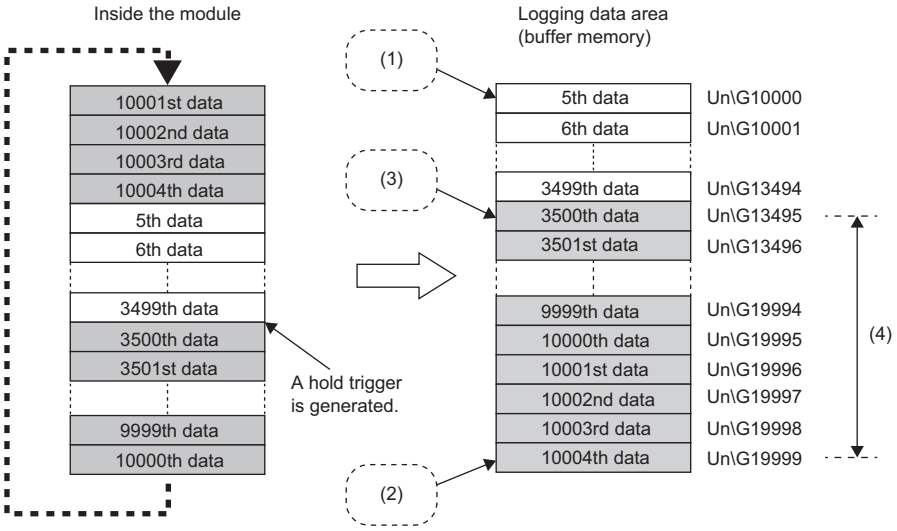
The storage location of the data of when a hold trigger has occurred can be checked with 'CH1 Trigger pointer' (Un\G442, Un\G443).

The offset value counted from the start address is stored in 'CH1 Trigger pointer' (Un\G442, Un\G443).

Ex.

The value to be stored in 'CH1 Trigger pointer' (Un\G442, Un\G443) when the logging operation stops under the following conditions

- 'CH1 Logging data points setting' (Un\G536): 10000 points
- 'CH1 Post-trigger logging points' (Un\G540, Un\G541): 6505 points
- The data location where a hold trigger has occurred: 3500th data



(1) Storage location of the oldest data CH1 Head pointer = 0
(2) Storage location of the latest data CH1 Latest pointer = 9999
(3) Storage location of data at the generation of a hold trigger CH1 Trigger pointer = 3495
(4) Post-trigger logging points

■Checking the trigger generation time

The trigger generation time can be checked with 'CH1 Trigger generation time' (Un\G453 to Un\G457).

Ex.

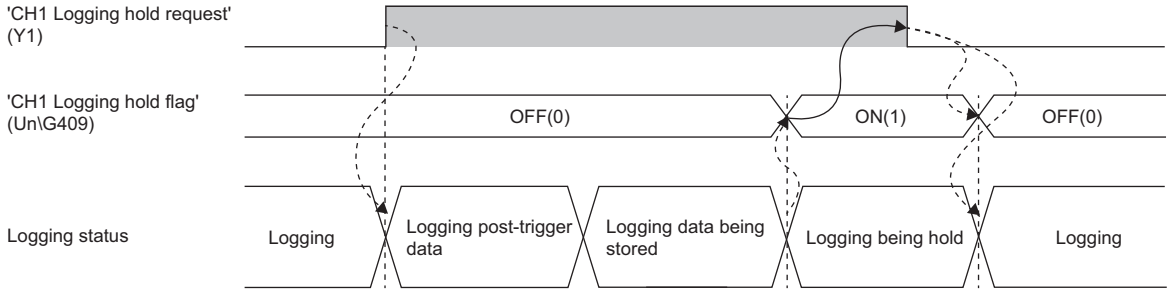
For 'CH1 Trigger generation time' (Un\G453 to Un\G457)

	b15 ... b8	b7 ... b0
Un\G453	First two digits of the year	Last two digits of the year
Un\G454	Month	Day
Un\G455	Hour	Minute
Un\G456	Second	Day of the week
Un\G457	Millisecond (higher-order digits)	Millisecond (lower-order digits)

Item		Storage contents
First two digits of the year	Last two digits of the year	Stored in BCD code.
Month	Day	
Hour	Minute	
Second		
Day of the week		One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3 Thursday: 4, Friday: 5, Saturday: 6
Millisecond (upper)		Stored in BCD code.
Millisecond (lower)		

Restarting the high speed logging

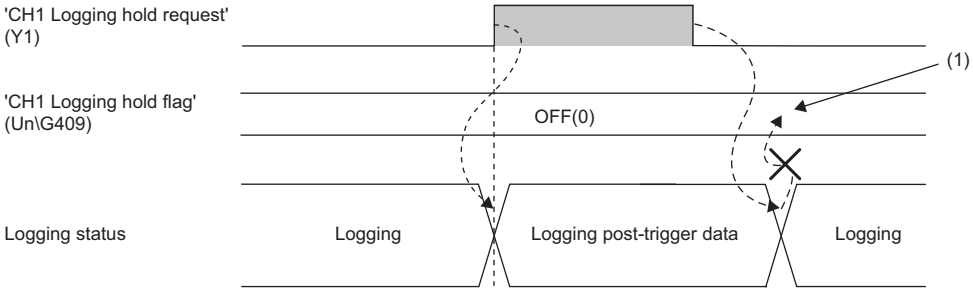
To restart high speed logging, check that ON (1) is stored in 'CH1 Logging hold flag' (Un\G409) and turn off 'CH1 Logging hold request' (Y1). OFF (0) is stored in 'CH1 Logging hold flag' (Un\G409).



Performed by the A/D converter module.

Performed by a program.

High speed logging does not stop when 'CH1 Logging hold request' (Y1) is turned off before ON (1) is stored in 'CH1 Logging hold flag' (Un\G409). The post-trigger logging stops and high speed logging restarts. The logging data collected before 'CH1 Logging hold request' (Y1) is turned off is not transferred to Logging data area (Un\G10000 to Un\G99999).



Performed by the A/D converter module.

Performed by a program.

(1) High speed logging does not stop.

■Buffer memory area status when logging is restarted

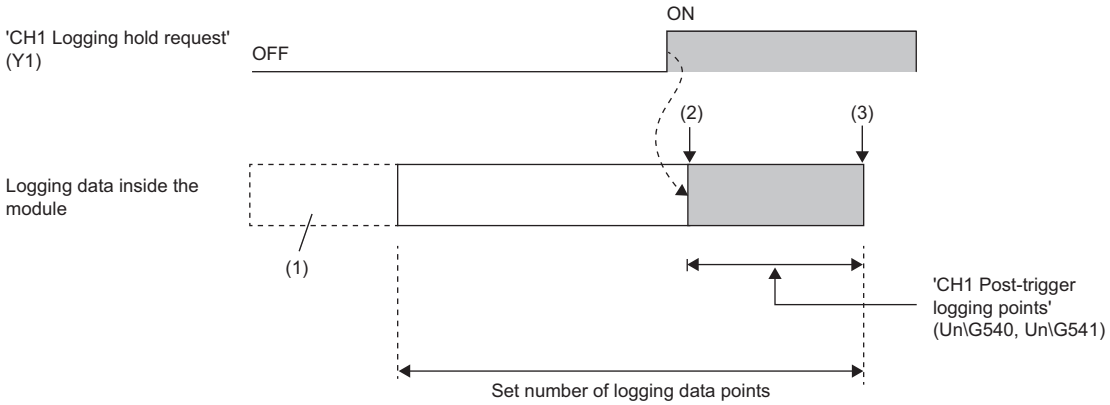
The following table shows the status of each buffer memory area when logging is restarted.

Buffer memory area	Value status
'CH1 Head pointer' (Un\G436, Un\G437)	Values are initialized.
'CH1 Latest pointer' (Un\G438, Un\G439)	
'CH1 Number of logging data' (Un\G440, Un\G441)	
'CH1 Trigger pointer' (Un\G442, Un\G443)	
'CH1 Trigger generation time' (Un\G453 to Un\G457)	
Logging data area (Un\G10000 to Un\G99999)	The values before high speed logging is restarted are not initialized. When 'CH1 Logging hold flag' (Un\G409) has changed to ON (1) again, the logging data area is overwritten with the data collected by restarted high speed logging.

Logging hold request

A hold trigger is generated from a program at any timing.

Logging stops when data collection for the preset number of post-trigger logging points is completed after 'CH1 Logging hold request' (Y1) is turned on.



----------▶ Performed by the A/D converter module.

(1) The data before the setting value of 'CH1 Logging data points setting' (Un\G536) is discarded.

(2) Generation of a hold trigger

(3) High speed logging is held

Point

It takes the following time (trigger delay) until the A/D converter module receives a hold trigger after 'CH1 Logging hold request' (Y1) is turned on.

Trigger delay = 20μs + Scan time of the CPU module

Checking that the logging has stopped

Check that 'CH1 Logging hold flag' (Un\G409) has changed to ON (1).

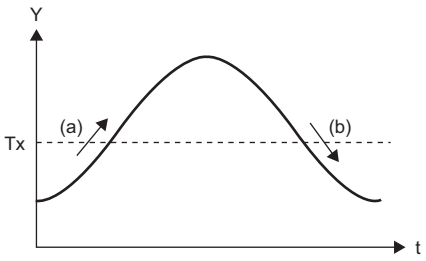
Level trigger

When the monitored digital operation value inside the module satisfies a preset condition, a hold trigger is generated. The monitoring to generate a level trigger is performed on the logging cycle.

Initial setting of a level trigger

■Setting the condition to be monitored

• Set a condition to generate a hold trigger in 'CH1 Level trigger condition setting' (Un\G542).

Setting value	Description	
Level trigger (Rise) (1)		A hold trigger is generated under the condition (a).
Level trigger (Fall) (2)		A hold trigger is generated under the condition (b).
Level trigger (Rise and fall) (3)		A hold trigger is generated under the condition (a) or (b).

Y: Digital operation value inside the module
t: Time
Tx: Trigger setting value
(a) The relation between the values changes from "Digital operation value inside the module ≤ Trigger setting value" to "Digital operation value inside the module > Trigger setting value".
(b) The relation between the values changes from "Digital operation value inside the module ≥ Trigger setting value" to "Digital operation value inside the module < Trigger setting value".

• Set a value to generate a hold trigger in 'CH1 Trigger setting value' (Un\G544).

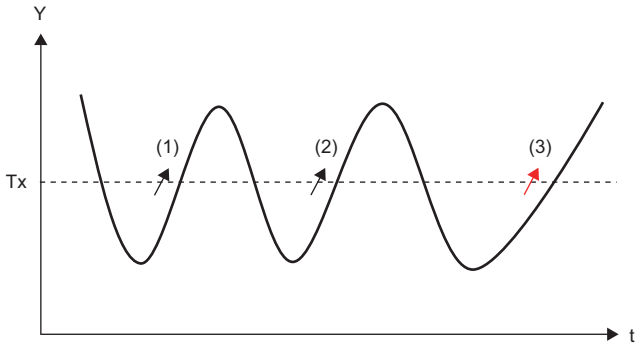
Item	Setting range
'CH1 Trigger setting value' (Un\G544)	-32768 to 32767

■Setting of the hold trigger generation timing

Set the timing of detecting a hold trigger after the number of the generated level triggers is counted in 'CH1 Trigger judgment count setting value' (Un\G545). When level triggers are generated for the set number of level triggers, a hold trigger is generated.

Ex.

When 'CH1 Level trigger condition setting' (Un\G542) is set to Level trigger (Rise) (1) and 'CH1 Trigger judgment count setting value' (Un\G545) is set to 3 (times), the following operation is performed.

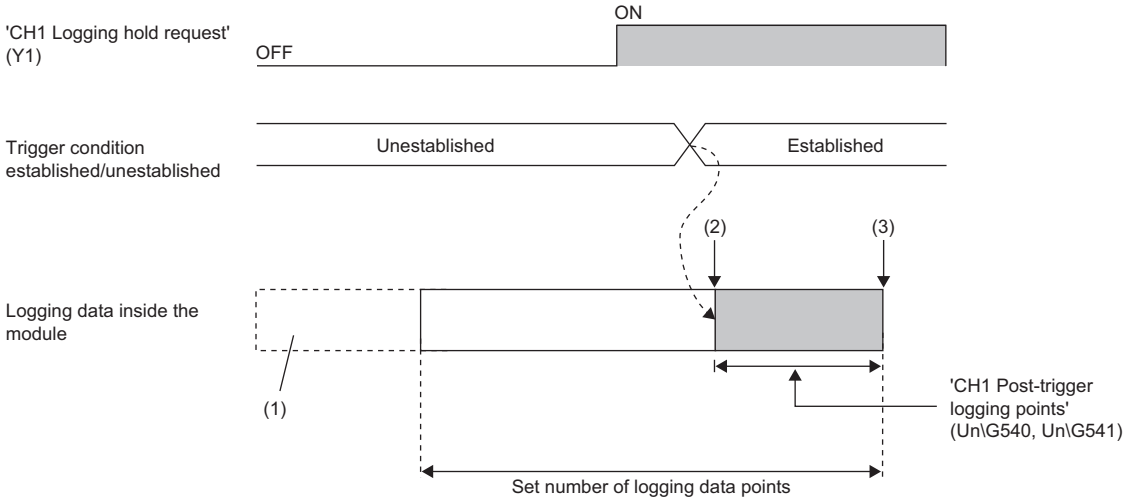


Y: Digital operation value inside the module
t: Time
Tx: Trigger setting value
(1) Level trigger generation (first time)
(2) Level trigger generation (second time)
(3) Hold trigger generation due to level trigger generation (third time)

Operation of a level trigger

To use a level trigger, turn on 'CH1 Logging hold request' (Y1) in advance. At the point where 'CH1 Logging hold request' (Y1) is turned on, the module becomes the trigger condition wait status.

The logging stops when data collection for the set number of data points is completed after the trigger condition is satisfied.



Performed by the A/D converter module.

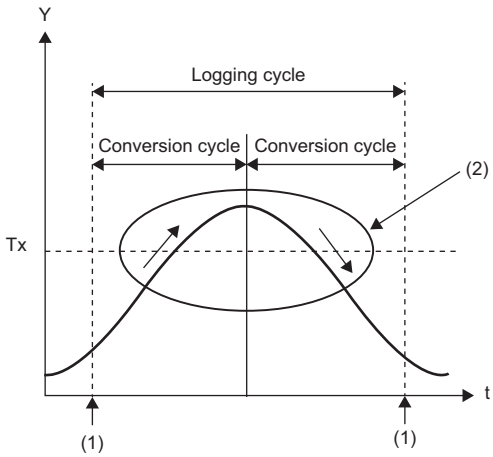
(1) The data before the setting value of 'CH1 Logging data points setting' (Un\G536) is discarded.

(2) Generation of a hold trigger

(3) High speed logging is held

■Precautions

A digital operation value inside the module is monitored on the logging cycle to generate a level trigger. When the logging cycle is larger than the conversion cycle ('CH1 Logging cycle setting value' (Un\G538) is 2 or more), even if the trigger condition is satisfied temporarily within the logging cycle, the hold trigger is not generated.



Y: Digital operation value

t: Time

Tx: Trigger setting value

(1) Logging data is temporarily stored inside the module, and the level trigger is detected.

(2) The level trigger is not detected even though a digital operation value exceeds or falls below the trigger setting value within the logging cycle.

To detect the level trigger within the conversion cycle, set 'CH1 Logging cycle setting value' (Un\G538) to 1.

■Checking that the logging has stopped

Check that 'CH1 Logging hold flag' (Un\G409) has changed to ON (1).

Initial settings of the high speed logging function

The following describes the initial setting procedure to use the high speed logging function.

Setting procedure

Select one of the following setting procedures depending on whether to use the level trigger or not.

■When the level trigger is used

1. Set "Operation mode setting" to "Normal mode (high speed: 1μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "A/D conversion enable/disable setting" to "A/D conversion enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion enable/disable setting function]

3. Set "Logging enable/disable setting" to "High speed logging". At this timing, check that "Logging enable/disable setting" is set to "High speed logging" or "Disable" for each channel.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function]

4. Set the number of points of the logging data areas to be used by each channel in "Logging data points setting".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function] ⇨ [Normal logging function/High speed logging function]

5. Set the cycle to store the logging data in "Logging cycle setting value".
6. Set a condition to generate a hold trigger in "Level trigger condition setting". Set "Level trigger (Condition: Rise)", "Level trigger (Condition: Fall)", or "Level trigger (Condition: Rise and fall)".
7. Set the judgment count of a level trigger in "Trigger judgment count setting value".
8. Set the number of points of data to be collected in the time period from the occurrence of a hold trigger to when logging stops in "Logging points after trigger".
9. Set a level where a level trigger operates in "Trigger setting value".

■When the level trigger is not used

1. Set "Operation mode setting" to "Normal mode (high speed: 1μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "A/D conversion enable/disable setting" to "A/D conversion enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion enable/disable setting function]

3. Set "Logging enable/disable setting" to "High speed logging". At this timing, check that "Logging enable/disable setting" is set to "High speed logging" or "Disable" for each channel.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function]

4. Set the number of points of the logging data areas to be used by each channel in "Logging data points setting".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function] ⇨ [Normal logging function/High speed logging function]

5. Set the cycle to store the logging data in "Logging cycle setting value".
6. Set "Level trigger condition setting" to "Disable".
7. Set the number of points of data to be collected in the time period from the occurrence of a hold trigger to when logging stops in "Logging points after trigger".

Saving to a CSV file

The logging data stored in the buffer memory areas can be saved to a CSV file by using function blocks (FBs).
However, function blocks (FBs) can be executed only when the logging operation is stopped. During the high speed logging operation, the execution of function blocks (FBs) is disabled.

Saving a CSV file

To save a CSV file, an SD memory card is required.
CSV files are saved in an SD memory card installed in the CPU module. CSV files cannot be saved in the built-in memory of the CPU module.

Saving procedure

1. Check that ON (1) is stored in 'CH1 Logging hold flag' (Un\G409).
2. Execute the function block (FB).

Point

If the execution state of the function block (FB) is maintained, logging data can be saved in the CSV file every time high speed logging stops.

Data to be saved in a CSV file

The logging data stored in the buffer memory areas is saved.
For how to check the logging data, refer to the following.
☞ Page 105 Checking data when a hold trigger has occurred

CSV file name

CSV files where data was saved with the function block (FB) are named as follows.

- AD□□△○○○.CSV

□□: First two digits of the start I/O number of the A/D converter module (when the number is displayed in four digits in hexadecimal)
△: Target channel
○○○: Consecutive number*1

*1 The maximum number of the consecutive numbers can be set with the input label i_uMaxNumber (maximum number of saving files) of the function block (FB).

Ex.
The CSV file name under the following condition is AD453006.CSV.

- Start I/O number of the A/D converter module: 0450H
- Target channel: 3
- Saving to a CSV file: 6th time

1.16 Continuous Logging Function

Simultaneous conversion | Synchronization

This function simultaneously logs digital output values in four channels and continuously transfers logging data to the CPU module without stopping logging. This function continuously collects data where A/D conversion has been performed for four channels simultaneously at high speed (with a maximum cycle time of 5μs). Thus, when the module is connected with a sensor that has input characteristics of the high-frequency band, this function can collect data for signal analysis.

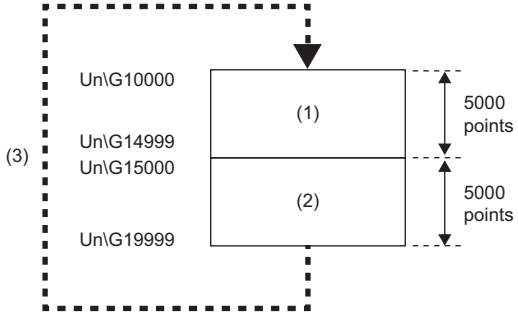
Collecting logging data

Logging data is stored in CH1 Logging data area (Un\G10000 to Un\G19999). Each channel has buffer memory areas of 10000 points for storing logging data.

■Timing to store data in the buffer memory areas

Logging data is temporarily stored in the module, and when the number of temporarily-stored logging data reaches 5000 points, the data is stored into buffer memory areas. At this time, the buffer memory addresses for the first 5000 points (logging data storage areas (A side)) of CH1 Logging data area (Un\G10000 to Un\G19999) are used. When the number of temporarily-stored logging data reaches 5000 points again after logging data is stored in the logging data storage areas (A side), the buffer memory addresses for the last 5000 points (logging data storage areas (B side)) of CH1 Logging data area (Un\G10000 to Un\G19999) are used.

After that, logging data areas are overwritten with new data by 5000 points as follows.



(1) Logging data storage areas (A side)

(2) Logging data storage areas (B side)

(3) The A-side areas and B-side areas are alternately overwritten with new logging data by 5000 points.

■Notification of logging data storage

- After logging data is stored into the logging data storage areas (A side), the value in 'CH1 Continuous logging data A side storage flag' (Un\G474) is changed from Logging data storage in A side not completed (0) to Logging data storage in A side completed (1).
- After logging data is stored into the logging data storage areas (B side), the value in 'CH1 Continuous logging data B side storage flag' (Un\G475) is changed from Logging data storage in B side not completed (0) to Logging data storage in B side completed (1).

■Transfer of logging data

Old logging data are overwritten when data more than 10000 points are stored. The data can be transferred into file registers (ZR) of the CPU module with function blocks (FBs). (☞ Page 115 Stopping continuous logging)

Check items before the start of continuous logging

■Operation modes and functions

Before starting continuous logging, check the operation mode and the settings of each function.

Item	Description
Operation mode	Check that the simultaneous conversion mode or inter-module synchronization mode is set.
A/D conversion enable/disable setting function	Check that the A/D conversion is enabled for the channel to be used.
Averaging processing function	Check that the sampling processing or moving average processing is set.
Warning output function (process alarm)	When using the warning output function (process alarm), check that each parameter has been correctly set.
Input signal error detection function	When using the input signal error detection function, check that each parameter has been correctly set.
Interrupt function	When using the interrupt function, check that the continuous logging data storage has been set as the condition target.

When the above functions have been set and an error has occurred, continuous logging cannot be started. In addition, settings cannot be changed during continuous logging. Thus, configure the above settings before starting the continuous logging.

■Continuous logging status monitor

Check whether the A/D converter module can start continuous logging or not with 'Continuous logging status monitor' (Un\G61). Check that Continuous logging start request waiting (1) is stored.

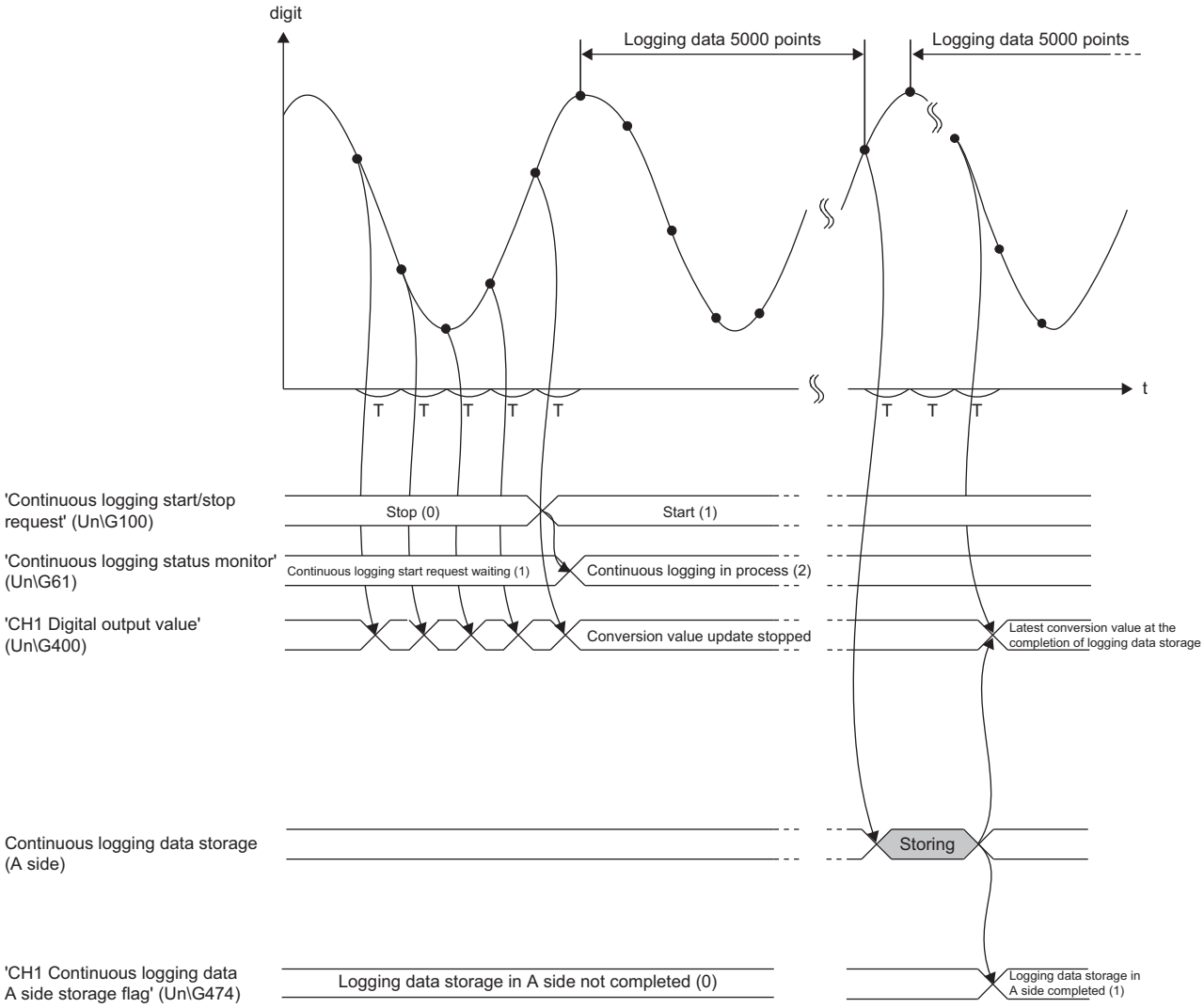
■Continuous logging cycle setting value

The logging cycle of the continuous logging function is obtained by the following formula: Conversion cycle (5μs) × (Value set in 'Continuous logging cycle setting value' (Un\G280)). Set a desired logging cycle with 'Continuous logging cycle setting value' (Un\G280). Check the set logging cycle with 'CH1 Logging cycle monitor value (μs)' (Un\G452).

Starting continuous logging

Changing the value of 'Continuous logging start/stop request' (Un\G100) from Stop (0) to Start (1) starts the continuous logging on the set continuous logging cycle. After the continuous logging is started, the update of 'CH1 Digital output value' (Un\G400) performed at every 5μs stops.

At the point when data of 5000 points has been logged, the logging data storage in the continuous logging data storage areas (A side) starts. Subsequently, Logging data storage in A side completed (1) is stored in 'CH1 Continuous logging data A side storage flag' (Un\G474) and the latest value is stored in 'CH1 Digital output value' (Un\G400).



digit: Digital output value

t: Time

T: Conversion cycle

When data of 5000 points has been logged again after logging data of 5000 points was stored in the continuous logging data storage areas (A side), the new data is stored in the continuous logging data storage areas (B side). Subsequently, Logging data storage in B side completed (1) is stored in 'CH1 Continuous logging data B side storage flag' (Un\G475). After that, new logging data is alternately logged into A-side areas → B-side areas → A-side areas ··· by 5000 points.

Point

- The time when continuous logging was started is stored in 'CH1 Trigger generation time' (Un\G453 to Un\G457).
- Refer to the value of 'CH1 Digital output value' (Un\G400), which is updated after data storage in the logging data areas is completed, as an indication to check that external devices (such as sensors) are operating.
- When the status of the CPU module is changed from RUN to STOP during continuous logging in the simultaneous conversion mode, the continuous logging continues without being stopped.

■Counting the number of logging data points

The value of 'CH1 Number of logging data' (Un\G440, Un\G441) increases by 5000 every time data of 5000 points has been logged.

After the number of data points reaches 720000000, the counter is reset to 0.

Ex.

When the value of 'CH1 Number of logging data' (Un\G440, Un\G441) is 719995000 and then data of 5000 points is continuously logged, the value changes as follows: 719995000 → 720000000 → 5000 ···.

Point

To calculate the elapsed time of continuous logging, refer to the values of 'CH1 Logging cycle monitor value (μs)' (Un\G452) and 'CH1 Number of logging data' (Un\G440, Un\G441).

• Elapsed time (μs) = Logging cycle monitor value (μs) × Number of logging data

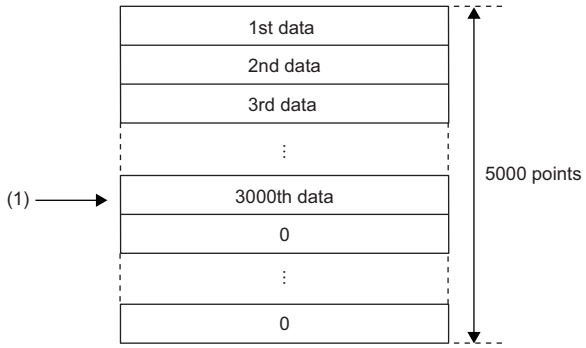
When 'CH1 Logging cycle monitor value (μs)' (Un\G452) is 5 and 'CH1 Number of logging data' (Un\G440, Un\G441) is 720000000 (maximum value), logging for 3600 seconds (1 hour) has been completed.

Stopping continuous logging

Changing the value of 'Continuous logging start/stop request' (Un\G100) from Start (1) to Stop (0) stops continuous logging. After continuous logging is stopped, the data that was partially logged is stored in buffer memory areas and the value of 'CH1 Number of logging data' (Un\G440, Un\G441) is updated to the number of points of when the stop request was accepted. In addition, 0 is stored in the data area and later of when the stop request was accepted.

Ex.

When a stop request is accepted at the timing of when 3000th data is logged under the condition in which 100000 is already stored in 'CH1 Number of logging data' (Un\G440, Un\G441), 103000 is stored in 'CH1 Number of logging data' (Un\G440, Un\G441). Subsequently, 0 is stored in the 3001th to 5000th logging data areas.



(1) A stop request is accepted.

■Restarting continuous logging

To restart continuous logging, change the value of 'Continuous logging start/stop request' (Un\G100) from Stop (0) to Start (1). Continuous logging is restarted from the beginning of the logging data storage areas. In this case, the values in the following buffer memory areas are initialized to 0.

- 'CH1 Number of logging data' (Un\G440, Un\G441)
- 'CH1 Continuous logging data A side storage flag' (Un\G474)
- 'CH1 Continuous logging data B side storage flag' (Un\G475)

After continuous logging is restarted, values are stored in the logging data storage areas (starting from A side).

The values before the restart of continuous logging remain in CH1 Logging data area (Un\G10000 to Un\G19999). Thus, before referring to the logging data, check that Logging data storage in A side completed (1) has been stored in 'CH1 Continuous logging data A side storage flag' (Un\G474) again.

Point

The value of 'CH1 Trigger generation time' (Un\G453 to Un\G457) is updated to the time when continuous logging was restarted.

Setting procedure

1. Set "Operation mode setting" to "Simultaneous conversion mode (5μs/4CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "A/D conversion enable/disable setting" to "A/D conversion enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion enable/disable setting function]

3. Set the cycle to perform logging in "Continuous logging cycle setting value".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Continuous logging function]

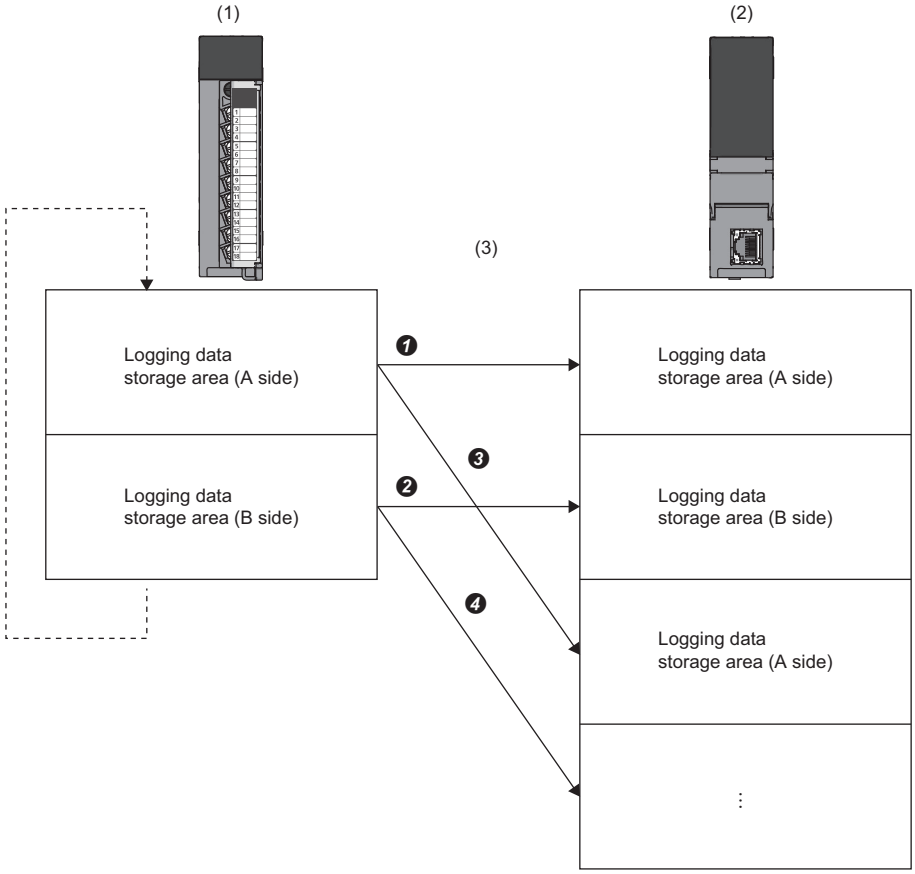
Transfer of continuous logging data

Logging data can be transferred into file registers (ZR) of the CPU module by using following items.

- Function block for continuous logging data transfer (M+R60ADH_ReadContinuousLogging)
- Interrupt function

Transfer of data with the function block

The function block for continuous logging data transfer continuously transfers logging data into file registers (ZR) of the CPU module in the storage order of logging data (A side → B side → A side ···). Set the number of data sets to be transferred into the CPU module considering the capacity of file registers of the CPU module in use.



(1) A/D converter module (buffer memory areas)

(2) CPU module (file registers (ZR))

(3) The function block transfers data into file registers in the order of ❶→❷→❸→❹···.

Point

- For the file register capacity setting, refer to the user's manual for the CPU module used.
- For details on the function block for continuous logging data transfer, refer to the MELSEC iQ-R Analog-Digital Converter Module/Digital-Analog Converter Module Function Block Reference.

■Program example to transfer data with the function block

Ex.

To start the continuous logging and copy logging data (CH1) for 100000 points and register them in file registers (ZR0 to ZR99999) of the CPU module continuously

• Label settings

Classification	Label name	Description	Device
Module label	R60ADH_1.uContinuousLoggingStartStopRequest_D	Continuous logging start/stop request	U0\G100
Labels to be defined	Define global labels as shown below:		

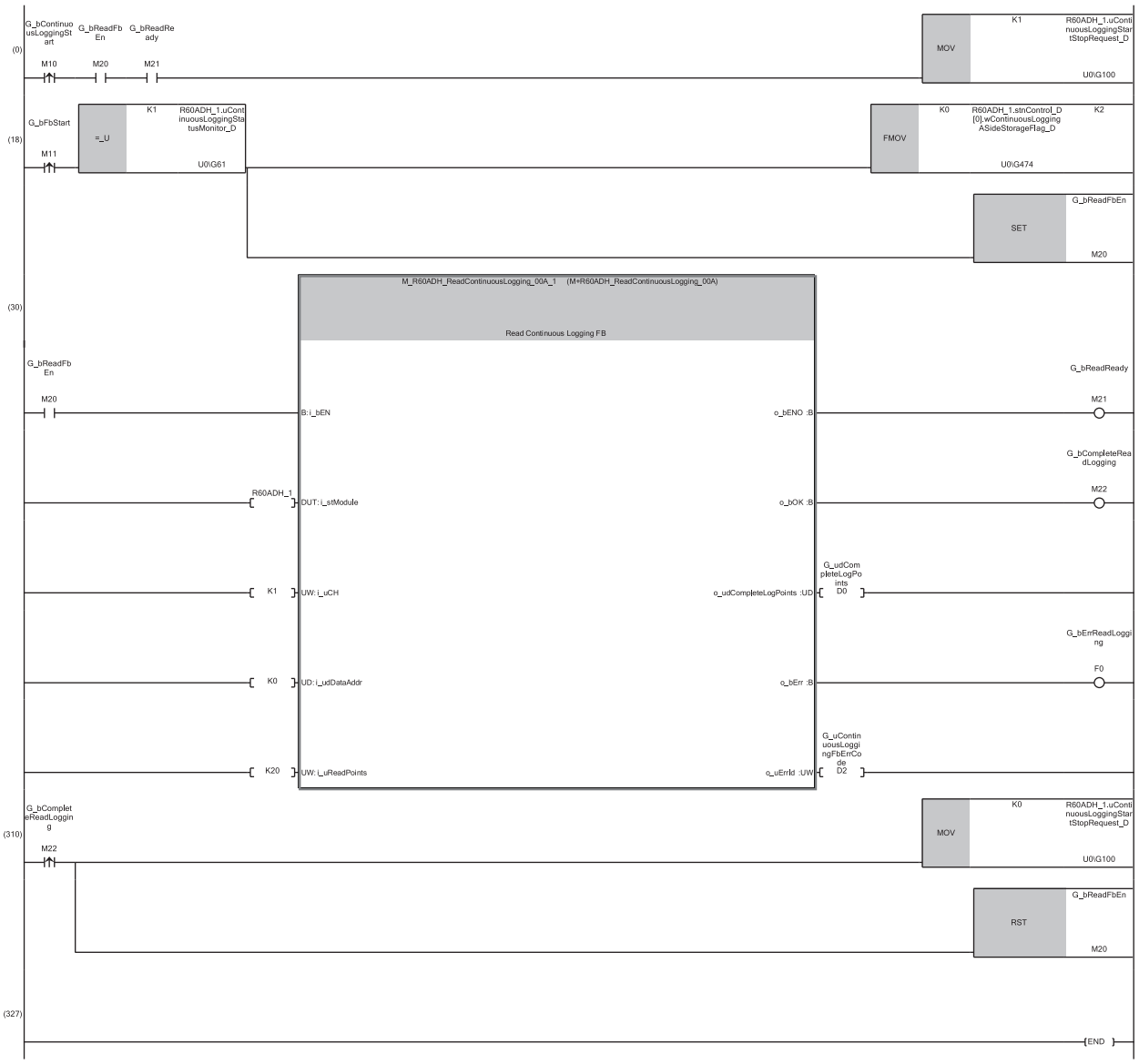
	Label Name	Data Type		Class	Assign (Device/Label)
1	G_bContinuousLoggingStart	Bit	...	VAR_GLOBAL	M10
2	G_bFbStart	Bit	...	VAR_GLOBAL	M11
3	G_bReadFbEn	Bit	...	VAR_GLOBAL	M20
4	G_bReadReady	Bit	...	VAR_GLOBAL	M21
5	G_bCompleteReadLogging	Bit	...	VAR_GLOBAL	M22
6	G_udCompleteLogPoints	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D0
7	G_bErrReadLogging	Bit	...	VAR_GLOBAL	F0
8	G_uContinuousLoggingFbErrCode	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D2

• The function block used

The following function block is used in this program example.

M+R60ADH_ReadContinuousLogging

• Program example



(18)Turn on 'G_bFbStart' (M11) to activate the function block (FB) for continuous logging data read.
(0) After the FB is activated, turn on 'G_bContinuousLoggingStart' (M10) to start continuous logging.
Logging data are automatically stored in the file registers (ZR0 to ZR99999) of the CPU module by the FB.
(310)After the logging of 100000-point data is complete, stop the continuous logging and FB.
If data omission occurs during continuous logging read because of the processing time of other scan program or interrupt program, the FB turns on 'G_bErrReadLogging' (M22), and stops the read of logging data.

■Precautions for creating the program

- The function block for continuous logging data transfer reads out the data to the file registers each time 5000 point data sets are stored in the A/D converter module. The approximate processing time of the function block is obtained by adding up the required time of following instruction operations used in the function block: five times of the FROM instruction (1000 points)[*1], nine times of the FROM instruction (1 point)[*1]. If the exact processing time is required, add up the processing time of all instructions used in the function block. For details on the processing time of each instruction used in the function block, refer to the MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks).
- To prevent logging data omission, create the program where the function block is executed once or more times in 20ms[*2]. (The processing time of this program must be 20ms[*2] or shorter including the processing time of the function block.)
- The following table (at the bottom row) shows the formula to calculate the approximate number of channels available for data transfer to the file registers with the function block. Note that this applies to the case when a user do not create any program.

Item	Calculation formula
Processing time (as a guide) of the function block for continuous logging data transfer	= (Processing time of the FROM instruction (1000 points)) × (5 times) + (Processing time of the FROM instruction (1 point)) × (9 times) = 55.6μs[*1] × 5 + 4.3μs[*1] × 9 = 316.7μs
Number of channels (as a guide) available for data read	= 20ms[*2] ÷ (Processing time (as a guide) of the function block for continuous logging data transfer) = 20ms ÷ 316.7μs = Approx. 63 channels

*1 Maximum processing time of each instruction is used for the calculation. (MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks))

*2 This value is for when the continuous logging is executed every 5μs cycle. When using the continuous logging cycle different from 5μs, apply the value obtained from T(ms) below for the calculation of the number of channels.
T(ms) = (Continuous logging cycle (μs) × 5000 (points)) ÷ 1000 - 5 (ms)

The calculation result of 63 channels, which is the number of channels available for data read, is a value for the case when the program consists of only the function block for continuous logging data transfer. If the other processing is added to the program, or another program is added, the number of channels available for the continuous logging decreases. Please consider an actual application and configure the system.

Transfer of data with the interrupt function

ON of Continuous logging data storage can be set as an interrupt factor of the interrupt function.
When the above item is set, the interrupt program is executed on the timing when the logging data for 5000 points are stored in a buffer memory area. Thus, logging data can be transferred into file registers (ZR) without depending on the scan time.
For the interrupt program, do not use the function block for continuous logging data transfer because the function block does not operate properly by doing so.

■Program example to transfer data with the interrupt function

Ex.

To start the continuous logging and copy logging data (CH1) for 100000 points and register them in file registers (ZR0 to ZR99999) of the CPU module continuously

• Label settings

Classification	Label name	Description	Device
Module label	RCPU.stSM.bAfter_RUN1_Scan_ON	Turning on for one scan after RUN	SM402
	R60ADH_1.unInterruptFactorDetectionFlag_D[0].0	Interrupt factor detection flag [1]	U0\G4.0
	R60ADH_1.uContinuousLoggingStartStopRequest_D.0	Continuous logging start/stop request	U0\G100.0
	R60ADH_1.unInterruptFactorMask_D[0].0	Interrupt factor mask [1]	U0\G124.0
	R60ADH_1.unInterruptFactorResetRequest_D[0].0	Interrupt factor reset request [1]	U0\G156.0
	R60ADH_1.stnControl_D[0].wContinuousLoggingASideStorageFlag_D.0	CH1 Continuous logging data A side storage flag	U0\G474.0
	R60ADH_1.stnControl_D[0].wContinuousLoggingBSideStorageFlag_D.0	CH1 Continuous logging data B side storage flag	U0\G475.0
Labels to be defined	Define global labels as shown below: (see table below) Set the class of 'G_wSaveFileRegisterPlusIndex' to VAR_GLOBAL_RETAIN. If the class is set to VAR_GLOBAL, the program operates normally. However, if the option in global label consistency check is set to "Yes", a conversion error occurs. "Tool" ⇨ "Options" ⇨ "Convert" ⇨ "Basic Setting" ⇨ "Operational Setting" ⇨ "Check the Consistency of Global Label"		

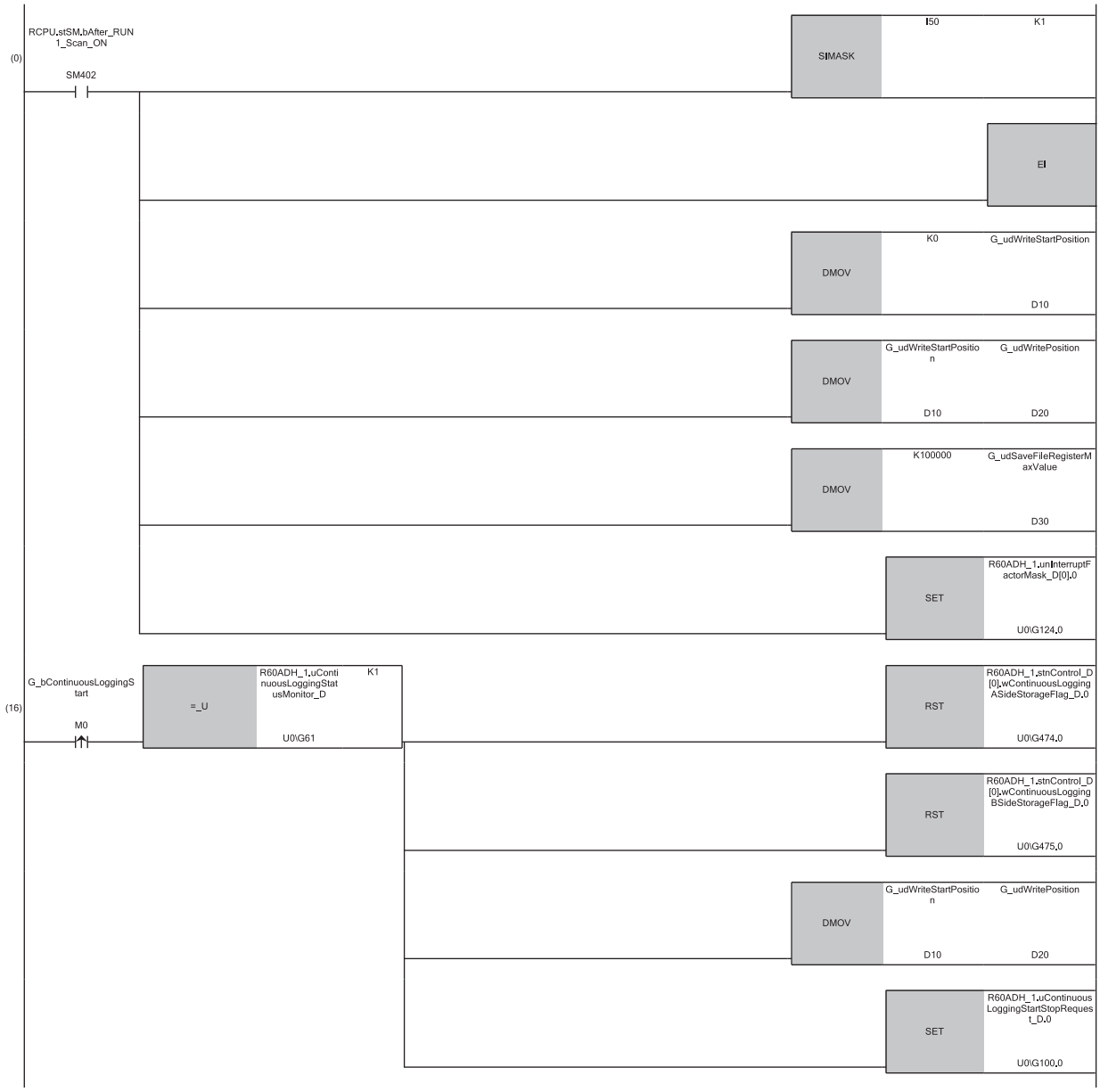
	Label Name	Data Type		Class	Assign (Device/Label)
1	G_bContinuousLoggingStart	Bit		VAR_GLOBAL	M0
2	G_bErrorDetection	Bit		VAR_GLOBAL	F0
3	G_udWriteStartPosition	Double Word [Unsigned]/Bit String [32-bit]		VAR_GLOBAL	D10
4	G_udWritePosition	Double Word [Unsigned]/Bit String [32-bit]		VAR_GLOBAL	D20
5	G_udSaveFileRegisterMaxValue	Double Word [Unsigned]/Bit String [32-bit]		VAR_GLOBAL	D30
6	G_udWritePositionIndex	Double Word [Unsigned]/Bit String [32-bit]		VAR_GLOBAL	Z4
7	G_wSaveFileRegisterPlusIndex	Word [Signed]		VAR_GLOBAL_RETAIN	ZR0ZZ4
8	G_wLoggingReadSideA	Word [Signed]		VAR_GLOBAL	U0\G10000
9	G_wLoggingReadSideB	Word [Signed]		VAR_GLOBAL	U0\G15000

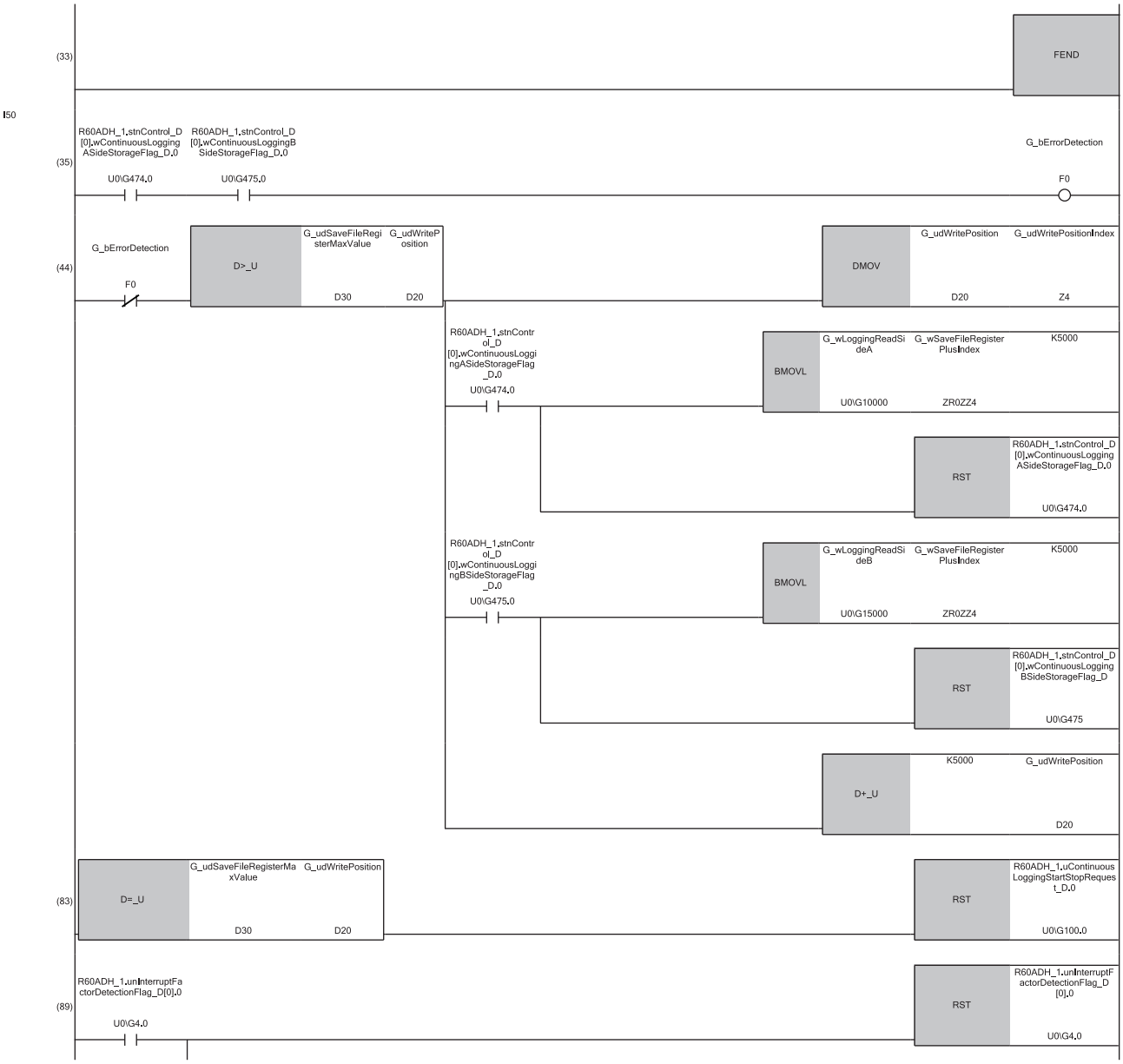
• Interrupt setting

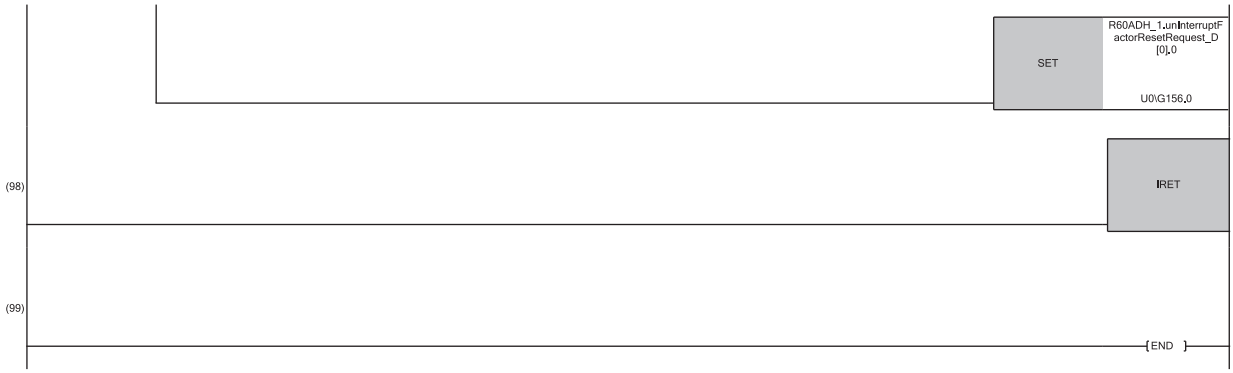
Setting Item

No.	Condition target setting	Condition target channel setting	Interrupt factor transaction setting	Interrupt pointer
1	Continuous logging data storage	CH1	Interrupt reissue requests	I50
2	Disable	All CH specification	Interrupt reissue requests	
3	Disable	All CH specification	Interrupt reissue requests	
4	Disable	All CH specification	Interrupt reissue requests	
5	Disable	All CH specification	Interrupt reissue requests	
6	Disable	All CH specification	Interrupt reissue requests	
7	Disable	All CH specification	Interrupt reissue requests	
8	Disable	All CH specification	Interrupt reissue requests	
9	Disable	All CH specification	Interrupt reissue requests	
10	Disable	All CH specification	Interrupt reissue requests	
11	Disable	All CH specification	Interrupt reissue requests	
12	Disable	All CH specification	Interrupt reissue requests	
13	Disable	All CH specification	Interrupt reissue requests	
14	Disable	All CH specification	Interrupt reissue requests	
15	Disable	All CH specification	Interrupt reissue requests	
16	Disable	All CH specification	Interrupt reissue requests	

• Program example




(33)
FEND
I50
(35)
R60ADH_1.stnControl_D[0].wContinuousLoggingASideStorageFlag_D.0
R60ADH_1.stnControl_D[0].wContinuousLoggingBSideStorageFlag_D.0
U0\G474.0
U0\G475.0
G_bErrorDetection
F0
(44)
G_bErrorDetection
F0
D>_U
G_udSaveFileRegisterMaxValue
G_udWritePosition
D30
D20
DMOV
G_udWritePosition
G_udWritePositionIndex
D20
Z4
R60ADH_1.stnControl_D[0].wContinuousLoggingASideStorageFlag_D.0
U0\G474.0
BMOVL
G_wLoggingReadSideA
G_wSaveFileRegisterPlusIndex
K5000
U0\G10000
ZR0ZZ4
RST
R60ADH_1.stnControl_D[0].wContinuousLoggingASideStorageFlag_D.0
U0\G474.0
R60ADH_1.stnControl_D[0].wContinuousLoggingBSideStorageFlag_D.0
U0\G475.0
BMOVL
G_wLoggingReadSideB
G_wSaveFileRegisterPlusIndex
K5000
U0\G15000
ZR0ZZ4
RST
R60ADH_1.stnControl_D[0].wContinuousLoggingBSideStorageFlag_D
U0\G475
D+_U
K5000
G_udWritePosition
D20
(83)
D=_U
G_udSaveFileRegisterMaxValue
G_udWritePosition
D30
D20
RST
R60ADH_1.uContinuousLoggingStartStopRequest_D.0
U0\G100.0
(89)
R60ADH_1.unInterruptFactorDetectionFlag_D[0].0
U0\G4.0
RST
R60ADH_1.unInterruptFactorDetectionFlag_D[0].0
U0\G4.0



(0) The settings are configured as follows by the contact turning on for one scan after RUN.
- 'G_udWriteStartPosition' (D10) is set to 0 so that ZR0 is set as the start position of the save destination file register.
- 'G_udWritePosition' (D20) is set to a value in 'G_udWriteStartPosition' (D10) so that the write position of the file register is initialized.
- 'G_udSaveFileRegisterMaxValue' (D30) is set to 100000, which is the maximum number of storage data points of the save destination file register.

(16)Turn on 'G_bContinuousLoggingStart' (M0) at the desired timing to start the continuous logging.

(35)An interrupt occurs each time logging data of 5000 points are stored in buffer memory areas. In addition, if both 'CH1 Continuous logging data A side storage flag' (Un\G474) and 'CH1 Continuous logging data B side storage flag' (Un\G475) are on, it is regarded as a logging data omission and 'G_bErrorDetectionBeforeSend' (M10) turns on. In such a case, the logging data transfer is stopped.

(44)The logging data are transferred to the file registers. The 5000 point logging data sets are transferred per interrupt. The transfer is repeated until the data are transferred to ZR99999.

(83)When the transfer of 100000 point logging data sets (ZR0 to ZR99999) is complete, the continuous logging is stopped.

■Starting the continuous logging again

To start the continuous logging again after the completion of logging data transfer, have the execution interval (ms) described below or longer between them.

- Execution interval (ms) ≥ 5000 (points) × CH1 Logging cycle monitor value (μs) ÷ 1000 × 2

Ex.

When 'CH1 Logging cycle monitor value' (Un\G450 to Un\G452) is 5(μs)

- Execution interval (ms) ≥ 5000 (points) × 5(μs) ÷ 1000 × 2 = 50(ms)

■Precautions for creating the program

- Each time 5000 point logging data sets are stored in the A/D converter module, an interrupt program is executed and the data are transferred to the file registers. The approximate instruction processing time of the interrupt program is obtained by adding up the processing time of instructions accessing to the buffer memory areas in the interrupt program (equivalent to a value of "5 times of the FROM instruction (1000 points)[*1] + 8 times of the FROM instruction (1 point)[*1] + 3 times of the TO instruction (1 point)[*1]") and the processing time of the IRET instruction. If the exact instruction processing time is required, add up the processing time of all instructions used in the interrupt program. For details on the processing time of each instruction used in the interrupt program, refer to the MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks).
- The approximate processing time of the interrupt program is obtained by adding both the interrupt overhead time and the refresh processing time (when the refresh processing is set) at the interrupt execution to the instruction processing time of the interrupt program. The interrupt overhead time and the refresh processing time at the interrupt execution vary depending on the parameter settings of the CPU module. For details, refer to the user's manual for the CPU module used.
- To prevent logging data omission, create the program so that a series of processing of the interrupt program (from the start to the completion) takes place within 20ms[*2] after an interrupt factor (storage of 5000 point continuous logging data sets) occurs.
- The following table (at the bottom row) shows the formula to calculate the approximate number of channels available for data transfer to the file registers with the interrupt program. Note that this applies to the case when a user do not create any program. (The calculation is for when the interrupt overhead time is 20.6μs and the refresh processing time at the interrupt execution is 0μs.)

Item	Calculation formula
Instruction processing time (as a guide) of the interrupt program	= (Processing time of the FROM instruction (1000 points)) × (5 times) + (Processing time of the FROM instruction (1 point)) × (8 times) + (Processing time of the TO instruction (1 point)) × (3 times) + (Processing time of the IRET instruction) × (1 time) = 55.6μs[*1] × 5 + 4.3μs[*1] × 8 + 2.7μs[*1] × 3 + 2.2μs[*1] × 1 = 322.7μs
Processing time (as a guide) of the interrupt program	= (Instruction processing time (as a guide) of the interrupt program) + (Interrupt overhead time) + (Refresh processing time at the interrupt execution) = 322.7μs + 20.6μs + 0μs = 343.3μs
Number of channels (as a guide) available for data read	= 20ms[*2] ÷ (Processing time (as a guide) of the interrupt program) = 20ms ÷ 343.3μs = Approx. 58 channels

*1 This value indicates the maximum processing time of each instruction. (MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks))

*2 This value is for when the continuous logging is executed every 5μs cycle. When using the continuous logging cycle different from 5μs, apply the value obtained from T(ms) below for the calculation of the number of channels.
T(ms) = (Continuous logging cycle (μs) × 5000 (points)) ÷ 1000 - 5 (ms)

The calculation result of 58 channels, which is the number of channels available for data read, is a value for the case when the program consists of only the interrupt program to transfer logging data. If a program or processing other than the interrupt program to transfer logging data is added, the number of channels available for the continuous logging decreases. Please consider an actual application and configure the system.

Saving continuous logging data

The logging data stored in the file registers (ZR) can be written into an SD memory card as a CSV file and checked with spreadsheet software.

Use the SP.FWRITE instruction to write the data into the SD memory card. For details on the SP.FWRITE instruction, refer to the following.

MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks)

Continuous logging when the inter-module synchronization function is used

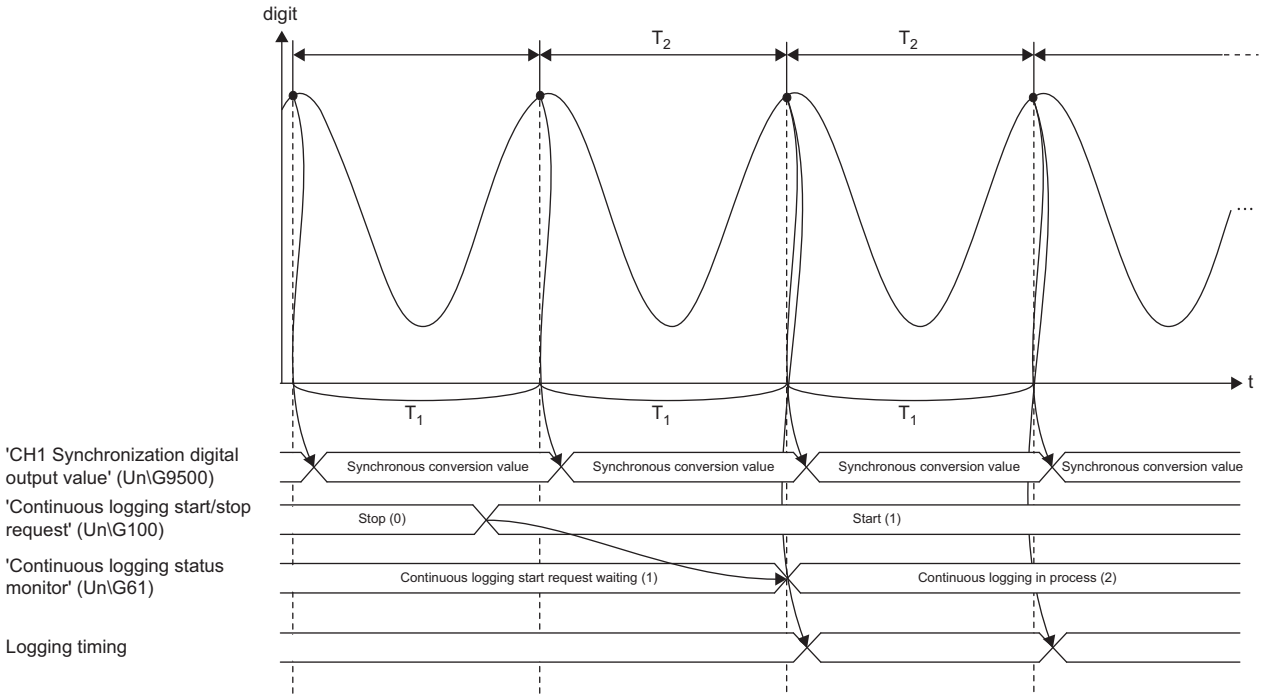
When the inter-module synchronization function is used, continuous logging can be used.
The conversion cycle of continuous logging of when the inter-module synchronization function is used depends on the oversampling mode enable/disable setting.

Oversampling

Oversampling is to take multiple samples using one inter-module synchronization cycle as a trigger. When the oversampling mode is enabled, data can be logged on a constant conversion cycle (5μs/4CH) without being affected by the longer inter-module synchronization cycle if the cycle is set to match with other slower modules.
When the conversion cycle same with the inter-module synchronization cycle is adequate, disable the oversampling mode.
When a fast conversion cycle is required for data analysis, enable the oversampling mode.

■When oversampling is disabled

The inter-module synchronization cycle is used as a trigger to take a sample of an analog input value. The conversion cycle becomes equal to the inter-module synchronization cycle and an A/D conversion value is logged by 1 point at every inter-module synchronization cycle.
Because the inter-module synchronization cycle is used as trigger to execute the A/D conversion in all channels, the logging timing of each A/D converter module is uniform.



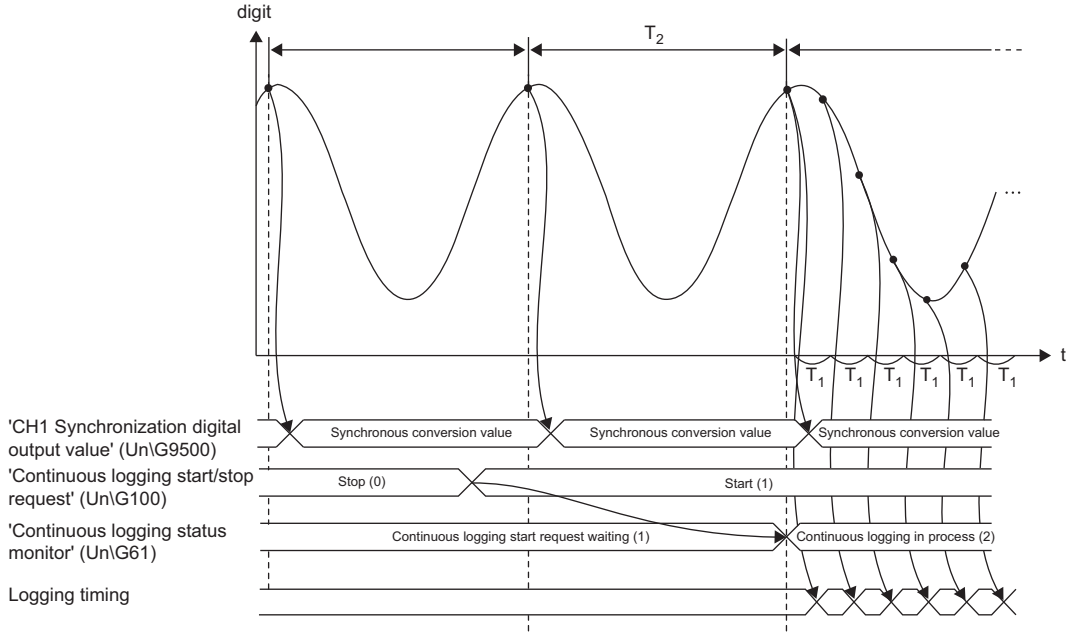
digit: Digital output value
t: Time
T_1: Conversion cycle
T_2: Inter-module synchronization cycle
●: Timing of A/D conversion

Point

During inter-module synchronization, the continuous logging starts at the second inter-module synchronization cycle after the continuous logging start request is set.

■When oversampling is enabled

An inter-module synchronization cycle is used as a trigger to sample an analog value at 5μs cycle. The conversion cycle is fixed to 5μs and A/D conversion values are logged by (Inter-module synchronization cycle/5μs) points.



digit: Digital output value

t: Time

T_1: Conversion cycle

T_2: Inter-module synchronization cycle

●: Timing of A/D conversion

Ex.

When the inter-module synchronization cycle is 1ms, data of 200 points is logged in an inter-module synchronization cycle.

Point

When the oversampling mode is enabled, the inter-module synchronization cycle is used as a trigger to start the conversion in all channels in the same way as when the oversampling mode is disabled. However, after the trigger of the inter-module synchronization cycle, A/D conversion is executed according to the cycle based on the clock of each A/D converter module. Thus, a time lag in the nanosecond range is generated in every conversion cycle due to the differences of modules (crystal frequency deviation) or the ambient temperature. But this does not affect the conversion cycle because the conversion cycle timing is corrected by using the inter-module synchronization cycle as a trigger.

■Setting procedure

The oversampling mode can be set only with an engineering tool. The default value is "Disable".

1. Set "Oversampling mode".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Oversampling mode]

2. Set "Fixed Scan Interval Setting of Inter-module Synchronization" as shown below.

[Navigation window] ⇨ [Parameter] ⇨ [System Parameter] ⇨ [Inter-module Synchronous Setting] ⇨ [Fixed Scan Interval Setting of Inter-module Synchronization]

Item	Setting details
0.05ms Unit Setting	Set
Fixed Scan Interval Setting	1ms or less

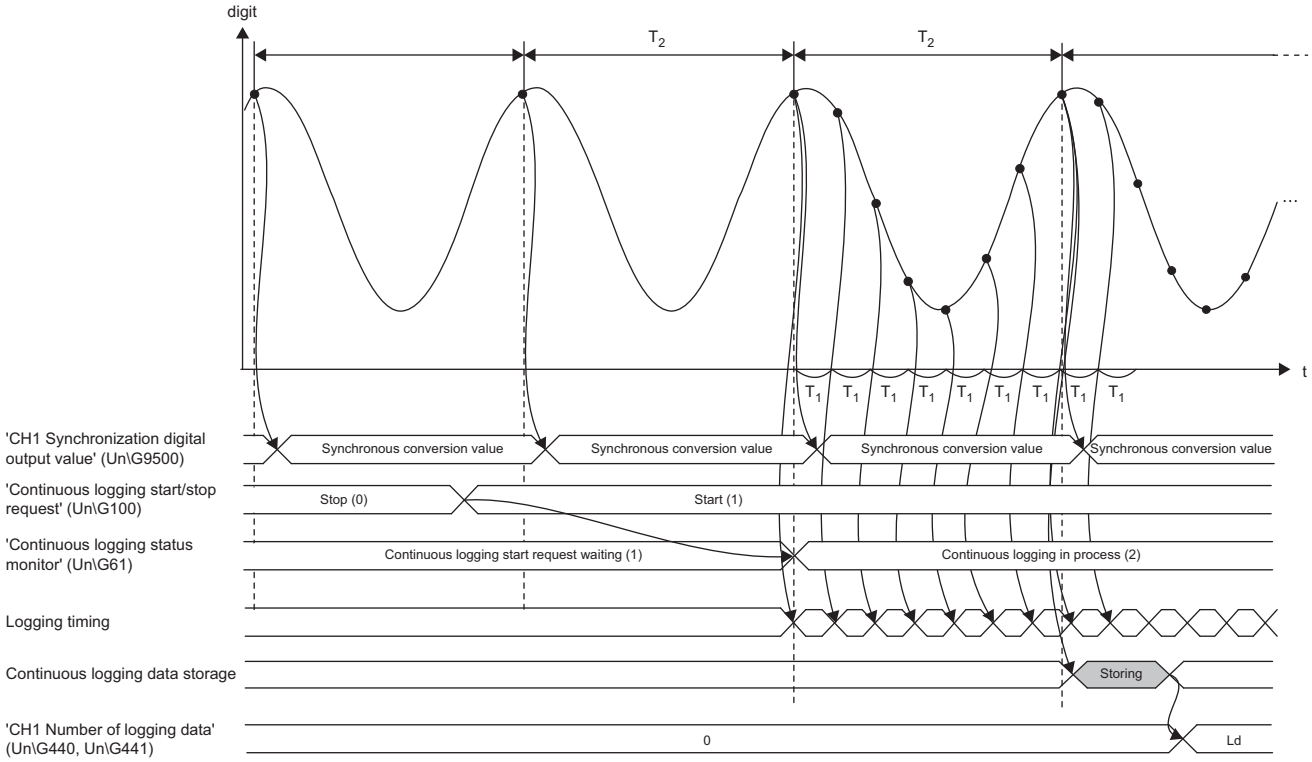
If "Fixed Scan Interval Setting of Inter-module Synchronization" is not set as shown above, a synchronization cycle time setting enabled range error (error code: 1EA0H) occurs. When oversampling is disabled, there are no restrictions on the setting of "Fixed Scan Interval Setting of Inter-module Synchronization".

Operation

The following shows the operation of the continuous logging function of when the inter-module synchronization function is used. The operation described in this section is the one of when oversampling is enabled.

■Starting continuous logging

A continuous logging start request is sent at every inter-module synchronization cycle. Thus, when the value in 'Continuous logging start/stop request' (Un\G100) is changed in the inter-module synchronous interrupt program, the continuous logging is started or stopped at the timing of the next inter-module synchronization cycle. To check whether the module is executing continuous logging or not, check that 'Continuous logging status monitor' (Un\G61) is set to Continuous logging in process (2).



digit: Digital output value

t: Time

T_1: Conversion cycle

T_2: Inter-module synchronization cycle

Ld: Number of data that were logged within the inter-module synchronization cycle

●: Timing of A/D conversion

■Operation of continuous logging in process

Once continuous logging is started, in the channel where A/D conversion is enabled, A/D conversion values are logged at every conversion cycle of the oversampling mode. The logged values are not immediately reflected into the buffer memory, but stored in the buffer memory in the next inter-module synchronization cycle. The latest A/D conversion value, which was converted in the inter-module synchronization cycle, is stored in 'CH1 Synchronization digital output value' (Un\G9500) regardless of whether continuous logging has stopped or is in process.

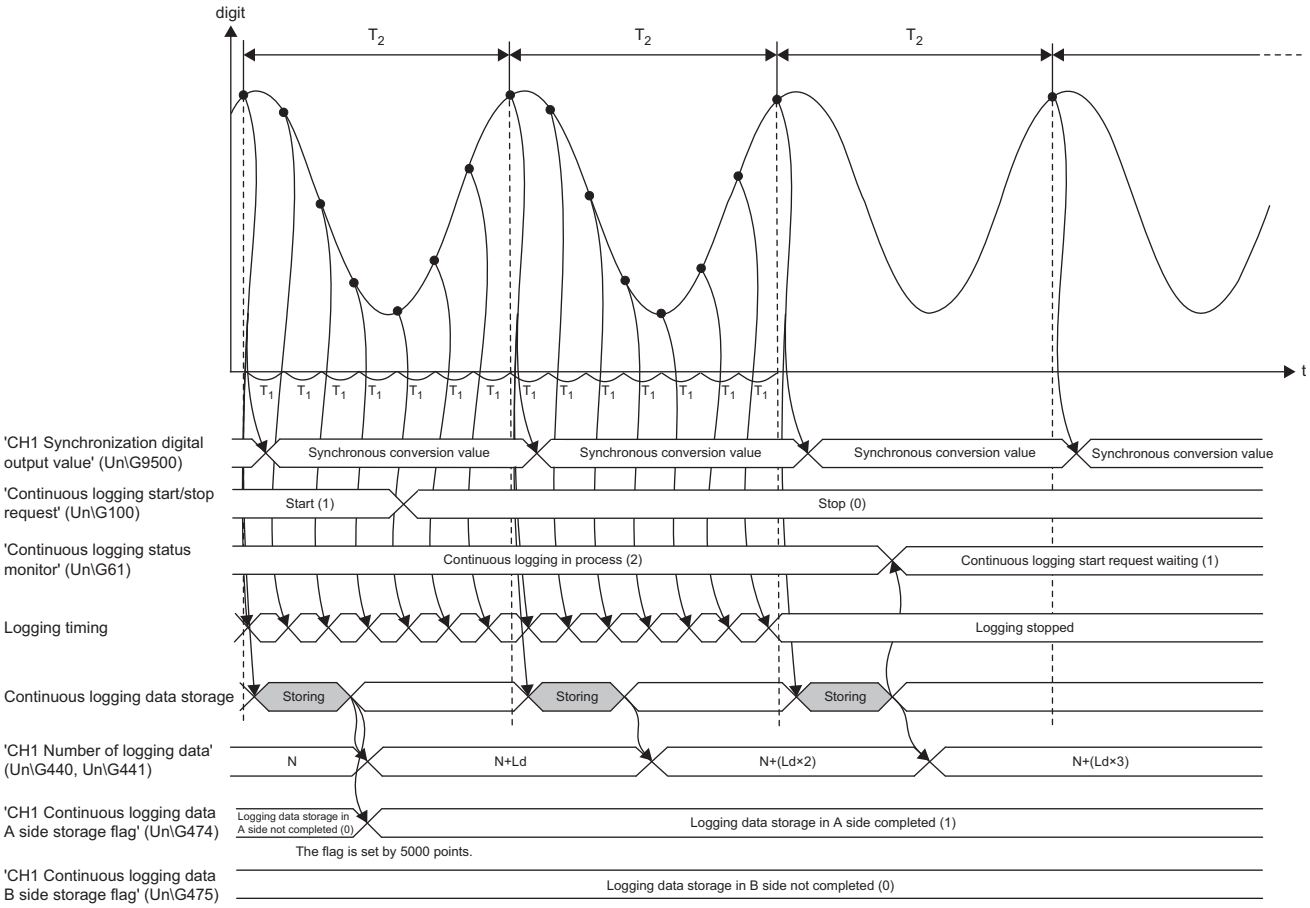
In addition, the values of 'CH1 Continuous logging data A side storage flag' (Un\G474) and 'CH1 Continuous logging data B side storage flag' (Un\G475) are changed from 0 to 1 every time data of 5000 points are stored in the buffer memory in the same way as the continuous logging executed when the inter-module synchronization processing is asynchronous.

Point

When the status of the CPU module is changed from RUN to STOP while continuous logging is in progress in the inter-module synchronization processing, the inter-module synchronization stops and continuous logging also automatically stops. After that, if the status of the CPU module is changed from STOP to RUN, the A/D conversion is restarted but continuous logging is not restarted. To execute continuous logging again, change the value of 'Continuous logging start/stop request' (Un\G100) from Stop (0) to Start (1).

■Stopping continuous logging

A continuous logging stop request is sent at every inter-module synchronization cycle in the same way as when continuous logging is started. Thus, logged data is stored in the buffer memory in the next inter-module synchronization cycle after the continuous logging stop request is accepted. After the data has been stored, 'Continuous logging status monitor' (Un\G61) is set to Continuous logging start request waiting (1).



digit: Digital output value

t: Time

T_1: Conversion cycle

T_2: Inter-module synchronization cycle

Ld: Number of data that were logged within the inter-module synchronization cycle

●: Timing of A/D conversion

1.17 High Speed Continuous Logging Function

High speed

This function logs digital operation values at 1μs cycle, which is the shortest cycle, and continuously transfers logging data to the CPU module without stopping logging. Compared to the continuous logging function, this function is more suitable for measurement since it can obtain analog values that are changing at high speed.

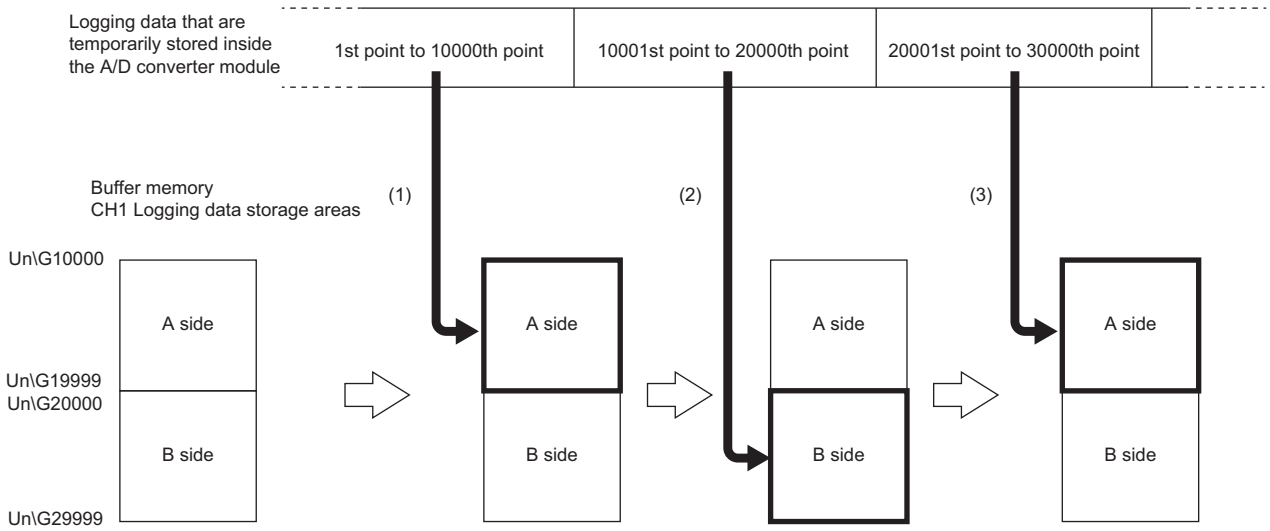
Collecting logging data

Logging data is stored in CH1 Logging data area (Un\G10000 to Un\G29999). Each channel has buffer memory areas of 20000 points for storing logging data.

■Timing to store data in the buffer memory areas

Logging data is temporarily stored in the module, and when the number of temporarily-stored logging data reaches 10000 points, the data is stored into buffer memory areas. At this time, the buffer memory addresses for the first 10000 points (logging data storage areas (A side)) of CH1 Logging data area (Un\G10000 to Un\G29999) are used. When the number of temporarily-stored logging data reaches 10000 points again after logging data is stored in the logging data storage areas (A side), the buffer memory addresses for the last 10000 points (logging data storage areas (B side)) of CH1 Logging data area (Un\G10000 to Un\G29999) are used.

After that, logging data areas are overwritten with new data by 10000 points as follows.



(1) After the 10000th data has been logged, the data of 10000 points are stored into the logging data storage areas (A side).

(2) After the 20000th data has been logged, the data of 10000 points are stored into the logging data storage areas (B side).

(3) After the 30000th data has been logged, the data of 10000 points are stored into the logging data storage areas (A side).

■Notification of logging data storage

- After logging data is stored into the logging data storage areas (A side), the value in 'CH1 High speed continuous logging data A side storage flag' (Un\G476) is changed from Logging data storage in A side not completed (0) to Logging data storage in A side completed (1).
- After logging data is stored into the logging data storage areas (B side), the value in 'CH1 High speed continuous logging data B side storage flag' (Un\G477) is changed from Logging data storage in B side not completed (0) to Logging data storage in B side completed (1).

■Transfer of logging data

Old logging data are overwritten when data more than 20000 points are stored. The data can be transferred into file registers (ZR) of the CPU module with function blocks (FBs). (☞ Page 136 Transfer of high speed continuous logging data)

Check items before the start of high speed continuous logging

■Operation modes and functions

Before starting high speed continuous logging, check the settings of the operation mode and each function.

Item	Description
Operation mode	Check that the normal mode (high speed: 1μs/CH) is set.
A/D conversion enable/disable setting function	Check that the A/D conversion is enabled for the channel to be used.
Averaging processing function	Check that the sampling processing or moving average processing is set.
Scaling function	When using the scaling function, check that each parameter has been correctly set.
Interrupt function	When using the interrupt function, check that the continuous logging data storage has been set as the condition target.

When the above functions have been set and an error has occurred, high speed continuous logging cannot be started. In addition, settings cannot be changed during high speed continuous logging. Thus, configure the above settings before starting the high speed continuous logging.

The settings of the functions that cannot be used in the normal mode (high speed: 1μs/CH) are ignored.

■High speed continuous logging status monitor

Check whether the A/D converter module can start high speed continuous logging or not with 'CH1 High speed continuous logging status monitor' (Un\G469). Check that High speed continuous logging start request waiting (1) is stored.

■Logging enable/disable setting

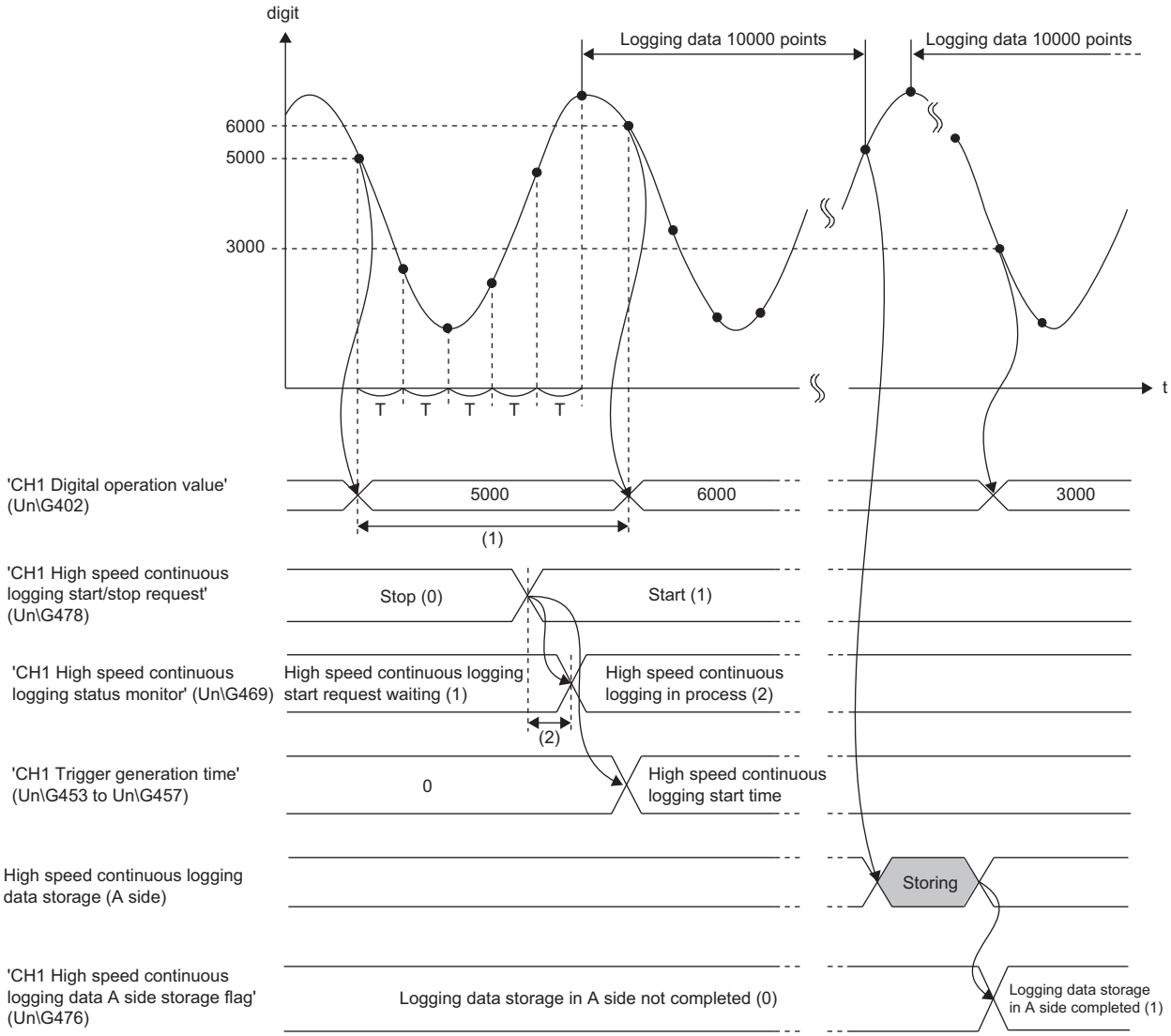
When using the high speed continuous logging function, set 'CH1 Logging enable/disable setting' (Un\G535) to High speed continuous logging (2). For the channels where the high speed continuous logging function is not used, set 'CH1 Logging enable/disable setting' (Un\G535) to Disable (1). If Normal logging (0) is set, a logging enable/disable setting range error (error code: 1D0□H) occurs. When a logging enable/disable setting range error (error code: 1D0□H) occurs in any channel, the A/D conversion stops in all channels. In addition, if a channel where High speed continuous logging (2) is set and a channel where High speed logging (3) is set co-exist, an across channels logging setting error (error code: 1DE0H) occurs. In this case, A/D conversion is stopped in all channels.

■High speed continuous logging cycle setting value

The logging cycle of the high speed continuous logging function is obtained by the following formula: Conversion cycle × (Value set in 'CH1 High speed continuous logging cycle setting value' (Un\G590)). Set a desired logging cycle with 'CH1 High speed continuous logging cycle setting value' (Un\G590). Check the set logging cycle with 'CH1 Logging cycle monitor value (μs)' (Un\G452).

Starting high speed continuous logging

Changing the value of 'CH1 High speed continuous logging start/stop request' (Un\G478) from Stop (0) to Start (1) starts the high speed continuous logging on the set high speed continuous logging cycle.
At the point when data of 10000 points has been logged, the logging data storage in the continuous logging data storage areas (A side) starts.



digit: Digital operation value

t: Time

T: Conversion cycle

(1) If 'CH1 Logging enable/disable setting' (Un\G535) is set to High speed continuous logging (2), the digital operation values are simultaneously updated in all channels at intervals of 5ms.

(2)The high speed continuous logging is started within 40μs after 'CH1 High speed continuous logging start/stop request' (Un\G478) is set to Start (1).

When data of 10000 points has been logged again after logging data of 10000 points was stored in the high speed continuous logging data storage areas (A side), the new data is stored in the high speed continuous logging data storage areas (B side). Subsequently, Logging data storage in B side completed (1) is stored in 'CH1 High speed continuous logging data B side storage flag' (Un\G477). After that, new logging data is alternately logged into A-side areas → B-side areas → A-side areas ··· by 10000 points.

Point

- The time when high speed continuous logging was started is stored in 'CH1 Trigger generation time' (Un\G453 to Un\G457).
- Refer to the value of 'CH1 Digital operation value' (Un\G402), which is updated every 5ms, as an indication to check that external devices (such as sensors) are operating.

■Counting the number of logging data points

The value of 'CH1 Number of logging data' (Un\G440, Un\G441) increases by 10000 every time data of 10000 points has been logged.

After the number of data points reaches 3600000000, the counter is reset to 0 and counting starts again.

Ex.

When the value of 'CH1 Number of logging data' (Un\G440, Un\G441) is 3599990000, the value changes from 3599990000 → 3600000000 → 10000 ··· every time logging of 10000 points is completed.

Point

To calculate the elapsed time of high speed continuous logging, refer to the values of 'CH1 Logging cycle monitor value (μs)' (Un\G452) and 'CH1 Number of logging data' (Un\G440, Un\G441).

• Elapsed time (μs) = Logging cycle monitor value (μs) × Number of logging data

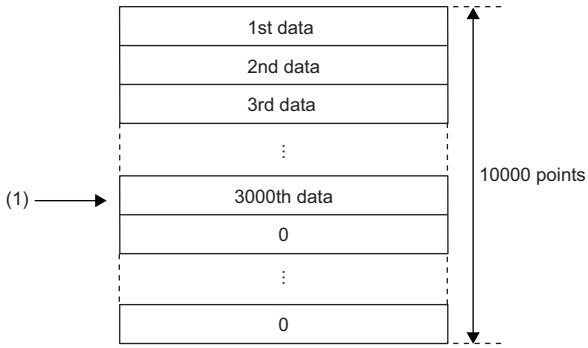
When 'CH1 Logging cycle monitor value (μs)' (Un\G452) is 1 and 'CH1 Number of logging data' (Un\G440, Un\G441) is 3600000000 (maximum value), logging for 3600 seconds (1 hour) has been completed.

Stopping high speed continuous logging

Changing 'CH1 High speed continuous logging start/stop request' (Un\G478) from Start (1) to Stop (0) stops high speed continuous logging. After high speed continuous logging is stopped, the data that was partially logged is stored in buffer memory areas and the value of 'CH1 Number of logging data' (Un\G440, Un\G441) is updated to the number of points of when the stop request was accepted. In addition, 0 is stored in the data area and later of when the stop request was accepted.

Ex.

When a stop request is accepted at the timing of when 3000th data is logged under the condition in which 100000 is already stored in 'CH1 Number of logging data' (Un\G440, Un\G441), 103000 is stored in 'CH1 Number of logging data' (Un\G440, Un\G441). Subsequently, 0 is stored in the 3001th to 10000th logging data areas.



(1) A stop request is accepted.

■Restarting high speed continuous logging

To restart high speed continuous logging, change the value of 'CH1 High speed continuous logging start/stop request' (Un\G478) from Stop (0) to Start (1). High speed continuous logging is restarted from the beginning of the logging data storage areas. In this case, the values in the following buffer memory areas are initialized to 0.

• 'CH1 Number of logging data' (Un\G440, Un\G441)
• 'CH1 High speed continuous logging data A side storage flag' (Un\G476)
• 'CH1 High speed continuous logging data B side storage flag' (Un\G477)

After high speed continuous logging is restarted, values are stored in the logging data storage areas (starting from A side). The values before the restart of high speed continuous logging remain in CH1 Logging data area (Un\G10000 to Un\G29999). Thus, before referring to the logging data, check that Logging data storage in A side completed (1) has been stored in 'CH1 High speed continuous logging data A side storage flag' (Un\G476) again.

Point

The value of 'CH1 Trigger generation time' (Un\G453 to Un\G457) is updated to the time when high speed continuous logging was restarted.

Setting procedure

1. Set "Operation mode setting" to "Normal mode (high speed: 1μs/CH)".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [Operation mode setting function]

2. Set "A/D conversion enable/disable setting" to "A/D conversion enable".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting] ⇨ [A/D conversion enable/disable setting function]

3. Set "Logging enable/disable setting" to "High speed continuous logging". At this timing, check that "Logging enable/disable setting" is set to "High speed continuous logging" or "Disable" for each channel.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function]

4. Set the cycle to perform logging in "High speed continuous logging cycle setting value".

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Logging function] ⇨ [High speed continuous logging function]

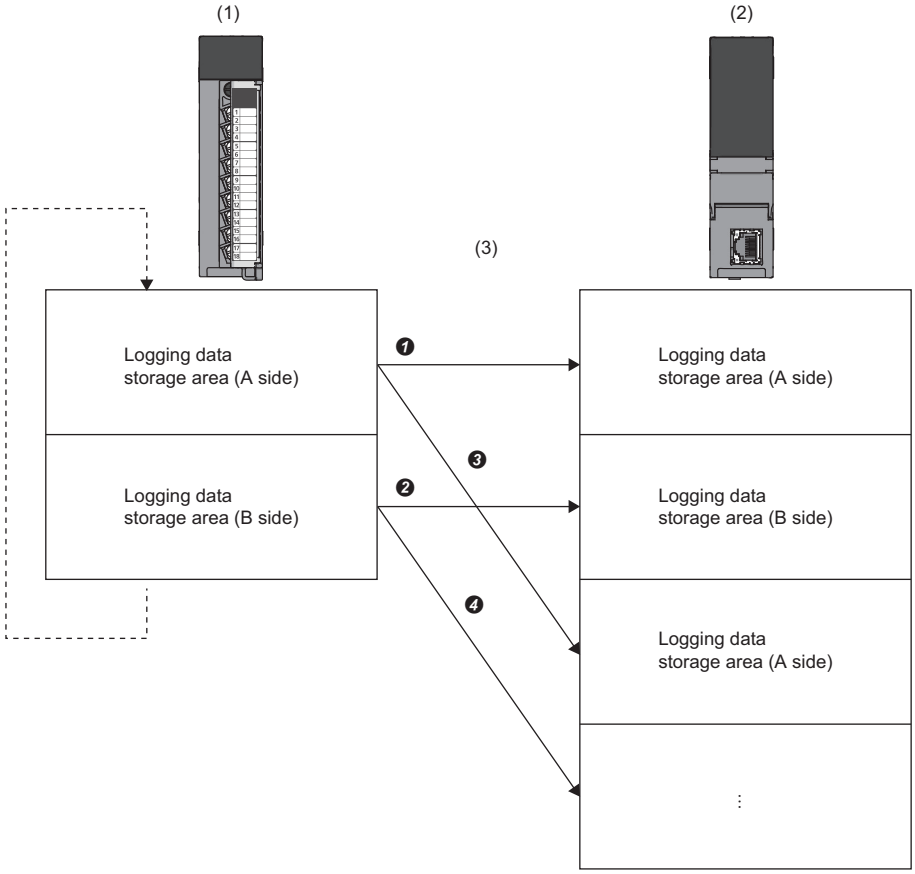
Transfer of high speed continuous logging data

Logging data can be transferred into file registers (ZR) of the CPU module by using the following items.

- Function block for high speed continuous logging data transfer (M+R60ADH_ReadHighSpeedContinuousLogging)
- Interrupt function

Transfer of data with the function block

The function block for high speed continuous logging data transfer continuously transfers logging data into file registers (ZR) of the CPU module in the storage order of logging data (A side → B side → A side ···). Set the number of data sets to be transferred into the CPU module considering the capacity of file registers of the CPU module in use.



(1) A/D converter module (buffer memory areas)

(2) CPU module (file registers (ZR))

(3) The function block transfers data into file registers in the order of ❶→❷→❸→❹···.

Point

- For the file register capacity setting, refer to the user's manual for the CPU module used.
- For details on the function block for high speed continuous logging data transfer, refer to the MELSEC iQ-R Analog-Digital Converter Module/Digital-Analog Converter Module Function Block Reference.

■Program example to transfer data with the function block

Ex.

To start the high speed continuous logging and copy logging data (CH1) for 100000 points and register them in file registers (ZR0 to ZR99999) of the CPU module continuously

• Label settings

Classification	Label name	Description	Device
Module label	R60ADH_1.stnControl_D[0].uHighSpeedContinuousLoggingStartStopRequest_D	CH1 High speed continuous logging start/stop request	U0\G478
Labels to be defined	Define global labels as shown below:		

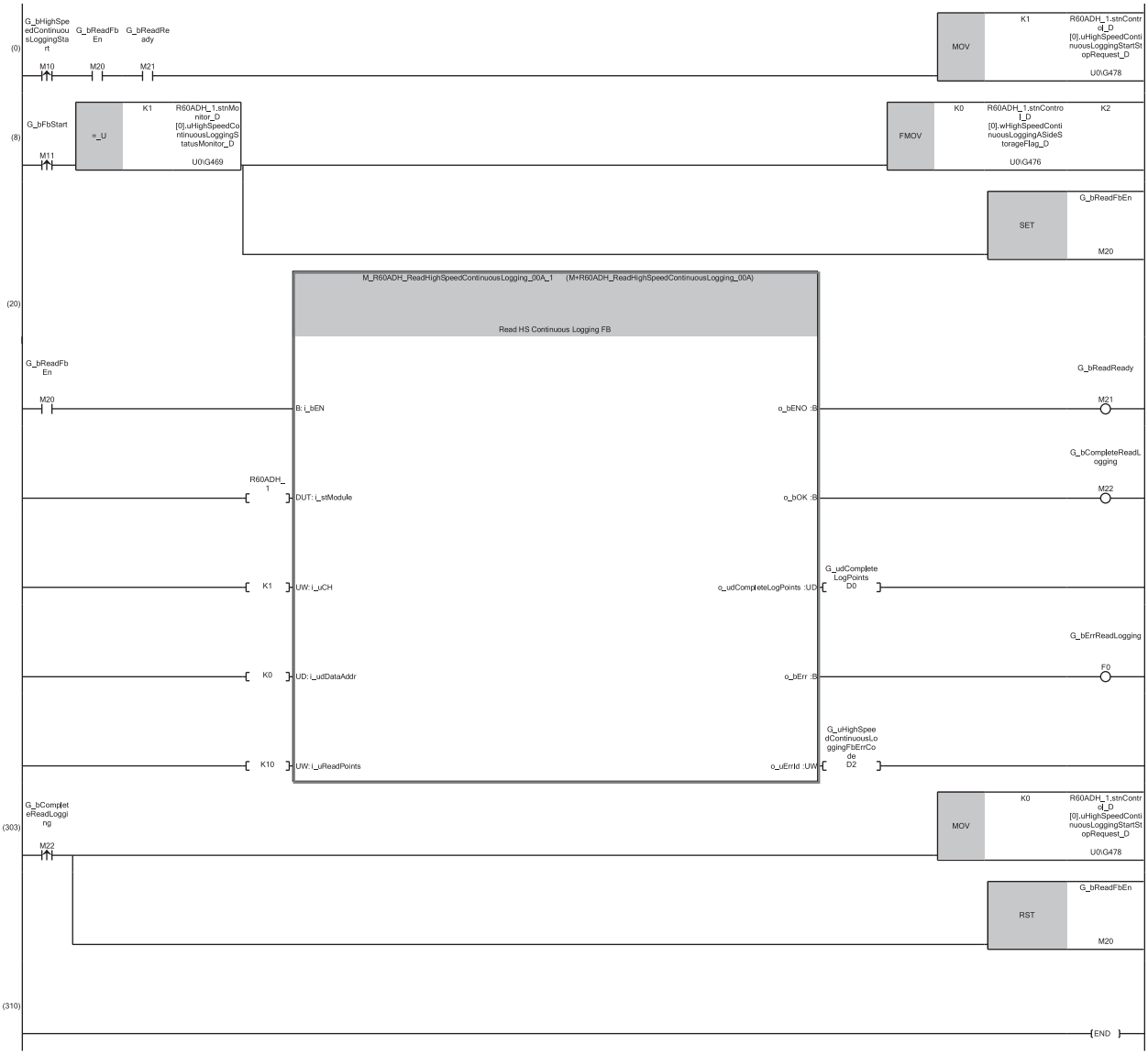
	Label Name	Data Type		Class	Assign (Device/Label)
1	G_bHighSpeedContinuousLoggingStart	Bit	...	VAR_GLOBAL	M10
2	G_bFbStart	Bit	...	VAR_GLOBAL	M11
3	G_bReadFbEn	Bit	...	VAR_GLOBAL	M20
4	G_bReadReady	Bit	...	VAR_GLOBAL	M21
5	G_bCompleteReadLogging	Bit	...	VAR_GLOBAL	M22
6	G_udCompleteLogPoints	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D0
7	G_bErrReadLogging	Bit	...	VAR_GLOBAL	F0
8	G_uHighSpeedContinuousLoggingFbErrCode	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D2

• The function block used

The following function block is used in this program example.

M+R60ADH_ReadHighSpeedContinuousLogging

• Program example



(8) Turn on 'G_bFbStart' (M11) to activate the function block (FB) for high speed continuous logging data transfer.
(0) After the FB is activated, turn on 'G_bHighSpeedContinuousLoggingStart' (M10) to start high speed continuous logging.
Logging data are automatically stored in the file registers (ZR0 to ZR99999) of the CPU module by the FB.
(303)After the transfer of 100000-point logging data is complete, stop the high speed continuous logging and FB.

■Precautions for creating the program

- The function block for high speed continuous logging data transfer reads out the data to the file registers each time 10000 point data sets are stored in the A/D converter module. The approximate processing time of the function block is obtained by adding up the required time of the following instruction operations used in the function block: 10 times of the FROM instruction (1000 points)[*1], 9 times of the FROM instruction (1 point)[*1]. If the exact processing time is required, add up the processing time of all instructions used in the function block. For details on the processing time of each instruction used in the function block, refer to the MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/ Function Blocks).
- To prevent logging data omission, create the program where the function block is executed once or more times in 5ms[*2]. (The processing time of this program must be 5ms[*2] or shorter including the processing time of the function block.)
- The following table (at the bottom row) shows the formula to calculate the approximate number of channels available for data transfer to the file registers with the function block. Note that this applies to the case when a user do not create any program.

Item	Calculation formula
Processing time (as a guide) of the function block for high speed continuous logging data transfer	= (Processing time of the FROM instruction (1000 points)) × (10 times) + (Processing time of the FROM instruction (1 point)) × (9 times) = 55.6μs[*1] × 10 + 4.3μs[*1] × 9 = 594.7μs
Number of channels (as a guide) available for data read	= 5ms[*2] ÷ (Processing time (as a guide) of the function block for high speed continuous logging data transfer) = 5ms ÷ 594.7μs = Approx. 8 channels

*1 Maximum processing time of each instruction is used for the calculation. (MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks))

*2 This value is for when the high speed continuous logging is executed every 1μs cycle. When using the high speed continuous logging cycle different from 1μs, apply the value obtained from T(ms) below for the calculation of the number of channels.
T(ms) = (High speed continuous logging cycle (μs) × 10000 (points)) ÷ 1000 - 5 (ms)

The calculation result of 8 channels, which is the number of channels available for data read, is a value for the case when the program consists of only the function block for high speed continuous logging data transfer. If the other processing is added to the program, or another program is added, the number of channels available for the high speed continuous logging decreases. Please consider an actual application and configure the system.

Transfer of data with the interrupt function

ON of High speed continuous logging data storage can be set as an interrupt factor of the interrupt function.
When the above item is set, the interrupt program is executed on the timing when the logging data for 10000 points are stored in a buffer memory area. Thus, logging data can be transferred into file registers (ZR) without depending on the scan time.
For the interrupt program, do not use the function block for high speed continuous logging data transfer because the function block does not operate properly by doing so.

■Program example to transfer data with the interrupt function

Ex.

To start the high speed continuous logging and copy logging data (CH1) for 100000 points and register them in file registers (ZR0 to ZR99999) of the CPU module continuously

• Label settings

Classification	Label name	Description	Device
Module label	RCPU.stSM.bAfter_RUN1_Scan_ON	Turning on for one scan after RUN	SM402
	R60ADH_1.unInterruptFactorDetectionFlag_D[0].0	Interrupt factor detection flag [1]	U0\G4.0
	R60ADH_1.unInterruptFactorMask_D[0].0	Interrupt factor mask [1]	U0\G124.0
	R60ADH_1.unInterruptFactorResetRequest_D[0].0	Interrupt factor reset request [1]	U0\G156.0
	R60ADH_1.stnControl_D[0].wHighSpeedContinuousLoggingASideStorageFlag_D.0	CH1 High speed continuous logging data A side storage flag	U0\G476.0
	R60ADH_1.stnControl_D[0].wHighSpeedContinuousLoggingBSideStorageFlag_D.0	CH1 High speed continuous logging data B side storage flag	U0\G477.0
	R60ADH_1.stnControl_D[0].uHighSpeedContinuousLoggingStartStopRequest_D.0	CH1 High speed continuous logging start/stop request	U0\G478.0
Labels to be defined	Define global labels as shown below: Set the class of 'G_wSaveFileRegisterPlusIndex' to VAR_GLOBAL_RETAIN. If the class is set to VAR_GLOBAL, the program operates normally. However, if the option in global label consistency check is set to "Yes", a conversion error occurs. "Tool" ⇨ "Options" ⇨ "Convert" ⇨ "Basic Setting" ⇨ "Operational Setting" ⇨ "Check the Consistency of Global Label"		

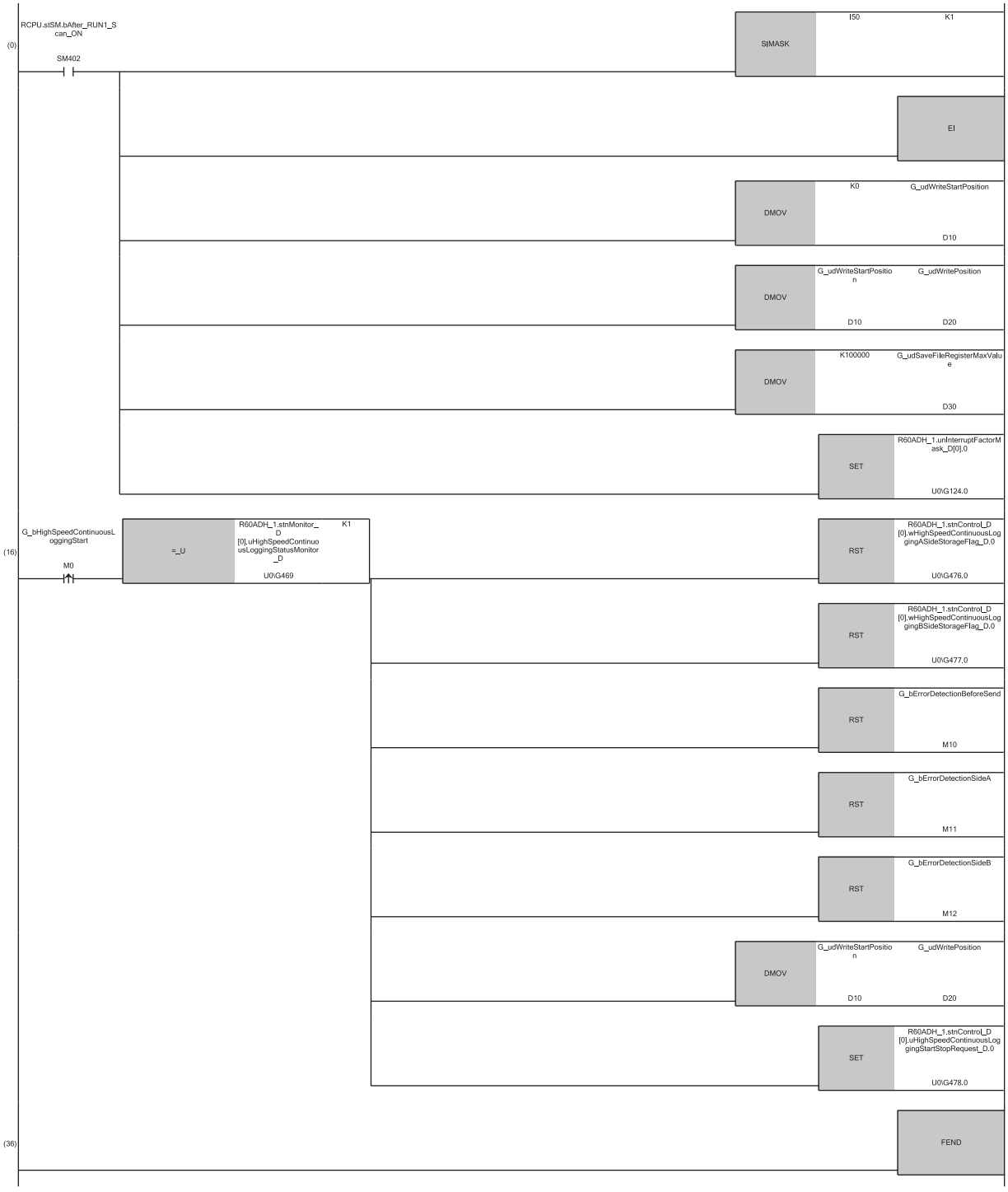
	Label Name	Data Type		Class	Assign (Device/Label)
1	G_bHighSpeedContinuousLoggingStart	Bit	...	VAR_GLOBAL	M0
2	G_udWriteStartPosition	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D10
3	G_udWritePosition	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D20
4	G_udSaveFileRegisterMaxValue	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D30
5	G_udWritePositionIndex	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	Z4
6	G_wSaveFileRegisterPlusIndex	Word [Signed]	...	VAR_GLOBAL_RETAIN	ZR0ZZ4
7	G_bErrorDetection	Bit	...	VAR_GLOBAL	F0
8	G_bErrorDetectionBeforeSend	Bit	...	VAR_GLOBAL	M10
9	G_bErrorDetectionSideA	Bit	...	VAR_GLOBAL	M11
10	G_bErrorDetectionSideB	Bit	...	VAR_GLOBAL	M12
11	G_wLoggingReadSideA	Word [Signed]	...	VAR_GLOBAL	U0\G10000
12	G_wLoggingReadSideB	Word [Signed]	...	VAR_GLOBAL	U0\G20000

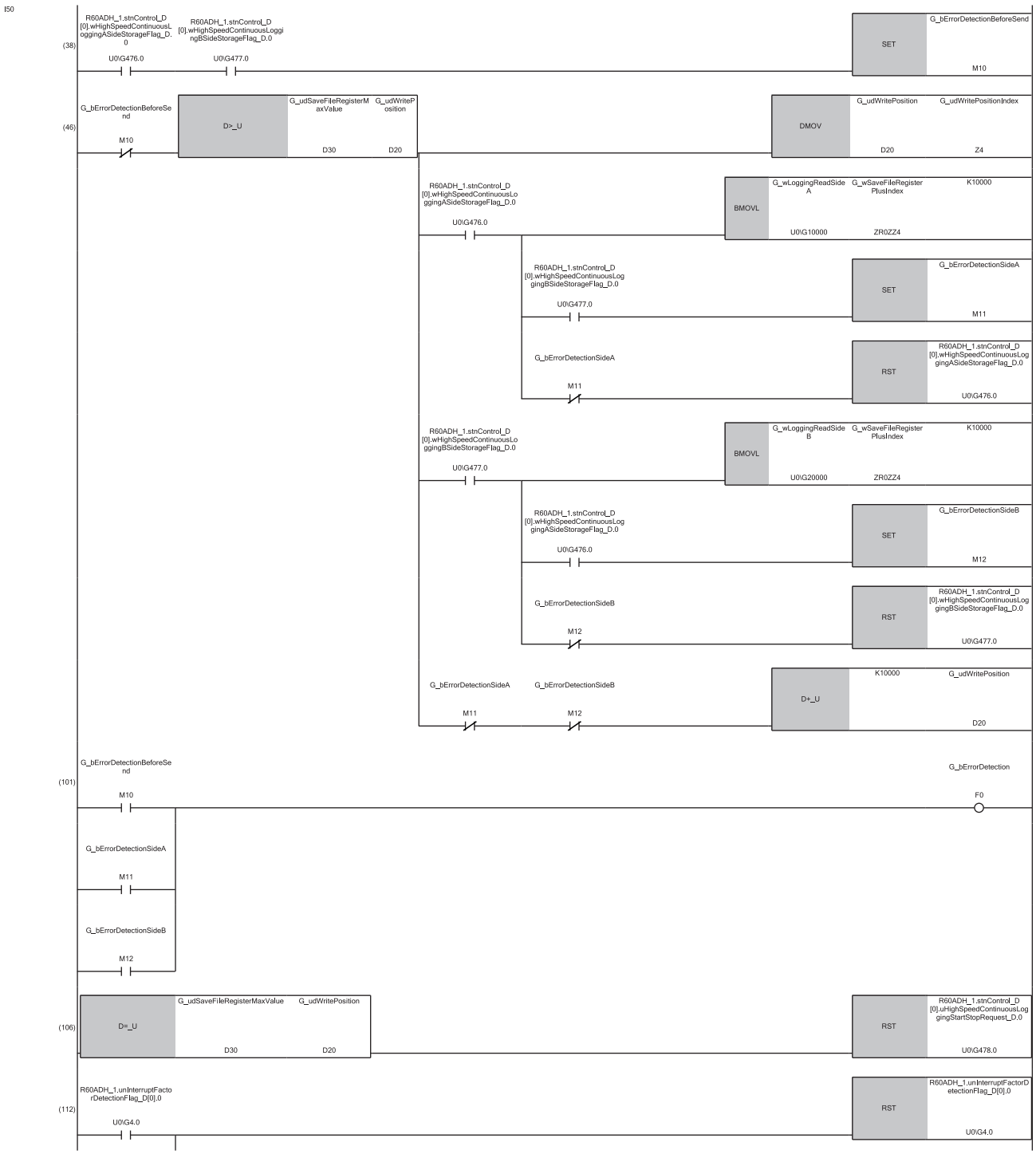
• Interrupt setting

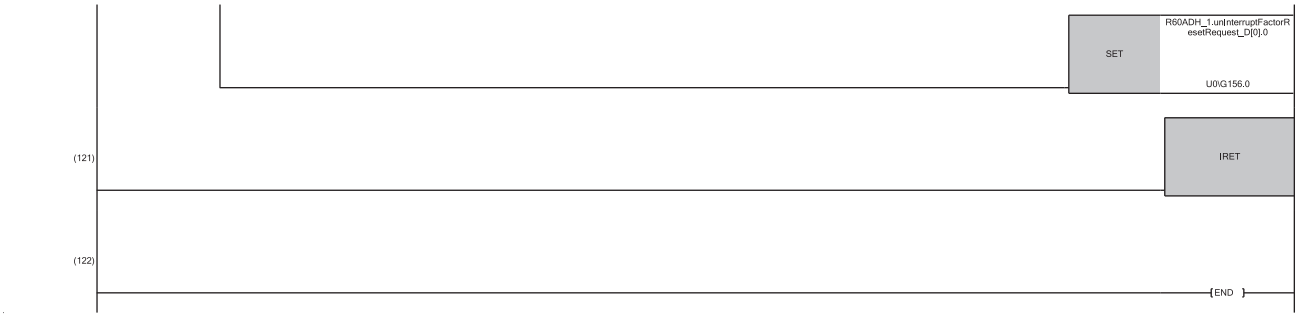
Setting Item

No.	Condition target setting	Condition target channel setting	Interrupt factor transaction setting	Interrupt pointer
1	Continuous logging data storage	CH1	Interrupt reissue requests	I50
2	Disable	All CH specification	Interrupt reissue requests	
3	Disable	All CH specification	Interrupt reissue requests	
4	Disable	All CH specification	Interrupt reissue requests	
5	Disable	All CH specification	Interrupt reissue requests	
6	Disable	All CH specification	Interrupt reissue requests	
7	Disable	All CH specification	Interrupt reissue requests	
8	Disable	All CH specification	Interrupt reissue requests	
9	Disable	All CH specification	Interrupt reissue requests	
10	Disable	All CH specification	Interrupt reissue requests	
11	Disable	All CH specification	Interrupt reissue requests	
12	Disable	All CH specification	Interrupt reissue requests	
13	Disable	All CH specification	Interrupt reissue requests	
14	Disable	All CH specification	Interrupt reissue requests	
15	Disable	All CH specification	Interrupt reissue requests	
16	Disable	All CH specification	Interrupt reissue requests	

• Program example




I50
(38)
R60ADH_1.stnControl_D[0].wHighSpeedContinuousLoggingASideStorageFlag_D.0
U0\G476.0
R60ADH_1.stnControl_D[0].wHighSpeedContinuousLoggingBSideStorageFlag_D.0
U0\G477.0
SET
G_bErrorDetectionBeforeSend
M10
(46)
G_bErrorDetectionBeforeSend
M10
D>=_U
G_udSaveFileRegisterMaxValue
D30
G_udWritePosition
D20
DMOV
G_udWritePosition
D20
G_udWritePositionIndex
Z4
R60ADH_1.stnControl_D[0].wHighSpeedContinuousLoggingASideStorageFlag_D.0
U0\G476.0
BMOVL
G_wLoggingReadSideA
U0\G10000
G_wSaveFileRegisterPlusIndex
ZR0ZZ4
K10000
R60ADH_1.stnControl_D[0].wHighSpeedContinuousLoggingBSideStorageFlag_D.0
U0\G477.0
SET
G_bErrorDetectionSideA
M11
G_bErrorDetectionSideA
M11
RST
R60ADH_1.stnControl_D[0].wHighSpeedContinuousLoggingASideStorageFlag_D.0
U0\G476.0
R60ADH_1.stnControl_D[0].wHighSpeedContinuousLoggingBSideStorageFlag_D.0
U0\G477.0
BMOVL
G_wLoggingReadSideB
U0\G20000
G_wSaveFileRegisterPlusIndex
ZR0ZZ4
K10000
R60ADH_1.stnControl_D[0].wHighSpeedContinuousLoggingASideStorageFlag_D.0
U0\G476.0
SET
G_bErrorDetectionSideB
M12
G_bErrorDetectionSideB
M12
RST
R60ADH_1.stnControl_D[0].wHighSpeedContinuousLoggingBSideStorageFlag_D.0
U0\G477.0
G_bErrorDetectionSideA
M11
G_bErrorDetectionSideB
M12
D+_U
K10000
G_udWritePosition
D20
(101)
G_bErrorDetectionBeforeSend
M10
G_bErrorDetection
F0
G_bErrorDetectionSideA
M11
G_bErrorDetectionSideB
M12
(106)
D=_U
G_udSaveFileRegisterMaxValue
D30
G_udWritePosition
D20
RST
R60ADH_1.stnControl_D[0].uHighSpeedContinuousLoggingStartStopRequest_D.0
U0\G478.0
(112)
R60ADH_1.unInterruptFactorDetectionFlag_D[0].0
U0\G4.0
RST
R60ADH_1.unInterruptFactorDetectionFlag_D[0].0
U0\G4.0



(0) The settings are configured as follows by the contact turning on for one scan after RUN.
 • 'G_udWriteStartPosition' (D10) is set to 0 so that ZR0 is set as the start position of the save destination file register.
 • 'G_udWritePosition' (D20) is set to a value in 'G_udWriteStartPosition' (D10) so that the write position of the file register is initialized.
 • The maximum number of storage data points of the save destination file register is set to 100000.
(16)Turn on 'G_bHighSpeedContinuousLoggingStart' (M0) at the desired timing to start the high speed continuous logging.
(38)An interrupt occurs each time logging data of 10000 points are stored in a buffer memory area. In addition, if both 'CH1 High speed continuous logging data A side storage flag' (Un\G476) and 'CH1 High speed continuous logging data B side storage flag' (Un\G477) are on, it is regarded as an error and 'G_bErrorDetectionBeforeSend' (M10) turns on. In such a case, the logging data transfer is stopped.
(46)The logging data are transferred to the file registers. The 10000 point logging data sets are transferred per interrupt. The transfer is repeated until the data are transferred to ZR99999.
(101)If data omission occurs, 'G_bErrorDetection' (F0) turns on.
(106)When the transfer of 100000 point logging data sets (ZR0 to ZR99999) is complete, the high speed continuous logging is stopped.

■Starting the high speed continuous logging again

To start the high speed continuous logging again after the completion of logging data transfer, have the execution interval (ms) described below or longer between them.

- Execution interval (ms) ≥ 10000 (points) × CH1 Logging cycle monitor value (μs) ÷ 1000 × 2

Ex.

When 'CH1 Logging cycle monitor value' (Un\G450) is 1(μs)

- Execution interval (ms) ≥ 10000 (points) × 1(μs) ÷ 1000 × 2 = 20(ms)

■Precautions for creating the program

- Each time 10000 point logging data sets are stored in the A/D converter module, an interrupt program is executed and the data are transferred to the file registers. The approximate instruction processing time of the interrupt program is obtained by adding up the processing time of instructions accessing to the buffer memory areas in the interrupt program (equivalent to a value of "10 times of the FROM instruction (1000 points)[*1] + 8 times of the FROM instruction (1 point)[*1] + 3 times of the TO instruction (1 point)[*1]") and the processing time of the IRET instruction. If the exact instruction processing time is required, add up the processing time of all instructions used in the interrupt program. For details on the processing time of each instruction used in the interrupt program, refer to the MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks).
- The approximate processing time of the interrupt program is obtained by adding both the interrupt overhead time and the refresh processing time (when the refresh processing is set) at the interrupt execution to the instruction processing time of the interrupt program. The interrupt overhead time and the refresh processing time at the interrupt execution vary depending on the parameter settings of the CPU module. For details, refer to the user's manual for the CPU module used.
- To prevent logging data omission, create the program so that a series of processing of the interrupt program (from the start to the completion) takes place within 5ms[*2] after an interrupt factor (storage of 10000 point high speed continuous logging data sets) occurs.
- The following table (at the bottom row) shows the formula to calculate the approximate number of channels available for data transfer to the file registers with the interrupt program. Note that this applies to the case when a user do not create any program. (The calculation is for when the interrupt overhead time is 20.6μs and the refresh processing time at the interrupt execution is 0μs.)

Item	Calculation formula
Instruction processing time (as a guide) of the interrupt program	= (Processing time of the FROM instruction (1000 points)) × (10 times) + (Processing time of the FROM instruction (1 point)) × (8 times) + (Processing time of the TO instruction (1 point)) × (3 times) + (Processing time of the IRET instruction) × (1 time) = 55.6μs[*1] × 10 + 4.3μs[*1] × 8 + 2.7μs[*1] × 3 + 2.2μs[*1] × 1 = 600.7μs
Processing time (as a guide) of the interrupt program	= (Instruction processing time (as a guide) of the interrupt program) + (Interrupt overhead time) + (Refresh processing time at the interrupt execution) = 600.7μs + 20.6μs + 0μs = 621.3μs
Number of channels (as a guide) available for data read	= 5ms[*2] ÷ (Processing time (as a guide) of the interrupt program) = 5ms ÷ 621.3μs = Approx. 8 channels

*1 This value indicates the maximum processing time of each instruction. (MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks))

*2 This value is for when the high speed continuous logging is executed every 1μs cycle. When using the high speed continuous logging cycle different from 1μs, apply the value obtained from T(ms) below for the calculation of the number of channels.
T(ms) = (High speed continuous logging cycle (μs) × 10000 (points)) ÷ 1000 - 5 (ms)

The calculation result of 8 channels, which is the number of channels available for data read, is a value for the case when the program consists of only the interrupt program to transfer logging data. If a program or processing other than the interrupt program to transfer logging data is added, the number of channels available for the continuous logging decreases. Please consider an actual application and configure the system.

Saving high speed continuous logging data

The logging data stored in the file registers (ZR) can be written into an SD memory card as a CSV file and checked with spreadsheet software.

Use the SP.FWRITE instruction to write the data into the SD memory card. For details on the SP.FWRITE instruction, refer to the following.

MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks)

1.18 Interrupt Function

High speed | Low speed | Simultaneous conversion | Synchronization

This function executes interrupt programs of the CPU module when an interrupt factor such as a warning output or an input signal error is detected.
For the A/D converter module, the maximum number of available interrupt pointers is 16 per module.

Operation

■Detecting an interrupt factor

An interrupt factor can be detected by setting "Interrupt setting" of the module parameter and by setting 'Interrupt factor mask [n]' (Un\G124 to Un\G139) to Mask clear (Interrupt used) (1) in advance. When an interrupt factor occurs, an interrupt request is sent to the CPU module at the same time as 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) is turned to Interrupt factor (1).

■How to reset an interrupt factor

When Reset request (1) is set in 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) corresponding to the interrupt factor, the specified interrupt factor is reset and the value of 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) changes to No interrupt factor (0).

Setting procedure

To use the interrupt function, set "Condition target setting", "Condition target channel setting", "Interrupt factor transaction setting", and "Interrupt pointer" with the engineering tool. After completing the settings, write the project to enable the settings.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Interrupt setting]

Item	Description
Condition target setting	Select a factor of the target for the interrupt detection.
Condition target channel setting	Select a target channel when the condition target setting for the interrupt detection is channel specification.
Interrupt factor transaction setting	Set an interrupt request for when an interrupt factor occurs while the same interrupt factor has been detected.
Interrupt pointer	Specify the number of an interrupt pointer that is started at the detection of an interrupt factor.

Point

When the operation mode is set to the normal mode (medium speed: 10μs/CH), the interrupt function cannot be used. Thus, even if "Interrupt setting" of the engineering tool is set, the setting is ignored.

■Condition target setting

Select a factor of the condition target setting for the interrupt detection.

Setting value	Description	Available operation mode
Disable	No interrupt is detected.	High speed Low speed Simultaneous conversion Synchronization
Error flag	An interrupt is detected at the timing of when 'Error flag' (XF) turns on.	Low speed Synchronization
Warning output flag (Process alarm)	An interrupt is detected at the timing of when Warning output flag (Process alarm) turns on (A channel is specified.).	
Warning output flag (Rate alarm)	An interrupt is detected at the timing of when Warning output flag (Rate alarm) turns on (A channel is specified.).	
Input signal error detection flag	An interrupt is detected at the timing of when Input signal error detection flag turns on (A channel is specified.).	
A/D conversion completed	An interrupt is detected every time A/D conversion is completed (A channel is specified.).	
Logging hold flag	An interrupt is detected at the timing of when Logging hold flag turns on (A channel is specified.).	
Logging read	The fact that data for the number of logging read points has been logged is detected (A channel is specified.).	
Continuous logging data storage	■Simultaneous conversion mode An interrupt is detected every time data of 5000 points is stored during continuous logging. ■Normal mode (high speed: 1μs/CH) An interrupt is detected every time data of 10000 points is stored during high speed continuous logging.	High speed Simultaneous conversion

When a value out of the setting range for each operation mode is set, a condition target setting range error (error code: 181△H) occurs. When a condition target setting range error (error code: 181△H) occurs in the normal mode (high speed: 1μs/CH), the A/D conversion stops in all channels.

■Condition target channel setting

Select a target channel when the condition target setting for the interrupt detection is channel specification. However, the same combination of the settings in 'Condition target setting [n]' (Un\G232 to Un\G247) and 'Condition target channel setting [n]' (Un\G264 to Un\G279) cannot be used for multiple interrupt settings (1 to 16). If the same setting combination is used for two or more interrupt settings, an interrupt condition setting overlap error (error code: 183△H) occurs. Note that setting All channels (0) in 'Condition target channel setting [n]' (Un\G264 to Un\G279) is regarded the same as setting CH1 (1), CH2 (2), CH3 (3), or CH4 (4) in 'Condition target channel setting [n]' (Un\G264 to Un\G279). Thus, the condition target where all channels are specified cannot be used for multiple interrupt settings. When an interrupt condition setting overlap error (error code: 183△H) occurs in the normal mode (high speed: 1μs/CH), the A/D conversion stops in all channels.

■Interrupt factor transaction setting

Set an interrupt request for when an interrupt factor occurs while the same interrupt factor has been detected.

- When "Interrupt reissue requests" has been set and the same interrupt factor occurs while the interrupt factor has been detected, an interrupt request is sent to the CPU module again.
- When "No interrupt reissue requests" has been set and the same interrupt factor occurs while the interrupt factor has been detected, an interrupt request is not sent to the CPU module.

■Interrupt pointer

Specify the number of an interrupt pointer that is started when an interrupt factor is detected. For details on the interrupt pointers, refer to the following.

📖User's manual for the CPU module used

Precautions

- When 'Condition target setting [n]' (Un\G232 to Un\G247) is Disable (0), an interrupt request is not sent to the CPU module.
- If an interrupt factor occurs when 'Interrupt factor mask [n]' (Un\G124 to Un\G139) is Mask (Interrupt unused) (0), an interrupt request is not sent to the CPU module though 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) is turned to Interrupt factor (1).
- To reset the interrupt factor, set Reset request (1) until 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) changes to No interrupt factor (0).
- Resetting interrupt factors is executed only when 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) changes from No reset request (0) to Reset request (1).
- Multiple interrupt pointers can share the same setting of 'Condition target setting [n]' (Un\G232 to Un\G247). When multiple interrupt pointers have shared the same setting of 'Condition target setting [n]' (Un\G232 to Un\G247) and interrupts occur, interrupt programs are executed in order of priority of the interrupt pointers. For the priority of the interrupt pointers, refer to the following.

📖User's manual for the CPU module used

- When All channels (0) is set for 'Condition target channel setting [n]' (Un\G264 to Un\G279) and an interrupt detection target is set for 'Condition target setting [n]' (Un\G232 to Un\G247) of each channel, the interrupt requests that have the same interrupt factor are sent to the CPU module if warnings are issued in multiple channels. In this case, the CPU module executes multiple interrupt programs and judges that the programs cannot be normally completed with the scan monitoring function, and a CPU module error may occur. When a CPU error occurs, refer to the following.

📖User's manual for the CPU module used

Setting example

Ex.

To execute the interrupt program (I51) when an error occurs in any channel

• Parameter setting

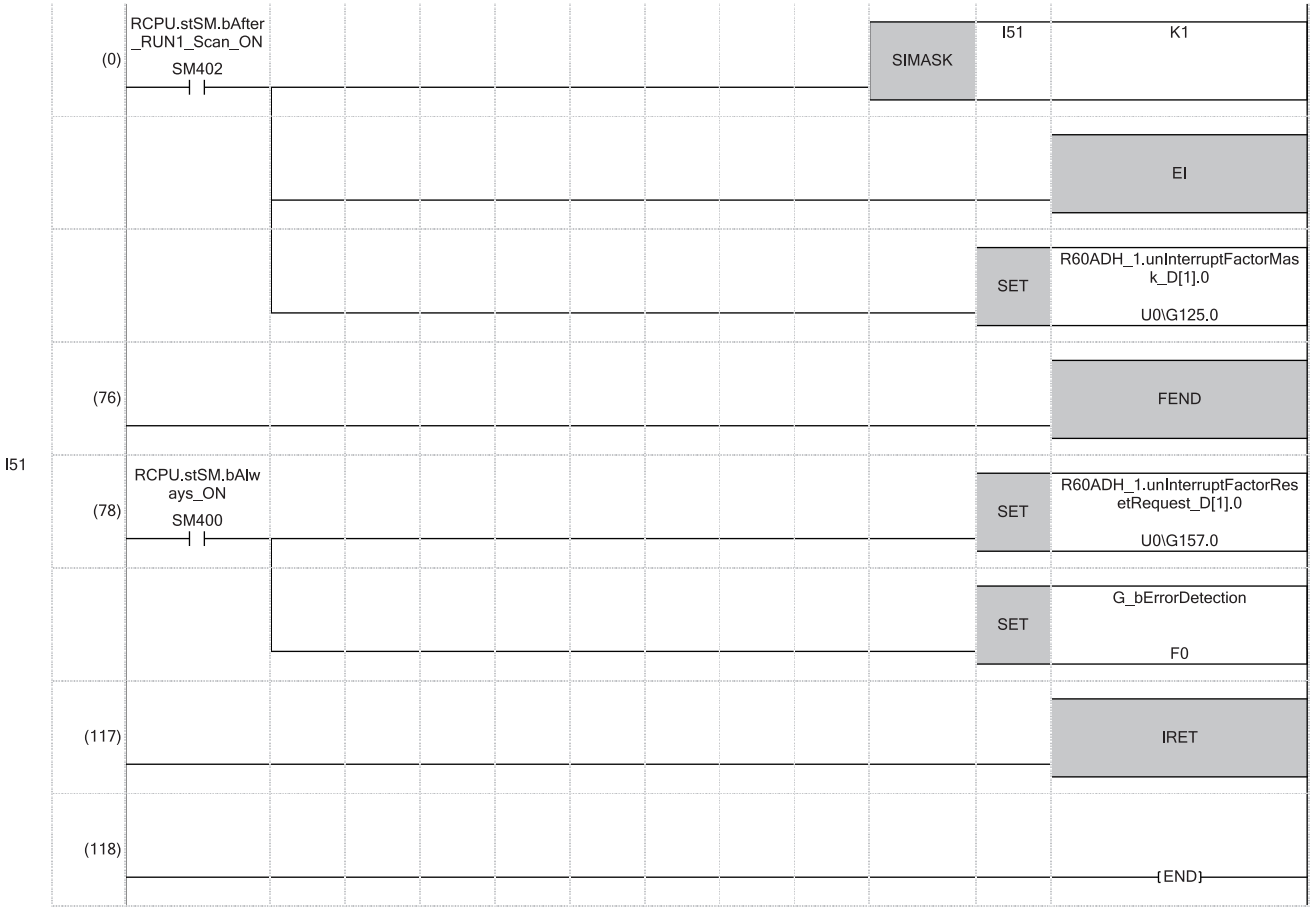
Set "Interrupt setting" of Module Parameter as follows.

No.	Condition target setting	Condition target channel setting	Interrupt pointer
2	Error flag	All CH specification	I51

• Label settings

Classification	Label name	Description	Device
Module label	RCPU.stSM.bAlways_ON	Always ON	SM400
	RCPU.stSM.bAfter_RUN1_Scan_ON	Turning on for one scan after RUN	SM402
	R60ADH_1.unInterruptFactorMask_D[1].0	Interrupt factor mask [2]	U0\G125.0
	R60ADH_1.unInterruptFactorResetRequest_D[1].0	Interrupt factor reset request [2]	U0\G157.0
Labels to be defined	Define global labels as shown below:		

	Label Name	Data Type		Class	Assign (Device/Label)
1	G_bErrorDetection	Bit	...	VAR_GLOBAL	F0



(0) Only the interrupt pointer I51 is enabled.

(78) 'Interrupt factor reset request [2]' (U0\G157) is turned on.
The processing of when an error is detected is performed.

1.19 Inter-Module Synchronization Function

Synchronization

The operations of multiple A/D converter modules and the timing of A/D conversion of all channels can be synchronized. An A/D converter module uses the inter-module synchronization signal as a trigger to simultaneously execute the A/D conversion of all channels. The A/D conversion value stored in the buffer memory before the execution of the inter-module synchronous interrupt program allows users to refer to the A/D conversion value of the latest synchronization cycle.

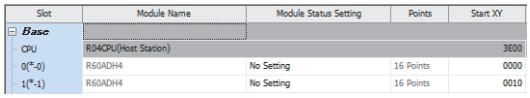
Setting procedure

■Setting the system parameter

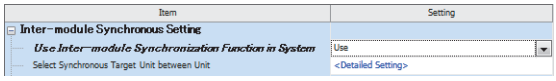
To use the inter-module synchronization function, configure the setting of the inter-module synchronization function in "System Parameter" to set the A/D converter module as the target module of the inter-module synchronization.
The following shows a setting procedure example.

[Navigation window] ⇨ [Parameter] ⇨ [System Parameter] ⇨ [Inter-module Synchronous Setting]

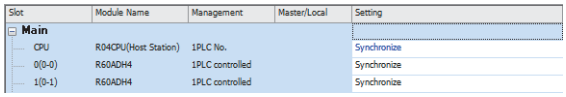
"I/O Assignment" window



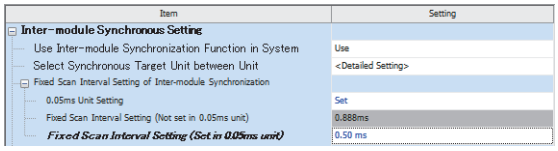
"Inter-module Synchronous Setting" window



"Select the Synchronous Target Unit" window



"Inter-module Synchronous Setting" window



1. Set the I/O assignment appropriate to the system in use.
2. Select "Use" for "Use Inter-module Synchronization Function in System".
3. Double-click "Detailed Setting" of "Select Synchronous Target Unit between Unit".
4. Set "Synchronize" for the A/D converter module.
5. Set the inter-module synchronization cycle in "Fixed Scan Interval Setting of Inter-module Synchronization".
6. Write the system parameter into the CPU module and change the status of the CPU module from RESET to RUN. When the inter-module synchronization function is enabled, whether the synchronization is in process or the synchronization is stopped can be monitored with 'Synchronization status monitor' (Un\G9600).

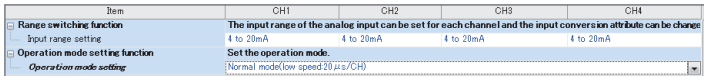
■Setting the module parameter

Set the module parameter to use the inter-module synchronization function.

The following shows a setting procedure example.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting]

"Module Parameter" window



1. The setting of "Input range setting" is the same as the one for the normal mode. Select an appropriate input range.
2. Select "Normal mode (low speed: 20μs/CH)" or "Normal mode (medium speed: 10μs/CH)" for "Operation mode setting".
3. Write the module parameter into the CPU module and change the status of the CPU module from RESET to RUN.

■Interrupt program setting

When the inter-module synchronization function is used, the A/D conversion values acquired on the inter-module synchronization cycle are stored in "CH1 Synchronization digital output value' (Un\G9500).

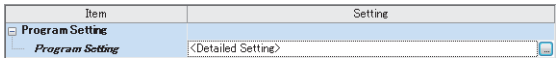
Read the value of 'CH1 Synchronization digital output value' (Un\G9500) with an interrupt program.

The interrupt program contains the interrupt pointer (I) to the IRET instruction set with the program, and the program is executed on the cycle set by a customer. The A/D converter module refreshes 'CH1 Synchronization digital output value' (Un\G9500) at the timing when the interrupt program is executed.

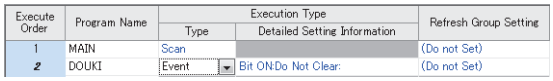
The following shows how to set an interrupt program.

[Navigation window] ⇨ [Parameter] ⇨ Model name of the CPU module ⇨ [CPU Parameter] ⇨ [Program Setting]

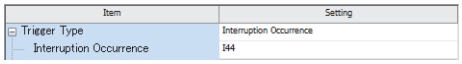
"CPU Parameter" window



"Program Setting" window



"Event Execution Type Detailed Setting" window



1. Double-click "Detailed Setting" of "Program Setting".
2. Set an interrupt program name for "Program Name".
3. Set "Event" for "Type" of "Execution Type".
4. Double-click "Detailed Setting Information" of "Execution Type".
5. Set "Interruption Occurrence" for "Trigger Type".
6. Set "I44" for "Interruption Occurrence".
7. Create an interrupt program.

The interrupt program is executed at every inter-module synchronization cycle set by a customer. For details on interrupt programs, refer to the following.

User's manual for the CPU module used

■Changing the module setting

- To write the default values with a program without using the module parameter or to change the parameter setting during module operation, the program that writes setting values and turns on and off Operating condition setting request (Y9) is required to enable the setting.
- When Operating condition setting request (Y9) is turned on and off to enable the setting, 0 is stored in 'CH1 Synchronization digital output value' (Un\G9500)' of the channel where A/D conversion disable is set.

Point

When the A/D converter module is set as the synchronization target, the I/O setting is refreshed before and after the execution of the synchronous interrupt program. Thus, use the direct access (DY) to immediately reflect the setting into the A/D converter module by turning on and off Operating condition setting request (Y9).

Operation example

When the inter-module synchronization function is used, control is basically performed with the inter-module synchronous interrupt program (I44).

To improve the synchronization performance of the entire system, the dedicated refresh target data is used when the inter-module synchronous interrupt program is executed. The following shows the refresh target data.

- 'CH1 Synchronization digital output value' (Un\G9500)
- 'Synchronization status monitor' (Un\G9600)

Point

When the inter-module synchronization function is used, the buffer memory areas dedicated for reading, such as 'CH1 Maximum value' (Un\G404), are updated based on 'CH1 Synchronization digital output value' (Un\G9500).

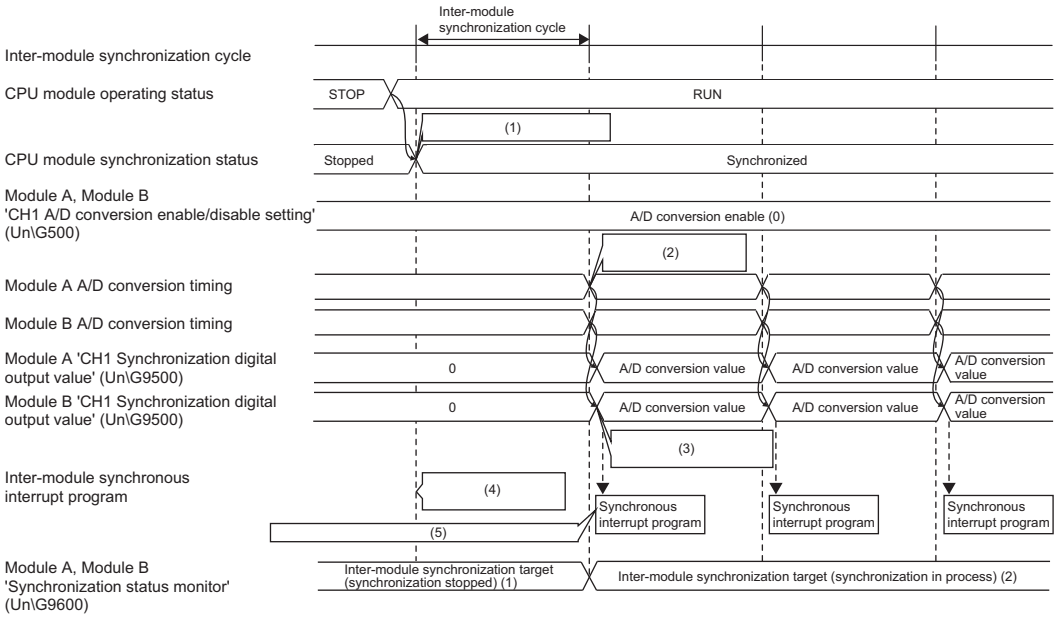
However, when the inter-module synchronous interrupt program is executed, only 'CH1 Synchronization digital output value' (Un\G9500) and 'Synchronization status monitor' (Un\G9600) are updated. Thus, when 'CH1 Synchronization digital output value' (Un\G9500) is compared with 'CH1 Maximum value' (Un\G404) in the inter-module synchronous interrupt program, the values of them do not match.

When creating the program that refers to the data other than 'CH1 Synchronization digital output value' (Un\G9500) and 'Synchronization status monitor' (Un\G9600) in the inter-module synchronous interrupt program, note the descriptions above.

■Basic operation

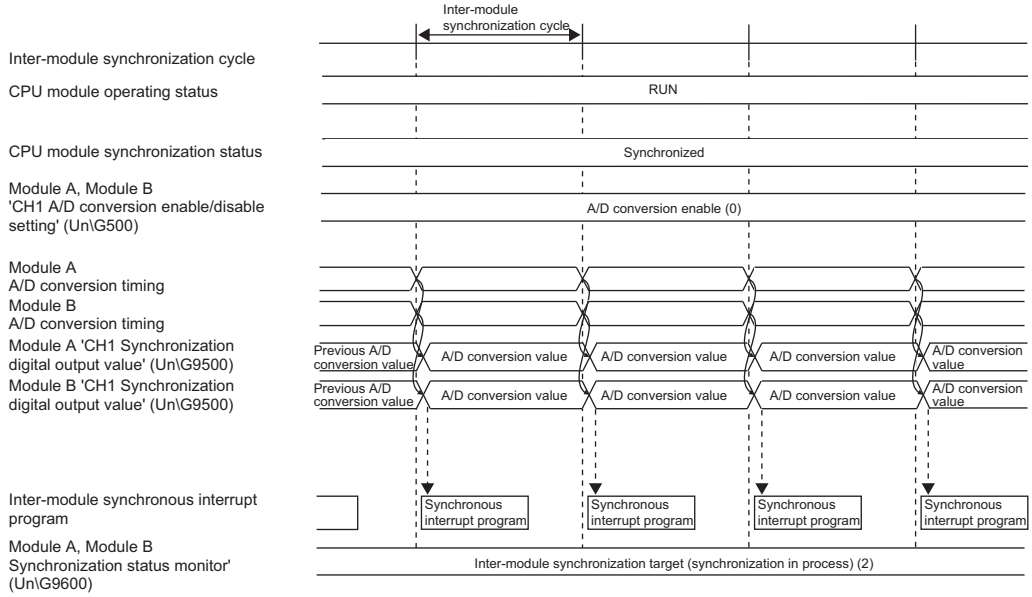
The following shows the basic operation of when the settings have been correctly configured and two A/D converter modules operate in synchronization with each other.

- Synchronized operation flow of when the status of the CPU module is changed from STOP to RUN

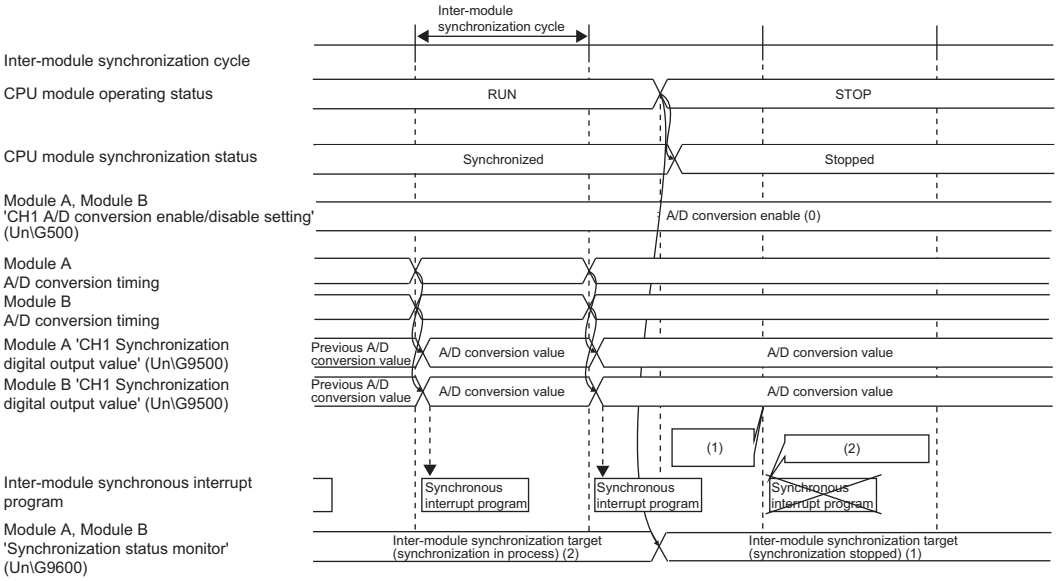


(1) The synchronization of the modules is started at the timing of the next inter-module synchronization cycle after the status of the CPU module is changed from STOP to RUN.
(2) When the CPU module is synchronized, A/D conversion is executed in all channels at the start timing of the inter-module synchronization cycle.
(3) The digital output value that was converted from an analog value immediately before the next timing of the inter-module synchronization cycle is stored in 'CH1 Synchronization digital output value' (Un\G9500).
(4) The synchronous interrupt program is not executed in the first inter-module synchronization cycle after the CPU module is set to RUN.
(5) The program is executed at the start timing of the second inter-module synchronization cycle.

- Synchronized operation flow of when the CPU module is in the RUN state



• Synchronized operation flow of when the status of the CPU module is changed from RUN to STOP

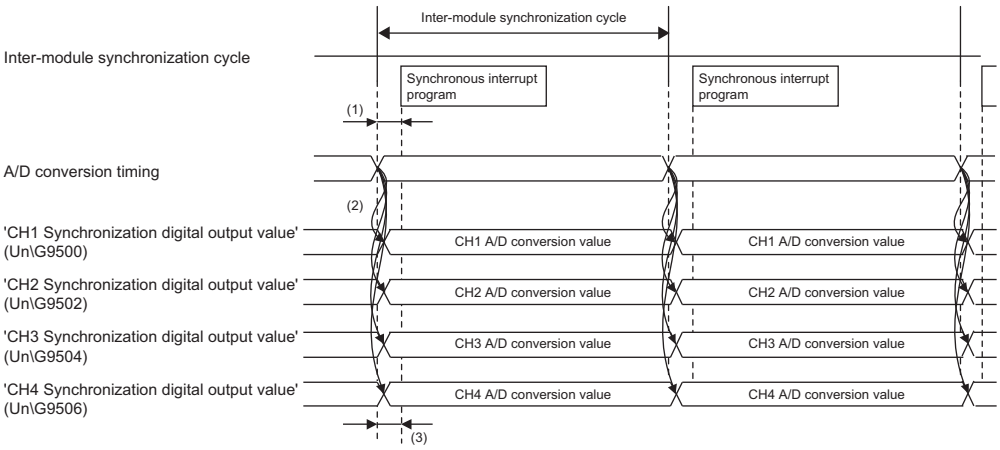


(1) When the CPU module is in the STOP state, the value of 'CH1 Synchronization digital output value' (Un\G9500) is not updated.
(2) When the CPU module is in the STOP state, the synchronous interrupt program is not executed.

■Synchronous conversion processing in the A/D converter module

The A/D converter module stores the latest A/D conversion value into 'CH1 Synchronization digital output value' (Un\G9500) within 5μs between the start timing of an inter-module synchronization cycle and the execution timing of the inter-module synchronous interrupt program.

The following shows the A/D conversion processing example of when A/D conversion is enabled in all channels.



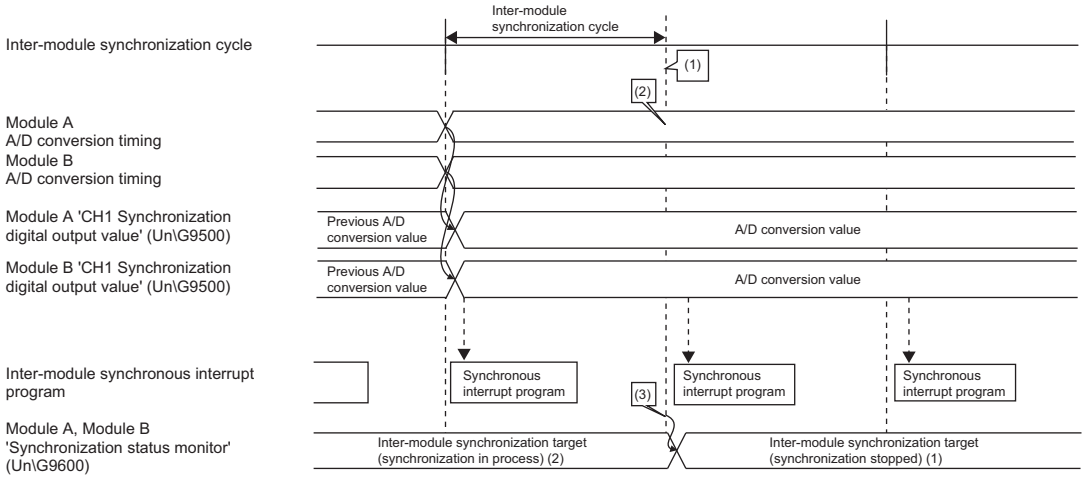
(1) Time between the start timing of an inter-module synchronization cycle and the execution timing of the interrupt program (5μs)
(2) The A/D converter module simultaneously executes A/D conversion in all channels using the timing of the inter-module synchronization cycle as a trigger and stores results in the following buffer memory areas.
- 'CH1 Synchronization digital output value' (Un\G9500)
- 'CH2 Synchronization digital output value' (Un\G9502)
- 'CH3 Synchronization digital output value' (Un\G9504)
- 'CH4 Synchronization digital output value' (Un\G9506)

(3) The A/D converter module simultaneously executes A/D conversion in all channels at the timing of the synchronization cycle. Because the conversion results are stored in the above buffer memory areas before the interrupt program is executed, all A/D converter modules can simultaneously refer to the data converted from analog to digital.

■Abnormal operation during synchronization

The phenomenon that the A/D converter module cannot receive inter-module synchronization signals at a normal cycle is called "synchronization loss". When a synchronization loss has occurred, an inter-module synchronization signal error (error code: 2610H) occurs. When this error has occurred, the synchronization of the A/D converter modules stops and 'CH1 Synchronization digital output value' (Un\G9500) keeps the previously stored value.

The following shows the operation of the A/D converter modules of when a synchronization loss has occurred.



(1) When the A/D converter module cannot accept the inter-module synchronization cycle, a synchronization loss has occurred.

(2) When the A/D converter module did not accept the synchronization cycle at the timing where the synchronization cycle was supposed to be accepted, an inter-module synchronization signal error (error code: 2610H) occurs and 'CH1 Synchronization digital output value' (Un\G9500) keeps the previously stored value.

(3) Once an inter-module synchronization signal error (error code: 2610H) is detected, Inter-module synchronization target (synchronization stopped) (1) is stored in 'Synchronization status monitor' (Un\G9600).

Point

When a synchronization loss has occurred, the module may be affected by noise. Check and adjust the cable wiring and the installation environment of the programmable controllers, and restart the system. If the error reoccurs even after the adjustment, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.

Monitor

When the inter-module synchronization function is used, the inter-module synchronization status can be monitored.

For details, refer to the following.

☞ Page 274 Synchronization status monitor

Precautions

• The following table shows the availability of other functions of when the inter-module synchronization function is enabled.

Function			Availability	Remarks
A/D conversion enable/disable setting function			○	—
Range switching function			○	—
A/D conversion method	Sampling processing		○	During inter-module synchronization, sampling processing or moving average processing can be specified. However, set the same A/D conversion method for all channels.
	Averaging processing	Count average	×	
		Time average	×	
		Moving average	○	
	Primary delay filter		×	
	Digital filter	Low pass filter	×	
		High pass filter	×	
		Band pass filter	×	
Scaling function			×	The scaling function cannot be used. When the function is set to be enabled, the setting is ignored.
Shift function			×	The value set for 'CH1 Conversion value shift amount' (Un\G472) is disabled.
Digital Clipping Function			×	The digital clipping function cannot be used. When the function is set to be enabled, the setting is ignored.
Difference conversion function			×	When 'CH1 Difference conversion trigger' (Un\G470) is set, the setting is ignored.
Maximum value/minimum value hold function			○	—
Warning output function	Process alarm		○	—
	Rate alarm		×	Rate alarm cannot be used. When the function is set to be enabled, the setting is ignored.
Input signal error detection function			○	—
Logging function	Normal logging function		×	—
	Logging read function		×	—
	High speed logging function		×	—
	Continuous logging function		○	For details on enabling the continuous logging function, refer to the following. ☞ Page 112 Continuous Logging Function
	High speed continuous logging function		×	—
Interrupt function			△	When continuous logging is executed, no interrupt is detected.
Error history function			○	—
Event history function			○	—
Offset/gain setting			×	—
Backing up, saving, and restoring offset/gain values			×	—
Online module change			×	During inter-module synchronization, the online module change is disabled. If the online module change is attempted during the inter-module synchronization, an online module change error (error code: 4206H) is stored in Online module change error cause (SD1618) and the module cannot be changed. If the module is changed, a module verification error (error code: 2400H) occurs in the CPU module.

- To execute the continuous logging function during inter-module synchronization, arrange the modules on the same base unit. If the modules were not arranged on the same base unit, the conversion timing of the modules may differ depending on the inter-module synchronization accuracy. (MELSEC iQ-R Inter-Module Synchronization Function Reference Manual)
- In the normal mode, 'CH1 Synchronization digital output value' (Un\G9500) is fixed to 0.
- When the offset/gain setting mode is set in the operation mode setting, an inter-module synchronization selection offset/gain setting error (error code: 1EA1H) occurs and the module does not operate.
- When a mode switching setting value is set for 'Mode switching setting' (Un\G296, Un\G297) and 'Operating condition setting request (Y9)' is turned on, a mode switching request error (alarm code: 0D00H) occurs and the ALM LED turns on. In this case, the mode is not switched and the synchronization processing continues. Turn on and off 'Error clear request' (YF) to clear the alarm that occurred.
- When performing the offset/gain setting, set the module as a synchronization non-target, and switch the mode to the normal mode (medium speed: 10μs/CH) or normal mode (low speed: 20μs/CH), and then switch the mode again to the offset/gain setting mode.
- Dedicated instructions cannot be used. The following shows the operation when a dedicated instruction has been executed.

Dedicated instruction*1	Operation
G(P).OFFGAN	If the G(P).OFFGAN instruction is executed, a mode switching request error (alarm code: 0D00H) occurs.
G(P).OGLOAD	The G(P).OGLOAD instruction is disabled.
G(P).OGSTOR	If the G(P).OGSTOR instruction is executed, a G(P).OGSTOR instruction execution error in offset/gain setting mode (error code: 1860H) is stored in the dedicated instruction completion status.

*1 For details on the dedicated instructions, refer to the following.
MELSEC iQ-R Programming Manual (Module Dedicated Instructions)

1.20 Error History Function

Common

This function stores up to the latest 16 errors and alarms that occurred in the A/D converter module to the buffer memory area.

Operation

When an error occurs, the error code and the error time are stored from Error history 1 (Un\G3600 to Un\G3609) in order. When an alarm occurs, the alarm code and the alarm time are stored from Alarm history 1 (Un\G3760 to Un\G3769) in order. Error time and alarm time are stored as follows:

Ex.

The following shows Error history 1 and Alarm history 1.

- Details of the error history

	b15 ... b8	b7 ... b0
Un\G3600	Error code	
Un\G3601	First two digits of the year	Last two digits of the year
Un\G3602	Month	Day
Un\G3603	Hour	Minute
Un\G3604	Second	Day of the week
Un\G3605	Millisecond (higher-order digits)	Millisecond (lower-order digits)
Un\G3606 to Un\G3609	System area	

- Details of the alarm history

	b15 ... b8	b7 ... b0
Un\G3760	Alarm code	
Un\G3761	First two digits of the year	Last two digits of the year
Un\G3762	Month	Day
Un\G3763	Hour	Minute
Un\G3764	Second	Day of the week
Un\G3765	Millisecond (higher-order digits)	Millisecond (lower-order digits)
Un\G3766 to Un\G3769	System area	

Item		Storage contents	Storage example*1
Error code or alarm code		An error code or alarm code is stored.	3030H
First two digits of the year	Last two digits of the year	Stored in BCD code.	2015H
Month	Day		1224H
Hour	Minute		1234H
Second			56H
Day of the week		One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3 Thursday: 4, Friday: 5, Saturday: 6	4H
Millisecond (upper)		Stored in BCD code.	7H
Millisecond (lower)			89H
System area		—	—

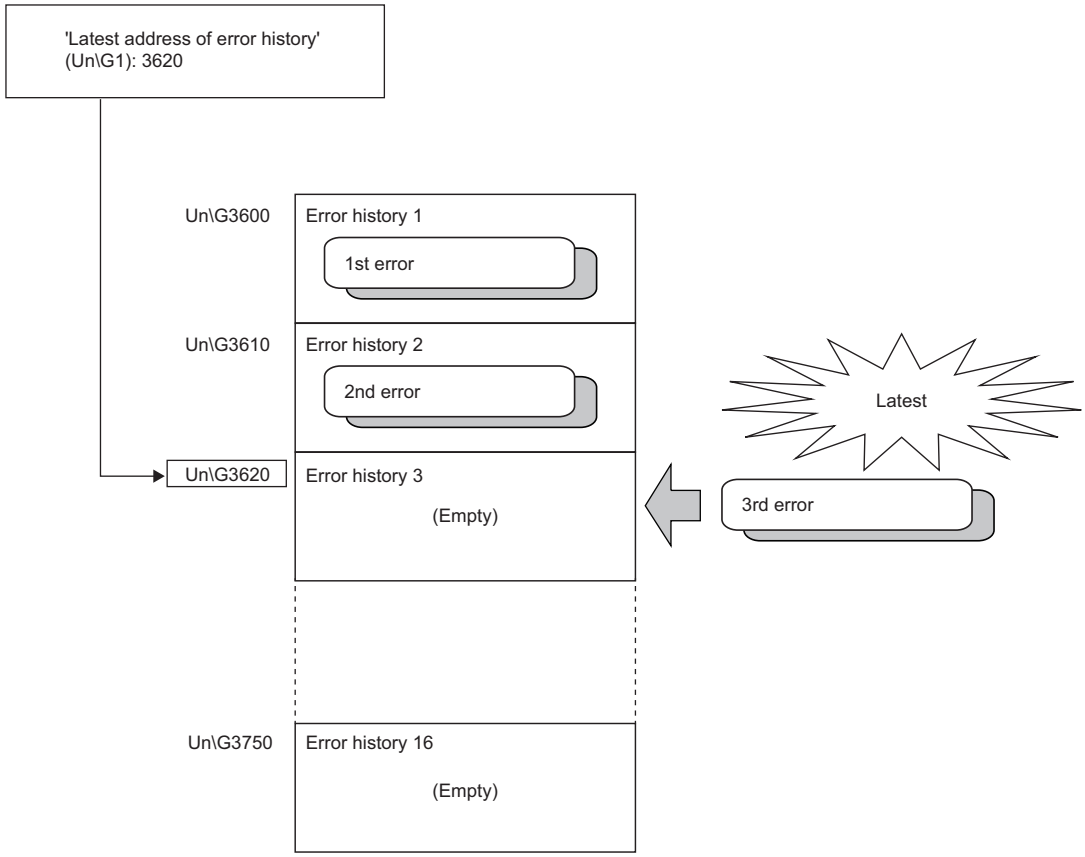
*1 Values stored when a flash memory error (error code: 3030H) occurs at 12:34:56.789 on Thursday, December 24th, 2015.

Checking method

The start address of Error history where the latest error is stored can be checked in 'Latest address of error history' (Un\G1).
The start address of Alarm history where the latest alarm is stored can be checked in 'Latest address of alarm history' (Un\G3).

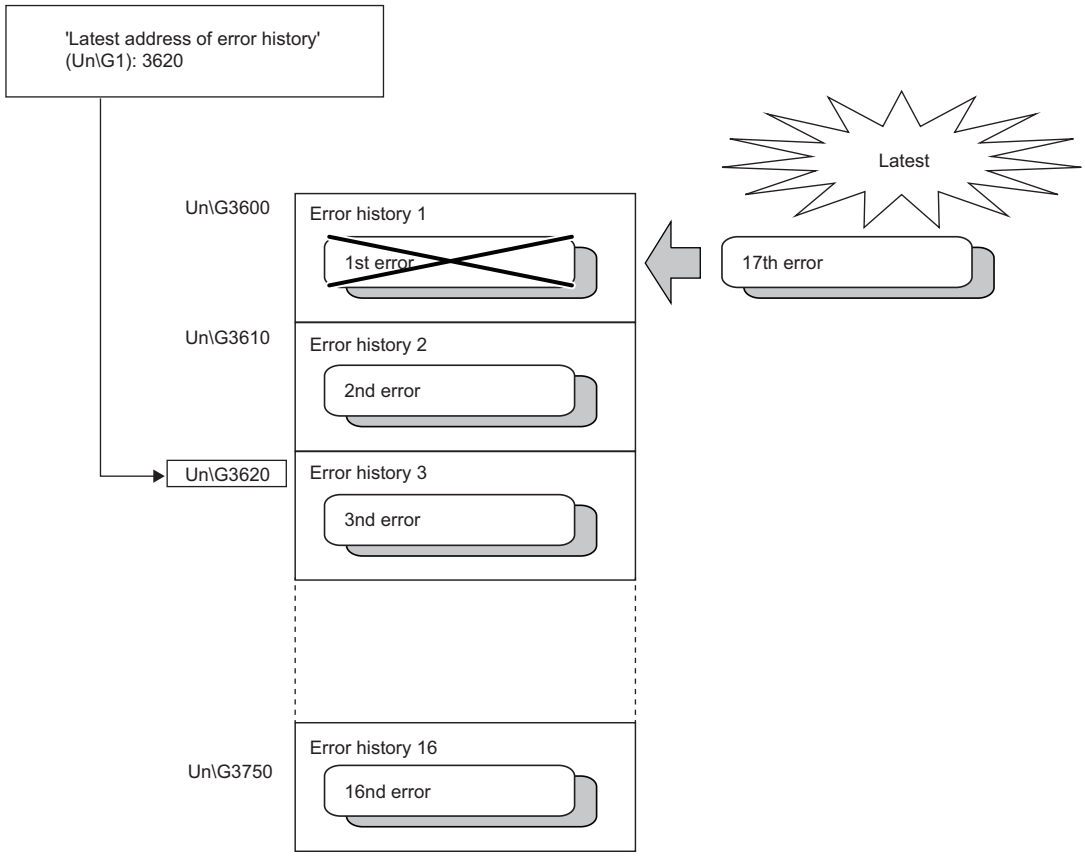
Ex.

The following shows an example of when the 3rd error occurs. The 3rd error is stored in Error history 3, and the value 3620 (start address of Error history 3) is stored in 'Latest address of error history' (Un\G1).



Ex.

The following shows an example of when the 17th error occurs. The 17th error is stored in Error history 1, and 'Latest address of error history' (Un\G1) is overwritten with the value 3620 (start address of Error history 1).



Point

- Once the error history storage area becomes full, subsequent error information will overwrite the existing data, starting from Error history 1 (Un\G3600 to Un\G3609), and the overwriting continues sequentially thereafter. The overwritten history is deleted.
- The same processing is performed for Alarm history when an alarm occurs.
- The stored error history is cleared when the A/D converter module is powered off, or when the CPU module is reset.

1.21 Event History Function

Common

This function collects generated errors, alarms or executed operations in the A/D converter module as event information in the CPU module.
The CPU module collects the event information of the A/D converter module and keeps them in the data memory inside of the CPU module or an SD memory card.
The event information collected by the CPU module can be displayed on an engineering tool to check the occurrence history in a time series.

Event type	Classification	Description
System	Error	An error detected by the self diagnostics in each module.
	Warning	A warning (alarm) detected in each module.
	Information	The operation by the normal detection of the system that is not classified as Error or Warning, or the operation performed automatically by the system.
Security	Warning	Operation that is judged as an unauthorized access to each module.
	Information	Operation that is hard to be judged as the success of unlocking passwords or an unauthorized access.
Operation	Warning	Deleting (data clear) operations that may change the action. (These operations are not judged as errors by the self diagnostics.)
	Information	Operations performed by users to change the system operation or configuration in the offset/gain setting.

Setting procedure

The event history function can be set from the event history setting window of the engineering tool. For the setting method, refer to the following.
📖User's manual for the CPU module used

Displaying event history

Access the menu window of the engineering tool. For details on the operating procedure and how to view the contents, refer to the following.
📖GX Works3 Operating Manual

List of event history data

The following table lists the events that would occur in the A/D converter module when the event type is set to "Operation"

Event code (Hex)	Classification	Event name	Event detail	Additional information
20010H	Information	Offset/gain setting execution	In the user range setting, offset/gain values has been set.	Total number of writes
20100H	Information	Error clear	Error clear request has been issued.	—

1.22 Backing up, Saving, and Restoring Offset/Gain Values

Medium speed Low speed

The A/D converter module is capable of backing up, saving, and restoring offset/gain values of the user range.

- Backup: Creates a module-specific backup parameter and saves offset/gain values.
- Save: Saves the offset/gain information, registered in this module by making the offset/gain setting, in the CPU module.
- Restoration: Writes the information backed up and saved in the CPU module to this module.

In the event that the A/D converter module fails and needs to be replaced, the offset/gain values of the failed A/D converter module can be restored onto the new A/D converter module.

However, if the offset/gain values are saved and restored, the accuracy after the restoration decreases to approximately the one-third compared to that before the restoration. Reconfigure the offset/gain setting when required.

Only when the model where the offset/gain values are to be saved and the model where the offset/gain values are to be restored are the same, the offset/gain values can be saved and restored. Each procedure differs depending on whether a module-specific backup parameter is used or not.

When a module-specific backup parameters is used

Medium speed Low speed

At the time of replacement by means of the online module change, the offset/gain values are automatically restored.

For details on the online module change, refer to the following.

MELSEC iQ-R Online Module Change Manual

Details of the module-specific backup parameter

A module-specific backup parameter is a file created in an SD memory card or the data memory of the control CPU. The contents of the parameter are the offset/gain values of the user range stored in the non-volatile memory of the A/D converter module.

The file name of a module-specific backup parameter is determined as follows based on the start I/O number of the A/D converter module.

UBPmmmnn.BPR

- mmm indicates a value calculated by dividing the module I/O No. by 10H (3 digits in hexadecimal).
- nn indicates a consecutive number of the module-specific backup parameters for each module and fixed to 00.

Creating and updating a module-specific backup parameter

A module-specific backup parameter is created or updated when the offset/gain values stored in the non-volatile memory of the A/D converter module are updated.

Timing when backup data is created or updated	Description
When the offset/gain setting is completed with "Offset/gain setting" of the engineering tool	A module-specific backup parameter is created or updated when the offset/gain setting is completed with "Offset/gain setting" of the engineering tool.
When 'User range write request' (YA) is turned on in the offset/gain setting mode	A module-specific backup parameter is created or updated when the offset/gain values of the user range are changed in the offset/gain setting mode.
When 'User range write request' (YA) is turned on in the normal mode (medium speed: 10μs/CH) or normal mode (low speed: 20μs/CH)	When 'User range write request' (YA) is turned on in the normal mode (medium speed: 10μs/CH) or normal mode (low speed: 20μs/CH), the offset/gain values of the user range are restored based on the settings of the buffer memory areas (Save data type, CH1 Factory default setting offset value (L) to CH4 User range setting gain value (H)). At this timing, module-specific backup parameters are updated.
When the G(P).OGSTOR instruction is executed in the normal mode (medium speed: 10μs/CH) or normal mode (low speed: 20μs/CH)	When the G(P).OGSTOR instruction is executed in the normal mode (medium speed: 10μs/CH) or normal mode (low speed: 20μs/CH), the offset/gain values of the user range are restored. At this timing, module-specific backup parameters are updated.
When a new module is recognized in the process of online module change	When a new module is mounted and recognized in the process of online module change, the offset/gain values of the user range are restored. At this timing, module-specific backup parameters are updated.

When no module-specific backup parameter exists in the data memory of the control CPU and a module-specific backup parameter needs to be created with the current setting, change the mode of the A/D converter module to the offset/gain setting mode and turn on 'User range write request' (YA). A module-specific backup parameter is created with the current setting of the flash memory.

■Precautions

If the creation of a module-specific backup parameter fails because the data memory of the control CPU does not have sufficient free space or the module-specific backup parameter is being used, a module-specific backup parameter creation error (error code: 17E1H) occurs.

Reading of module-specific backup parameters

To read a module-specific backup parameter and restore offset/gain values, set "Auto restore of Offset/gain setting with the module change" of the module parameter to "Enable" in advance.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting] ⇨ [Online module change]

■Reading timing

Module-specific backup parameters are read when a new module is mounted and recognized in the process of online module change. If the module is replaced with the programmable controller powered off, module-specific backup parameters are not read.

■Precautions

When the module-specific backup parameter for the target slot does not exist in an SD memory card or the data memory of the control CPU, the subsequent restoration of the offset/gain values is not performed. If the offset/gain values cannot be restored even though the module-specific backup parameter exists, a module-specific backup parameter restore error (error code: 17E0H) occurs.

Restoration of the offset/gain values of the user range

Upon the successful completion of reading module-specific backup parameters, the values are converted (restored) into the offset/gain values of the user range for the new module, and stored in the non-volatile memory. At the same time, the module-specific backup parameter in the data memory of the control CPU is updated with the setting of the new module.

Restrictions on the module-specific backup parameter

The backup and restoration by means of module-specific backup parameters fails in the following cases.

- When the control CPU is not the process CPU
- When replacing the A/D converter module with the programmable controller powered off
- When "Auto restore of Offset/gain setting with the module change" of the module parameter is set to "Disable"

In any of the cases above, back up and restore offset/gain values by referring to the following.

☞ Page 165 When the module-specific backup parameter is not used

When the module-specific backup parameter is not used

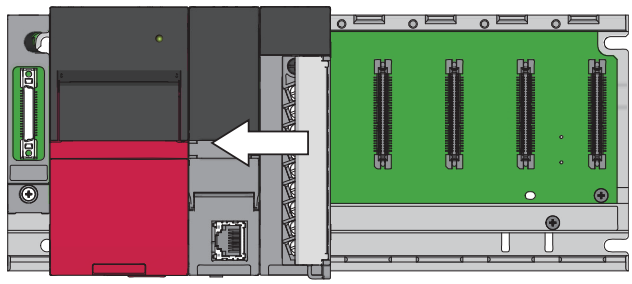
Medium speed Low speed

When the module-specific backup parameter is not used, back up and restore offset/gain values by one of the following methods.

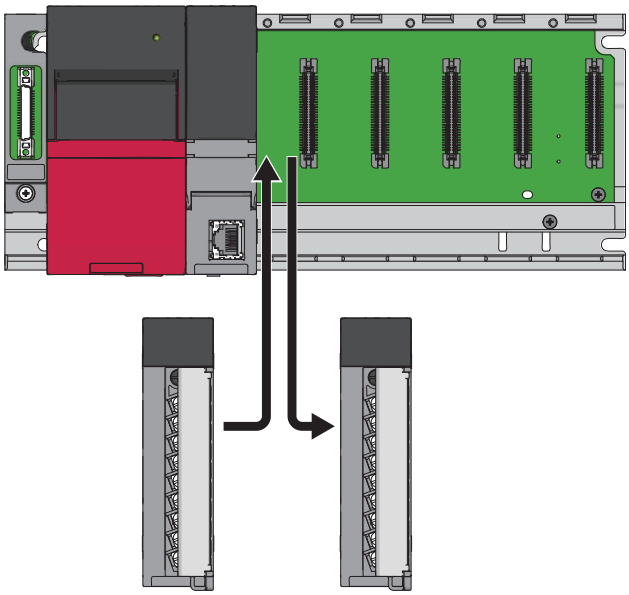
- Saving and restoring with dedicated instructions
- Saving and restoring by reading from and writing to the buffer memory

With the methods above, offset/gain values can be restored to a new module, or the offset/gain values set in one module can be applied to the other modules in the same system.

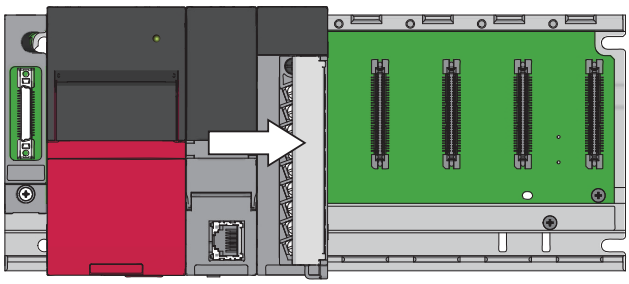
- To restore offset/gain values onto a new replaced module:



1. Save the offset/gain values.



2. Replace the A/D converter module.

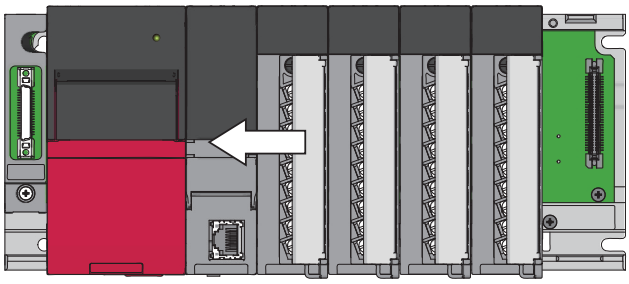


3. Restore the offset/gain values.

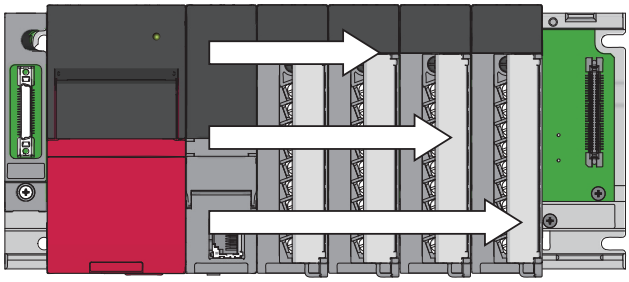
• To apply the offset/gain values set in one module to the other modules in the same system:

Ex.

When the offset/gain values in module No.1 are applied to modules No.2 to No.4



1. Save the offset/gain values of module No.1.



2. Apply the offset/gain values to modules No.2 to No.4.

Saving and restoring with dedicated instructions

Use the dedicated instruction G(P).OGLOAD to temporarily save the offset/gain values of the source A/D converter module to the internal device of the CPU module, and use the G(P).OGSTOR to write the values to the destination A/D converter module.

Prevent the saved offset/gain setting data from being deleted, by one of the following methods before replacing the modules:

- Use latch settings for the internal device of the destination module.
- Save the data onto an SD memory card. (To write data: use the SP.FWRITE instruction. To read data: use the SP.FREAD instruction.)
- Store the saved data.

For how to use dedicated instructions, refer to the following.

MELSEC iQ-R Programming Manual (Module Dedicated Instructions)

Saving and restoring by reading from and writing to the buffer memory

Use Save data type setting (Un\G4002), CH1 Factory default setting offset value (L) (Un\G4004) to CH4 User range setting gain value (H) (Un\G4035), and 'User range write request' (YA) to read the offset/gain values from the source A/D converter module. Use the buffer memory again to write the values to the destination A/D converter module.
The following describes the procedure for using the buffer memory.

■To restore offset/gain values onto a new replaced module:

Performing operations to the source A/D converter module

1. Set Save data type setting (Un\G4002).
2. Turn on and off 'Operating condition setting request' (Y9).
3. Save the stored values of Save data type setting (Un\G4002) and CH1 Factory default setting offset value (L) (Un\G4004) to CH4 User range setting gain value (H) (Un\G4035).

Performing the operation when the power of the module is off

4. Replace the A/D converter module.

Performing operations to the destination A/D converter module

5. Write the data saved in Save data type setting (Un\G4002) and CH1 Factory default setting offset value (L) (Un\G4004) to CH4 User range setting gain value (H) (Un\G4035).
6. Turn on 'User range write request' (YA).
7. Check that 'Offset/gain setting mode status flag' (XA) is on.
8. Turn off 'User range write request' (YA).
9. Check that the destination A/D converter module operates with the offset/gain values that are restored.

Point

When replacing modules, prevent the saved offset/gain setting data from being deleted, by one of the following methods before powering off the module.

- Use latch settings for the internal device of the destination module.
- Save the data onto an SD memory card. (To write data: use the SP.FWRITE instruction. To read data: use the SP.FREAD instruction.)
- Store the saved data.

■To apply the offset/gain values set in one module to the other modules in the same system:

Performing operations to the source A/D converter module

1. Set Save data type setting (Un\G4002).
2. Turn on and off 'Operating condition setting request' (Y9).
3. Save the stored values of Save data type setting (Un\G4002) and CH1 Factory default setting offset value (L) (Un\G4004) to CH4 User range setting gain value (H) (Un\G4035).

Performing operations to the destination A/D converter module

4. Write the data saved in Save data type setting (Un\G4002) and CH1 Factory default setting offset value (L) (Un\G4004) to CH4 User range setting gain value (H) (Un\G4035).
5. Turn on 'User range write request' (YA).
6. Check that 'Offset/gain setting mode status flag' (XA) is on.
7. Turn off 'User range write request' (YA).
8. Check that the destination A/D converter module operates with the offset/gain values that are restored.

Range reference table

The following shows the range reference tables to be used for saving and restoring offset/gain values.

■Range reference table of Factory default setting offset/gain value

Address (decimal)				Description	Save data type setting*1	Analog value	Reference value (hexadecimal)
CH1	CH2	CH3	CH4				
4004 4005	4008 4009	4012 4013	4016 4017	Factory default setting offset value	Voltage specification	0V	00000H
					Current specification	0mA	00000H
4006 4007	4010 4011	4014 4015	4018 4019	Factory default setting gain value	Voltage specification	10V	179C3H
					Current specification	20mA	0BCE2H

*1 The reference values differ depending on the setting of Save data type setting (Un\G4002) (voltage or current).

■Range reference table of User range setting offset/gain value

The following values are stored as the user range setting by default.

Address (decimal)				Description	Range type	Setting details	Reference value (hexadecimal)
CH1	CH2	CH3	CH4				
4020 4021	4024 4025	4028 4029	4032 4033	User range setting offset value	Current	4mA	025C7H
4022 4023	4026 4027	4030 4031	4034 4035	User range setting gain value	Current	20mA	0BCE2H

The following shows the range reference table of User range setting offset/gain value.

Offset/gain value		Reference value (hexadecimal)
Voltage	0V	00000H
	1V	025C7H
	5V	0BCE2H
	10V	179C3H
Current	0mA	00000H
	4mA	025C7H
	20mA	0BCE2H

2 PARAMETER SETTINGS

Set the parameters of each channel.
Setting parameters here eliminates the need to program them.

2.1 Parameter Setting Procedure

1. Add the A/D converter module to the engineering tool.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ [Add New Module]

2. The parameter setting includes four types of settings: basic setting, application setting, interrupt setting, refresh setting. Set parameters by performing the following and selecting a desired setting from the tree displayed on the window.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Select the A/D converter module.

3. Write the settings to the CPU module using the engineering tool.

[Online] ⇨ [Write to PLC]

4. The settings are reflected by resetting the CPU module or powering off and on the system.

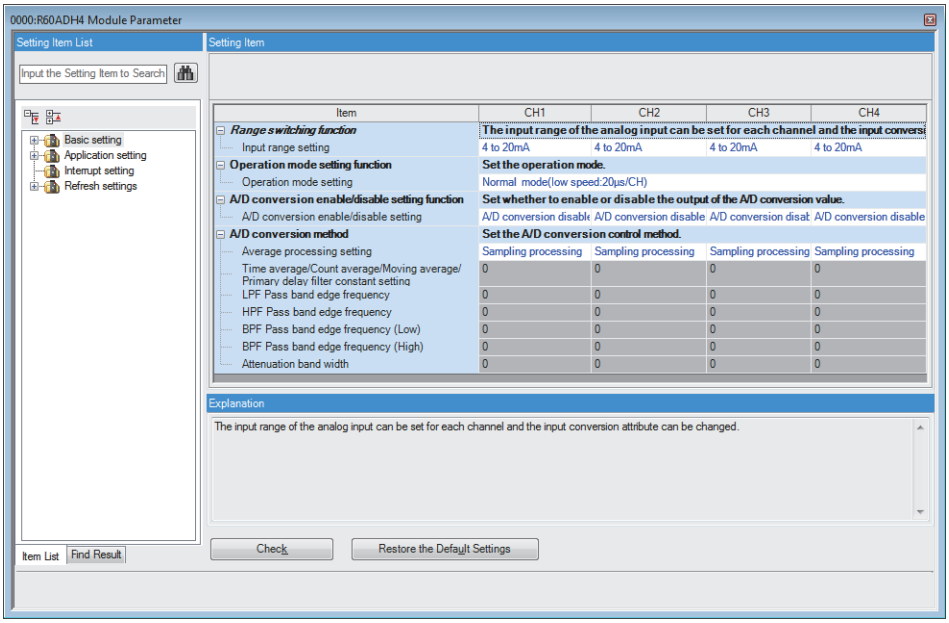
2.2 Basic Setting

Setting procedure

Open "Basic setting" of the engineering tool.

1. Start Module Parameter.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Basic setting]



2. Click the item to be changed to enter the setting value.

• Item where a value is selected from the drop-down list

Click the [▼] button of the item to be set, and from the drop-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

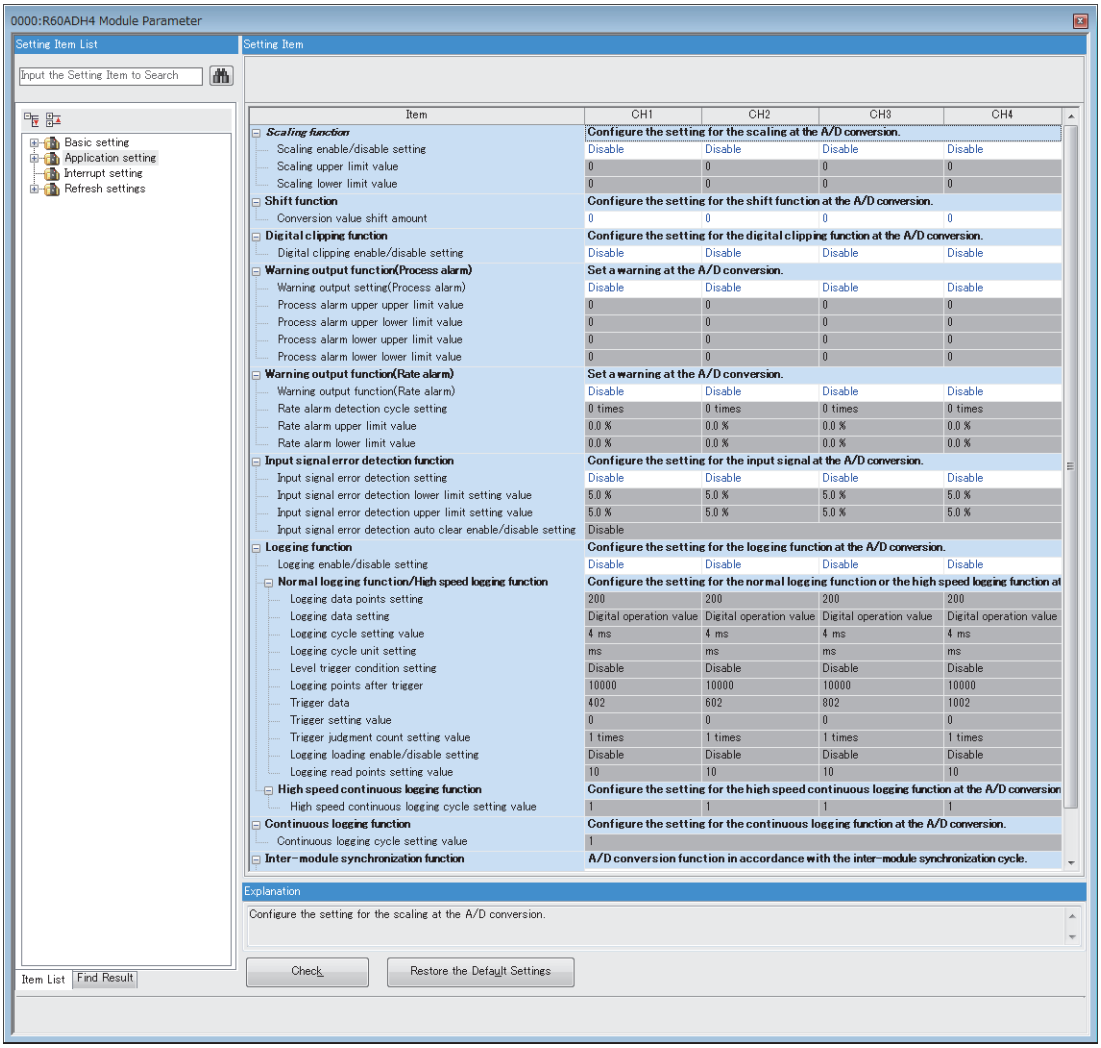
2.3 Application Setting

Setting procedure

Open "Application setting" of the engineering tool.

1. Start Module Parameter.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Application setting]



2. Click the item to be changed to enter the setting value.

• Item where a value is selected from the drop-down list

Click the [▼] button of the item to be set, and from the drop-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

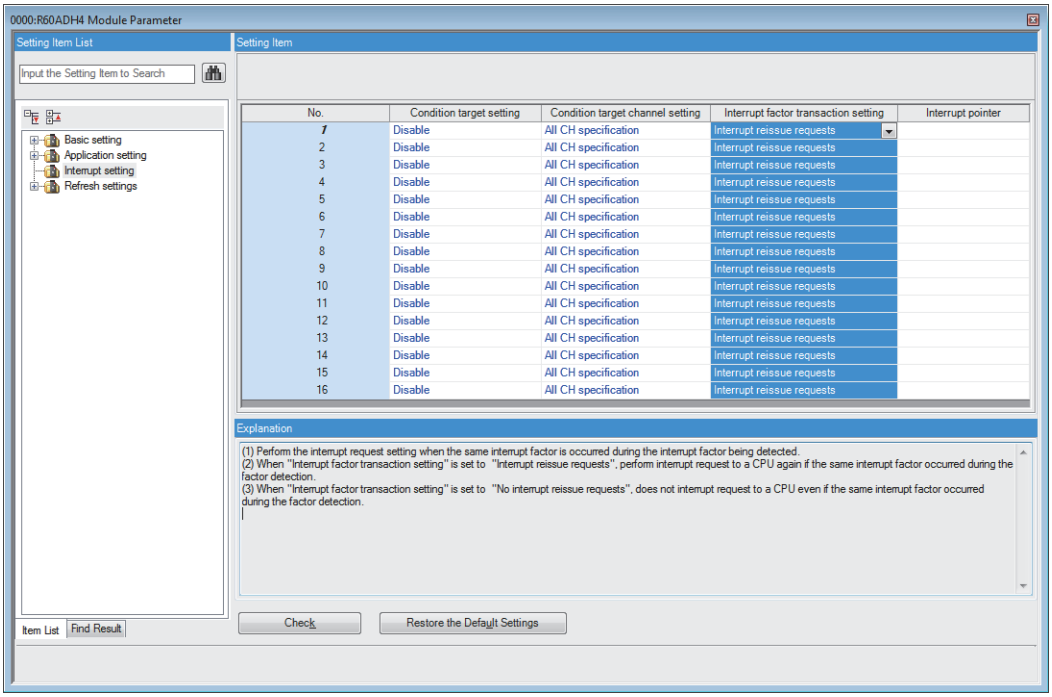
2.4 Interrupt Setting

Setting procedure

Open "Interrupt setting" of the engineering tool.

1. Start Module Parameter.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Interrupt setting]



2. Click the item of interrupt setting number (No.1 to 16) to be changed to enter the setting value.

• Item where a value is selected from the drop-down list

Click the [▼] button of the item to be set, and from the drop-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

2.5 Refresh Setting

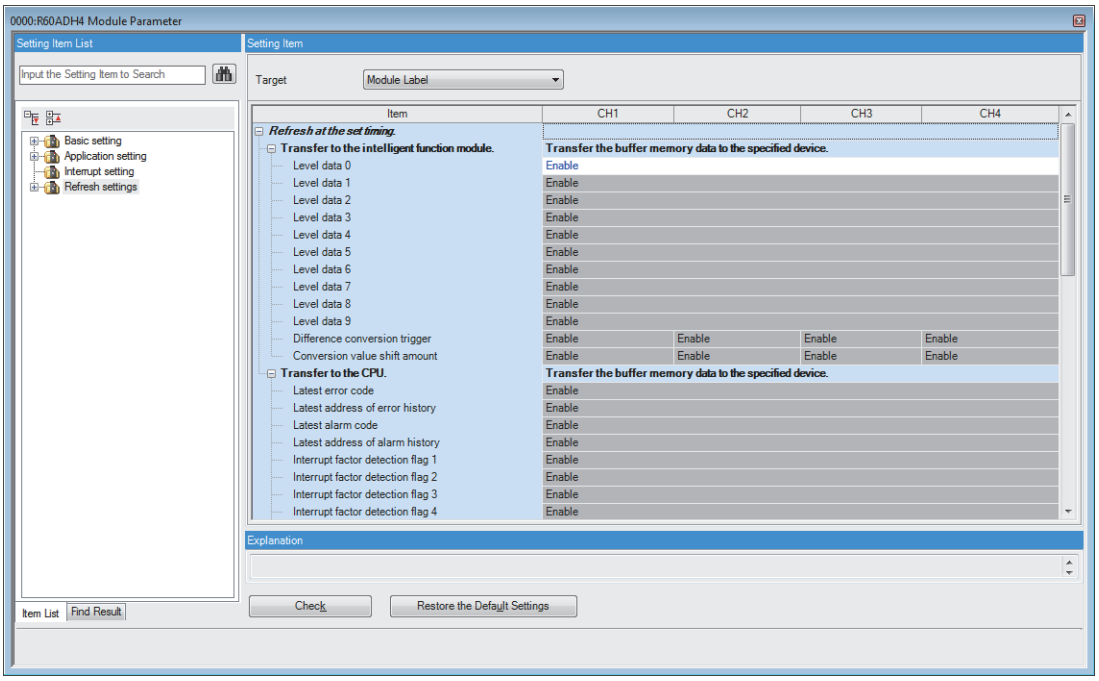
Setting procedure

Set the buffer memory area of the A/D converter module to be refreshed.

This refresh setting eliminates the need for reading/writing data by programming.

1. Start Module Parameter.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Refresh settings]



2. Click "Target", and set the auto refresh destination.

• When "Target" is "Module Label"

Set whether to enable or disable the refresh by setting "Level data 0" to Enable or Disable.

• When "Target" is "Refresh Data Register (RD)"

The transfer destinations of all items are automatically set by setting the start device to "Start Device Name".

• When "Target" is "Device"

Double-click the item to be set to enter the refresh destination device.

3. Click "Refresh Group" to set the timing to refresh.

Set "Refresh Group" to "At the Execution Time of END Instruction" or "At the Execution Time of Specified Program".

When "At the Execution Time of Specified Program" is set, double-click "Group [n] (n: 1-64)" and set a value of 1 to 64.

Point

When the refresh is enabled, the values of the refresh destination are enabled at the refresh timing set with the engineering tool. At this time, the buffer memory areas are overwritten with the values of the refresh destination. To change the values of the refresh target buffer memory areas, create a program so that the values of module labels or devices of the refresh source are changed.

Refresh processing time

A refresh processing time [μs] is a constituent of the scan time of the CPU module. For details on the scan time, refer to the following.

User's manual for the CPU module used

The refresh processing time [μs], which is taken for refresh, is given by:

- Refresh processing time [μs] = Refresh read time (time for transferring refresh data to the CPU module) + Refresh write time (time for transferring refresh data to the intelligent function module)

The refresh read time and refresh write time vary depending on the settings of "Target".

When "Target" is "Module Label" or "Refresh Data Register (RD)"

The following table shows the refresh read time and refresh write time with an R□CPU used.

Model	Classification	When using the refresh settings	When using the inter-module synchronization function
R60ADH4	Refresh read time	20.56μs	12.94μs
	Refresh write time	12.35μs	0μs

When "Target" is "Device"

Calculate the refresh read time and refresh write time according to the number of items and the number of their transfer data (in units of word) that are set to be refreshed. For the calculation method, refer to the following.

User's manual for the CPU module used

3 TROUBLESHOOTING

This chapter describes errors that may occur in the use of the A/D converter module and those troubleshooting.

3.1 Troubleshooting with the LEDs

Check the state of the LEDs to narrow down the possible causes of the trouble. This step is the first diagnostics before using the engineering tool.

A state of the A/D converter module can be checked with the RUN LED, ERR LED, and ALM LED. The following table shows the correspondence of these LEDs and a state of the A/D converter module.

Name	Description
RUN LED	Indicates the operating status of the module. On: Normal operation Flashing (1s cycles): In offset/gain setting mode Flashing (400ms cycles): Selected as a module for the online module change Off: 5V power supply interrupted, watchdog timer error occurred, or module replacement allowed in the process of the online module change
ERR LED	Indicates the error status of the module.*1 On: Error occurred Off: Normal operation
ALM LED	Indicates the alarm status of the module.*2 On: Warning (process alarm or rate alarm) issued Flashing: Input signal error detected Off: Normal operation

*1 For details, refer to the following.
☞ Page 183 List of Error Codes

*2 For details, refer to the following.
☞ Page 190 List of Alarm Codes

3.2 Checking the State of the Module

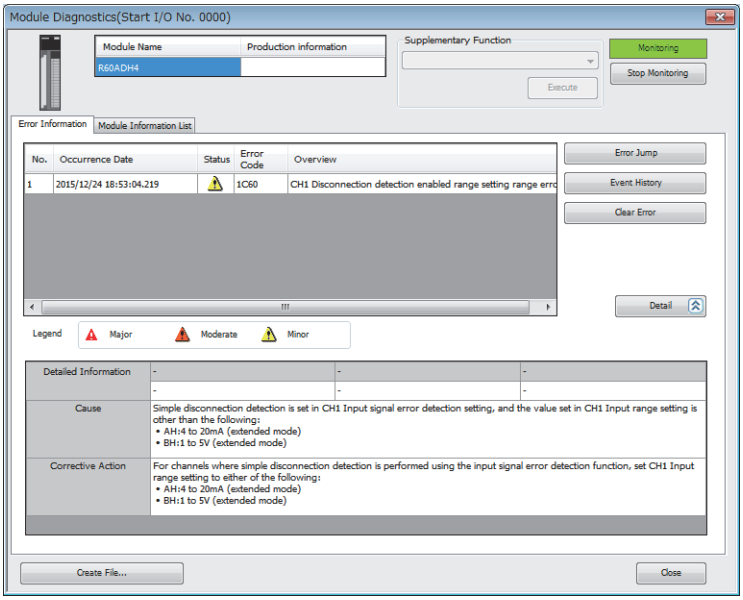
The following functions can be used on the "Module Diagnostics" window of the A/D converter module.

Function	Application
Error Information	Indicates the errors that have occurred. Click the [Event History] button to check not only the errors and alarms that occurred in the A/D converter module, but also the errors detected by each module and the operation history.
Module Information List	Indicates each status information of the A/D converter module.

Error Information

Check the details and actions for the errors that have occurred.

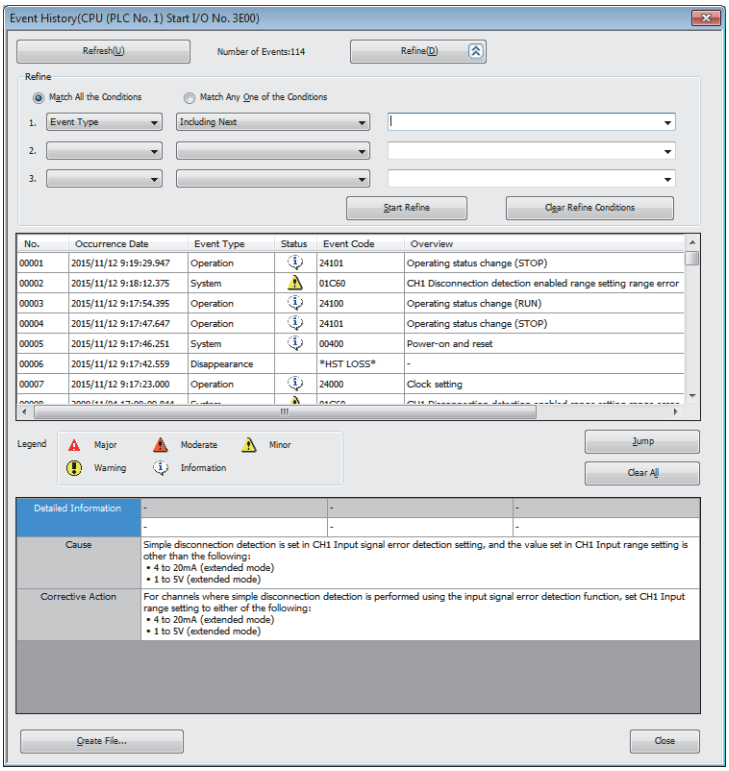
[Diagnostics] ⇨ [System Monitor] ⇨ Right-click the module to be checked. ⇨ "Module Diagnostics"



Item	Description
Cause	Indicates detailed causes of the error.
Corrective Action	Indicates the actions for the error.

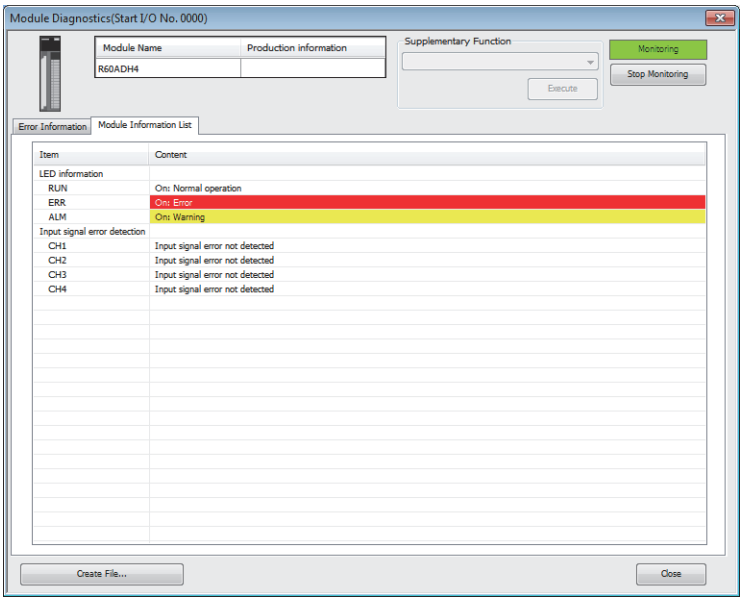
Check alarm codes, error history, and alarm history on the Event History window of the engineering tool.

[Diagnostics] ⇨ [System Monitor] ⇨ [Event History] button



Module Information List

Switch the tab to the "Module Information List" tab and check each status information of the A/D converter module.



Item	Description
LED information	Indicates the LED status of the A/D converter module.
Input signal error detection	Indicates the input signal error detection status of the A/D converter module for each channel.

3.3 Troubleshooting by Symptom

When the RUN LED flashes or turns off

When flashing

Check item	Cause	Action
Check whether the module is in the offset/gain setting mode.	The programmable controller power supply has been turned off and on, or the CPU module has been reset with "Operation mode setting" set to "Offset/gain setting mode" in the module parameter setting of the engineering tool.	In the module parameter setting of the engineering tool, set "Operation mode setting" to other than "Offset/gain setting mode", and turn off and on the programmable controller power supply or reset the CPU module.
	The G(P).OFFGAN instruction has been executed with the mode being set to be switched to the offset/gain setting mode.	Review the program that uses the G(P).OFFGAN instruction to check whether the mode has been switched erroneously.
	The value in 'Mode switching setting' (Un\G296, Un\G297) has been changed and the mode has been switched to the offset/gain setting mode.	Review the program that uses 'Mode switching setting' (Un\G296, Un\G297) to check whether the mode has been switched erroneously.
	For the A/D converter module with the firmware version "03" or earlier, the programmable controller power supply has been turned off and on, or the CPU module has been reset with "Operation mode setting" set to "Normal mode (high speed: 1μs/CH)" in the module parameter setting of the engineering tool.	The normal mode (high speed: 1μs/CH) cannot be used for the A/D converter module with the firmware version "03" or earlier. In the module parameter setting of the engineering tool, set "Operation mode setting" to other than "Normal mode (high speed: 1μs/CH)" or "Offset/gain setting mode", and turn off and on the programmable controller power supply or reset the CPU module. When the normal mode (high speed: 1μs/CH) is used, use the A/D converter module with the firmware version "04" or later.
Check whether the module is selected as the target module for the online module change.	The base number and slot number of the A/D converter module have been set in Module selection specification (Base No.) (SD1600) and Module selection specification (Slot No.) (SD1601).	Turn on Module selection cancel request flag (SM1615).

When turning off

Check item	Action
Check whether the power is supplied.	Check that the supply voltage of the power supply module is within the rated range.
Check whether the capacity of the power supply module is enough.	Calculate the current consumption of mounted modules, such as the CPU module, I/O modules, and intelligent function modules to check that the power capacity is enough.
Check whether the module is mounted properly.	Check the mounting state of the module.
Check whether the module replacement is allowed in the process of the online module change.	Perform the online module change. For details, refer to the following. 📖MELSEC iQ-R Online Module Change Manual
Cases other than the above	Reset the CPU module, and check if the RUN LED turns on. If the RUN LED still remains off, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.

When the ERR LED turns on

When turning on

Check item	Action
Check whether any error has occurred.	Check 'Latest error code' (Un\G0) and take actions described in the list of error codes. ☞ Page 183 List of Error Codes

When the ALM LED turns on or flashes

When turning on

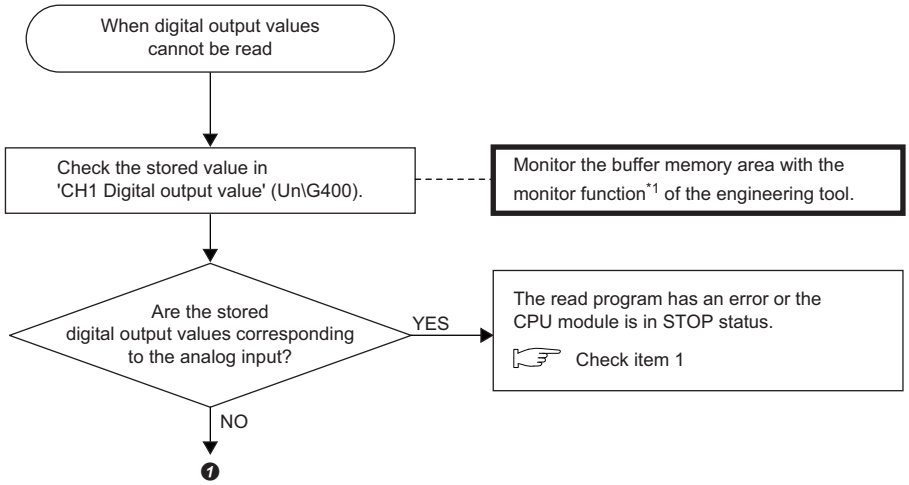
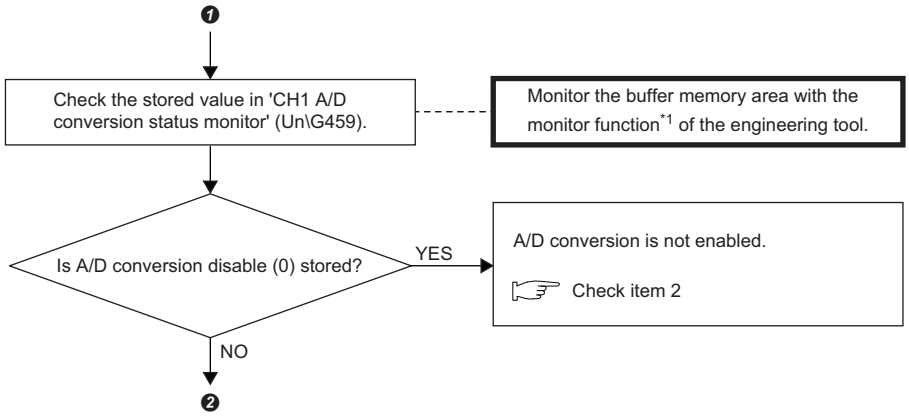
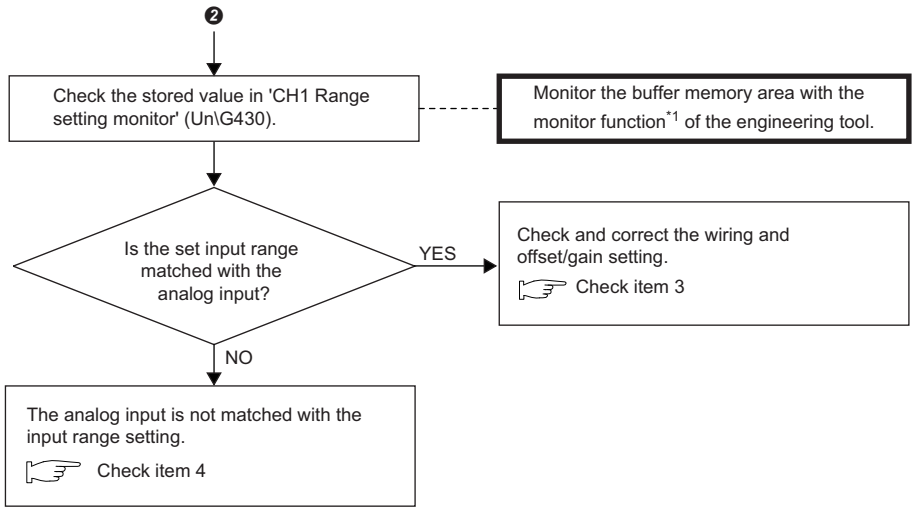
Check item	Action
Check whether any warning has been issued.	Check 'Warning output flag (Process alarm upper limit)' (Un\G36), 'Warning output flag (Process alarm lower limit)' (Un\G37), 'Warning output flag (Rate alarm upper limit)' (Un\G38), and 'Warning output flag (Rate alarm lower limit)' (Un\G39). Take actions described in the list of alarm codes. ☞ Page 190 List of Alarm Codes

When flashing

Check item	Action
Check whether any input signal error has occurred.	Check 'Input signal error detection signal' (XC) or 'Input signal error detection flag' (Un\G40). Take actions described in the list of alarm codes. ☞ Page 190 List of Alarm Codes

When a digital output value cannot be read

Follow the steps in the table below to find the cause of the trouble.

Description	Procedure
■Step 1: Checking the digital output value Check the following. • Check whether digital output values have been stored in the buffer memory. • Check whether the program for reading digital output values has an error.	
■Step 2: Checking the conversion status Check the execution status of the A/D conversion in the module, such as whether the A/D converter module have executed the A/D conversion.	
■Step 3: Checking the input range setting Check whether the input range appropriate to the analog input is set.	

*1 Monitor the buffer memory areas using "Device/Buffer Memory Batch Monitor" or "Intelligent Function Module Monitor".

Point

If digital output values cannot be read even after the above actions are taken, the possible cause is a failure of the A/D converter module. Please consult your local Mitsubishi representative.

Check item 1

The program for reading digital output values has an error or the CPU module is in the STOP state. Check the following items.

Check item	Action
Check whether the program for reading digital output values has an error.	Check 'CH1 Digital output value' (Un\G400) using the monitor functions of the engineering tool ("Device/Buffer Memory Batch Monitor" or "Intelligent Function Module Monitor"). If the digital output value corresponding to the analog input is stored, review and correct the program for reading digital output values.
Check whether the auto refresh setting is correct.	If the value in 'CH1 Digital output value' (Un\G400) is transferred to a device of the CPU module with the auto refresh, review and correct the auto refresh setting.
Check whether the CPU module is in the STOP state.	Change the state of the CPU module to RUN.

Check item 2

The A/D conversion is not executed. Check the following items.

Check item	Action
Check whether A/D conversion disable (1) is set in 'CH1 A/D conversion enable/disable setting' (Un\G500) of the channel where a value is to be input.	Check 'CH1 A/D conversion enable/disable setting' (Un\G500) using the monitor functions of the engineering tool ("Device/Buffer Memory Batch Monitor" or "Intelligent Function Module Monitor"). When 'CH1 A/D conversion enable/disable setting' (Un\G500) is set to A/D conversion disable (1), change it to A/D conversion enable (0) with the engineering tool or a program.
Check whether 'Operating condition setting request' (Y9) has been executed after parameter changes.	Turn on and off 'Operating condition setting request' (Y9)*1 with the engineering tool and check that a digital output value is stored in 'CH1 Digital output value' (Un\G400). If the stored value is correct, further check the program to verify the description of 'Operating condition setting request' (Y9).

*1 If 'Operating condition setting request' (Y9) is on, the A/D conversion does not start. Therefore, first turn on 'Operating condition setting request' (Y9), check the off state of 'Operating condition setting completed flag' (X9), and make sure to turn off 'Operating condition setting request' (Y9).

Check item 3

Wiring or the offset/gain setting is incorrect. Check the following items.

Check item	Action
Check whether a terminal screw is loosen.	Retighten the terminal screw within the specified torque range.
Check whether an incorrect terminal is not connected.	Refer to the external wiring example and check and correct the wiring. MELSEC iQ-R High Speed Analog-Digital Converter Module User's Manual (Startup)
Check whether there is any problem with the wiring, such as looseness or disconnection of analog signal wires.	Identify the faulty area of signal wires by a visual check and continuity check.
Check whether the terminals (V+) and (I+) are connected at the current input.	Always connect the terminals (V+) and (I+) at the current input as shown in the external wiring example. MELSEC iQ-R High Speed Analog-Digital Converter Module User's Manual (Startup)
Check whether there is any potential difference between the AG terminal and the external device GND.	A potential difference may occur between the AG terminal and the external device GND by a cause such as a long wiring distance, resulting in an incorrect A/D conversion. Connect the AG terminal and the external device GND to eliminate the potential difference.
Check whether external devices to be connected at each channel share the same GND.	If the external device GND is shared across channels, noise can sneak in between channels, which may cause some error in A/D conversion. Connect the AG terminal and the external device GND to eliminate the errors.
Check whether the offset/gain setting is correct.	If the input range setting is the user range, turn on and off 'Operating condition setting request' (Y9) and compare CH□ User range setting offset/gain value (Un\G4020 to Un\G4035) with the range reference table. If the stored values are not desired offset/gain values, configure the offset/gain setting again. For the range reference table, refer to the following. ☞ Page 168 Range reference table

Check item 4

The analog input and input range setting do not match. Check the following items.

Check item	Action
Check whether "Input range setting" of the module parameter is correct.	Check "Input range setting" of the module parameter and configure the setting again if the setting is incorrect.
When an input range is set in 'CH1 Range setting' (Un\G598) with a program, check whether the program has any error.	Check 'CH1 Range setting' (Un\G598) using the monitor functions of the engineering tool ("Device/Buffer Memory Batch Monitor" or "Intelligent Function Module Monitor"). If the set value is incorrect, correct the value with the engineering tool or a program.
Check whether 'Operating condition setting request' (Y9) has been executed after parameter changes.	Turn on and off 'Operating condition setting request' (Y9)*1 with the engineering tool and check that a digital output value is stored in 'CH1 Digital output value' (Un\G400). If the stored value is correct, further check the program to verify the description of 'Operating condition setting request' (Y9).

*1 If 'Operating condition setting request' (Y9) is on, the A/D conversion does not start. Therefore, first turn on 'Operating condition setting request' (Y9), check the off state of 'Operating condition setting completed flag' (X9), and make sure to turn off 'Operating condition setting request' (Y9).

When the digital output value does not fall within the range of accuracy

Check item	Action
Check whether any measures have been taken to reduce noise.	To reduce noise, take measures such as the use of shielded cables for connection.

When the synchronization digital output value does not change

Check item		Action
Checking the system parameter settings of GX Works3	Check whether the module is selected as the target module to be synchronized.	Check 'Synchronization status monitor' (Un\G9600). If the monitor status is Not inter-module synchronization target (0), the module is not selected as the target module to be synchronized. Set the module as the target to be synchronized in the system parameter of GX Works3.
Checking the operating status of the CPU module	Check whether the RUN/STOP/RESET switch indicates the STOP state or a stop error has occurred.	Set the RUN/STOP/RESET switch to RUN. When a stop error has occurred, take actions described in the list of error codes. ☞ Page 183 List of Error Codes
Checking the program	Check whether A/D conversion disable (1) is set in 'CH1 A/D conversion enable/disable setting' (Un\G500).	Check 'CH1 A/D conversion enable/disable setting' (Un\G500) and set it to A/D conversion enable (0).
	Check whether 'Operating condition setting request' (Y9) has turned on and off.	Turn on and off 'Operating condition setting request' (Y9) to enable the parameter settings of the function.
	Check whether the inter-module synchronous interrupt program (I44) is prepared.	When obtaining the synchronization digital output value, run the inter-module synchronous interrupt program to refresh the value.
	Check whether the EI instruction has been executed.	To run the inter-module synchronous interrupt program, execute the EI instruction in the program.

3.4 List of Error Codes

If an error occurs during operation, the A/D converter module stores the error code into 'Latest error code' (Un\G0) of the buffer memory. In addition, 'Error flag' (XF) turns on. Turning on 'Error clear request' (YF) allows clearing of the error code of 'Latest error code' (Un\G0), and turning off of 'Error flag' (XF).

Error codes of the A/D converter module are classified in minor errors or moderate errors.

- Minor error: This error is caused by a setting failure of programs and parameters. The A/D conversion continues with the parameter setting before the change. (1000H to 1FFFH)
- Moderate error: Hardware failures are included. The A/D conversion do not continue. (2000H to 2FFFH, 3000H to 3FFFH)

The following table lists the error codes that may be stored.

☐ in an error code: This symbol indicates the number of the channel where an error has occurred. A numerical value of 0 to 3 is used to correspond to CH1 to 4.
(CH1: 0, CH2: 1, CH3: 2, CH4: 3)

△ in an error code: For what this symbol indicates, refer to Description and cause.

Error code (Hex)	Error name	Description and cause	Action
0000H	—	There is no error.	—
1080H	Number of writes to offset/gain settings reach limit error	The number of the offset/gain settings has exceeded the guaranteed maximum number.	Any further setting of offset/gain values may not be reflected correctly.
17E0H	Module-specific backup parameter restore error	Offset/gain values cannot be restored with the module-specific backup parameter.	The module-specific backup parameter file may be damaged. Readjust the user range.
17E1H	Module-specific backup parameter creation error	The module-specific backup parameter has not been created.	Check the free space on the data memory of the control CPU and the SD memory card, and recreate a module-specific backup parameter. For how to create module-specific backup parameters, refer to the following. ☞ Page 163 Creating and updating a module-specific backup parameter
180△H	Interrupt factor generation setting range error	A value other than Interrupt resend request (0) and No interrupt resend request (1) is set in Interrupt factor generation setting [n]. △ indicates the interrupt setting related to the error as follows: 0: Setting 1 to F: Setting 16	Set Interrupt factor generation setting [n] to Interrupt resend request (0) or No interrupt resend request (1).
181△H	Condition target setting range error	A value out of the range is set in Condition target setting [n]. △ indicates the interrupt setting related to the error as follows: 0: Setting 1 to F: Setting 16	■Normal mode (low speed: 20μs/CH), inter-module synchronization mode Set Condition target setting [n] to Disable (0) to Logging read (7). ■Normal mode (high speed: 1μs/CH), simultaneous conversion mode Set Condition target setting [n] to Disable (0) or Continuous logging data storage (8).
182△H	Condition target channel setting range error	A value out of the range is set in Condition target channel setting [n]. △ indicates the interrupt setting related to the error as follows: 0: Setting 1 to F: Setting 16	Set Condition target channel setting [n] to All channels (0) to CH4 (4).
183△H	Interrupt condition setting overlap error	The same combination of condition target and condition target channel are set to multiple interrupt settings. (Setting 0: All channels in Condition target channel setting is regarded the same as setting 1: CH1 to 4: CH4.)	For each interrupt setting, check and correct the combination of all Condition target setting and Condition target channel setting.
184△H	Condition target setting error	For one channel, both "5: A/D conversion completed" and "7: Logging read" are set as an interrupt condition target.	For each channel, set either "5: A/D conversion completed" or "7: Logging read" in Condition target setting [n].
1860H[*1]	G(P).OGSTOR instruction execution error in offset/gain setting mode	The G(P).OGSTOR instruction has been executed in offset/gain setting mode.	Do not execute the G(P).OGSTOR instruction in the offset/gain setting mode.

Error code (Hex)	Error name	Description and cause	Action
1861H	Offset/gain setting continuous write occurrence error	The G(P).OGSTOR instruction has been executed continuously or a setting value has been continuously written to the flash memory 26 times or more in the offset/gain setting.	For the G(P).OGSTOR instruction, execute it only once per module. For the offset/gain setting, write the setting value only once per setting.
1862H	Model mismatch error at the execution of OGSTOR	The G(P).OGSTOR instruction has been executed on a module different from the one on which the G(P).OGLOAD instruction was executed. The G(P).OGSTOR instruction has been executed ahead of the G(P).OGLOAD instruction.	Execute the G(P).OGLOAD and G(P).OGSTOR instructions on the same module. As the other way, execute the G(P).OGLOAD instruction on the module whose data is to be restored, and then execute the G(P).OGSTOR instruction on the module to which the data is to be restored.
190☐H	Range setting range error	A value out of the range is set in CH☐ Range setting.	Set CH☐ Range setting to the following values: • 4 to 20mA (0H) to 0 to 10V (5H) • 4 to 20mA (extended mode) (AH) • 1 to 5V (extended mode) (BH) • User range setting (FH)
191☐H	Averaging process specification setting range error	A value out of the range is set in CH☐ Averaging process specification.	■Normal mode (medium speed: 10μs/CH), normal mode (low speed: 20μs/CH) Set CH☐ Averaging process specification to Sampling processing (0) to Band pass filter (7). ■Normal mode (high speed: 1μs/CH), simultaneous conversion mode, inter-module synchronization mode Set CH☐ Averaging process specification to Sampling processing (0) or Moving average (3).
192☐H	Time average setting range error	When the time average is set in CH☐ Averaging process specification, a value other than 1 to 5000 is set in CH☐ Time average/Count average/Moving average/Primary delay filter constant setting.	Set CH☐ Time average/Count average/Moving average/Primary delay filter constant setting to 1 to 5000.
193☐H	Count average setting range error	When the count average is set in CH☐ Averaging process specification, a value other than 4 to 62500 is set in CH☐ Time average/Count average/Moving average/Primary delay filter constant setting.	Set CH☐ Time average/Count average/Moving average/Primary delay filter constant setting to 4 to 62500.
194☐H	Moving average setting range error	When the moving average is set in CH☐ Averaging process specification, a value other than 2 to 1000 is set in CH☐ Time average/Count average/Moving average/Primary delay filter constant setting.	Set CH☐ Time average/Count average/Moving average/Primary delay filter constant setting to 2 to 1000.
195☐H	Primary delay filter constant setting range error	When the primary delay filter is set in CH☐ Averaging process specification, a value other than 1 to 500 is set in CH☐ Time average/Count average/ Moving average/Primary delay filter constant setting.	Set CH☐ Time average/Count average/Moving average/Primary delay filter constant setting to 1 to 500.

Error code (Hex)	Error name	Description and cause	Action
196☐H	Low pass filter setting range error	A value out of the range is set in CH☐ LPF Pass band edge frequency or CH☐ Attenuation band width.	Set CH☐ LPF Pass band edge frequency and CH☐ Attenuation band width to the following values: ■When the conversion cycle is 10μs • Pass band edge frequency + Attenuation band width ≤ 48000 • Attenuation band width ≥ 1300 • Pass band edge frequency ≥ 0 ■When the conversion cycle is 20μs • Pass band edge frequency + Attenuation band width ≤ 24000 • Attenuation band width ≥ 650 • Pass band edge frequency ≥ 0 ■When the conversion cycle is 30μs • Pass band edge frequency + Attenuation band width ≤ 16000 • Attenuation band width ≥ 440 • Pass band edge frequency ≥ 0 ■When the conversion cycle is 40μs • Pass band edge frequency + Attenuation band width ≤ 12000 • Attenuation band width ≥ 330 • Pass band edge frequency ≥ 0 ■When the conversion cycle is 60μs • Pass band edge frequency + Attenuation band width ≤ 8000 • Attenuation band width ≥ 220 • Pass band edge frequency ≥ 0 ■When the conversion cycle is 80μs • Pass band edge frequency + Attenuation band width ≤ 6000 • Attenuation band width ≥ 170 • Pass band edge frequency ≥ 0
197☐H	High pass filter setting range error	A value out of the range is set in CH☐ HPF Pass band edge frequency or CH☐ Attenuation band width.	Set CH☐ HPF Pass band edge frequency and CH☐ Attenuation band width to the following values: ■When the conversion cycle is 10μs • Pass band edge frequency - Attenuation band width > 0 • Attenuation band width ≥ 1300 • Pass band edge frequency ≤ 48000 ■When the conversion cycle is 20μs • Pass band edge frequency - Attenuation band width > 0 • Attenuation band width ≥ 650 • Pass band edge frequency ≤ 24000 ■When the conversion cycle is 30μs • Pass band edge frequency - Attenuation band width > 0 • Attenuation band width ≥ 440 • Pass band edge frequency ≤ 16000 ■When the conversion cycle is 40μs • Pass band edge frequency - Attenuation band width > 0 • Attenuation band width ≥ 330 • Pass band edge frequency ≤ 12000 ■When the conversion cycle is 60μs • Pass band edge frequency - Attenuation band width > 0 • Attenuation band width ≥ 220 • Pass band edge frequency ≤ 8000 ■When the conversion cycle is 80μs • Pass band edge frequency - Attenuation band width > 0 • Attenuation band width ≥ 170 • Pass band edge frequency ≤ 6000

Error code (Hex)	Error name	Description and cause	Action
198☐H	Band pass filter setting range error	A value out of the range is set in CH☐ BPF Pass band edge frequency (Low), CH☐ BPF Pass band edge frequency (High), or CH☐ Attenuation band width.	Set CH☐ BPF Pass band edge frequency (Low), CH☐ BPF Pass band edge frequency (High), and CH☐ Attenuation band width to the following values: ■When the conversion cycle is 10μs • Pass band edge frequency (High) + Attenuation band width ≤ 48000 • Pass band edge frequency (Low) - Attenuation band width > 0 • Attenuation band width ≥ 1300 • Pass band edge frequency (Low) < Pass band edge frequency (High) ■When the conversion cycle is 20μs • Pass band edge frequency (High) + Attenuation band width ≤ 24000 • Pass band edge frequency (Low) - Attenuation band width > 0 • Attenuation band width ≥ 650 • Pass band edge frequency (Low) < Pass band edge frequency (High) ■When the conversion cycle is 30μs • Pass band edge frequency (High) + Attenuation band width ≤ 16000 • Pass band edge frequency (Low) - Attenuation band width > 0 • Attenuation band width ≥ 440 • Pass band edge frequency (Low) < Pass band edge frequency (High) ■When the conversion cycle is 40μs • Pass band edge frequency (High) + Attenuation band width ≤ 12000 • Pass band edge frequency (Low) - Attenuation band width > 0 • Attenuation band width ≥ 330 • Pass band edge frequency (Low) < Pass band edge frequency (High) ■When the conversion cycle is 60μs • Pass band edge frequency (High) + Attenuation band width ≤ 8000 • Pass band edge frequency (Low) - Attenuation band width > 0 • Attenuation band width ≥ 220 • Pass band edge frequency (Low) < Pass band edge frequency (High) ■When the conversion cycle is 80μs • Pass band edge frequency (High) + Attenuation band width ≤ 6000 • Pass band edge frequency (Low) - Attenuation band width > 0 • Attenuation band width ≥ 170 • Pass band edge frequency (Low) < Pass band edge frequency (High)
19A0H	Across channels average setting error	The averaging processing different from one another is set for each channel in simultaneous conversion mode or in inter-module synchronization mode.	Set values so that the settings of CH☐ Averaging process specification and CH☐ Time average/Count average/Moving average/Primary delay filter constant setting are the same for all channels where A/D conversion is enabled.
1A0☐H	Scaling enable/disable setting range error	A value other than Enable (0) and Disable (1) is set in CH☐ Scaling enable/disable setting.	Set CH☐ Scaling enable/disable setting to Enable (0) or Disable (1).
1A1☐H	Scaling setting range error	A value other than -32000 to 32000 is set in CH☐ Scaling lower limit value and/or CH☐ Scaling upper limit value.	Set CH☐ Scaling lower limit value and CH☐ Scaling upper limit value to -32000 to 32000.
1A2☐H	Scaling upper/lower limit value setting error	CH☐ Scaling upper limit value and CH☐ Scaling lower limit value are set as the scaling upper limit value = the scaling lower limit value.	Set CH☐ Scaling upper limit value and CH☐ Scaling lower limit value as the scaling upper limit value ≠ the scaling lower limit value.
1A5☐H	Digital clipping enable/ disable setting range error	A value other than Enable (0) and Disable (1) is set in CH☐ Digital clipping enable/disable setting.	Set CH☐ Digital clipping enable/disable setting to Enable (0) or Disable (1).
1A8☐H	Maximum value reset request setting range error	A value other than No request (0) and Reset request (1) is set in CH☐ Maximum value reset request.	Set CH☐ Maximum value reset request to No request (0) or Reset request (1).

Error code (Hex)	Error name	Description and cause	Action
1A9☐H	Minimum value reset request setting range error	A value other than No request (0) and Reset request (1) is set in CH☐ Minimum value reset request.	Set CH☐ Minimum value reset request to No request (0) or Reset request (1).
1B0☐H	Warning output setting (Process alarm) range error	A value other than Enable (0) and Disable (1) is set in CH☐ Warning output setting (Process alarm).	Set CH☐ Warning output setting (Process alarm) to Enable (0) or Disable (1).
1B△☐H	Process alarm upper lower limit value setting range error	The values set in CH☐ Process alarm upper upper limit value to CH☐ Process alarm lower lower limit value do not satisfy the following condition: Upper upper limit value ≥ Upper lower limit value ≥ Lower upper limit value ≥ Lower lower limit value △ indicates that the set values are as follows: 1: Process alarm lower lower limit value > Process alarm lower upper limit value 2: Process alarm lower upper limit value > Process alarm upper lower limit value 3: Process alarm upper lower limit value > Process alarm upper upper limit value	Set CH☐ Process alarm upper upper limit value to CH☐ Process alarm lower lower limit value so that the values satisfy the following condition: Upper upper limit value ≥ Upper lower limit value ≥ Lower upper limit value ≥ Lower lower limit value
1B8☐H	Warning output setting (Rate alarm) range error	A value other than Enable (0) and Disable (1) is set in CH☐ Warning output setting (Rate alarm).	Set CH☐ Warning output setting (Rate alarm) to Enable (0) or Disable (1).
1B9☐H	Rate alarm warning detection cycle setting range error	A value other than 1 to 32000 is set in CH☐ Rate alarm warning detection cycle setting.	Set CH☐ Rate alarm warning detection cycle setting to 1 to 32000.
1BA☐H	Rate alarm upper/lower limit setting value inversion error	CH☐ Rate alarm upper limit value and CH☐ Rate alarm lower limit value are set as Lower limit value ≥ Upper limit value.	Set CH☐ Rate alarm upper limit value and CH☐ Rate alarm lower limit value as Lower limit value < Upper limit value.
1C0☐H	Input signal error detection setting range error	A value out of the range is set in CH☐ Input signal error detection setting.	Set CH☐ Input signal error detection setting to Disable (0) to Simple disconnection detection (4).
1C1☐H	Input signal error detection setting value range error	A value other than 0 to 250 is set in CH☐ Input signal error detection lower limit setting value or CH☐ Input signal error detection upper limit setting value.	Set CH☐ Input signal error detection lower limit setting value or CH☐ Input signal error detection upper limit setting value to 0 to 250.
1C6☐H	Disconnection detection enabled range setting range error	Simple disconnection detection is set in CH☐ Input signal error detection setting, and the value set in CH☐ Input range setting is other than the following: • 4 to 20mA (extended mode) (AH) • 1 to 5V (extended mode) (BH)	For channels where simple disconnection detection is performed using the input signal error detection function, set CH☐ Input range setting to either of the following: • 4 to 20mA (extended mode) (AH) • 1 to 5V (extended mode) (BH)
1D0☐H	Logging enable/disable setting range error	A value out of the range is set in CH☐ Logging enable/disable setting.	■Normal mode (low speed: 20μs/CH) Set CH☐ Logging enable/disable setting to Normal logging (0) or Disable (1). ■Normal mode (high speed: 1μs/CH) Set CH☐ Logging enable/disable setting to any of the following: • Disable (1) • High speed continuous logging (2) • High speed logging (3) High speed logging (3) cannot be used for the module with the firmware version 04 or earlier. Set CH☐ Logging enable/disable setting to Disable (1) or High speed continuous logging (2). When using High speed logging (3), use the module with the firmware version 05 or later.
1D1☐H	Logging cycle setting value range error	A value out of the range is set in CH☐ Logging cycle setting value and/or CH☐ Logging cycle unit setting.	Set one or both of CH☐ Logging cycle setting value and CH☐ Logging cycle unit setting to the values within the range.
1D2☐H	Logging cycle setting disable error	CH☐ Logging cycle setting value and CH☐ Logging cycle unit setting are set so that the set logging cycle falls below the conversion cycle.	Set CH☐ Logging cycle setting value and CH☐ Logging cycle unit setting so that the logging cycle is not less than the conversion cycle of the object to be logged.
1D3☐H	Logging data setting range error	A value other than Digital output value (0) and Digital operation value (1) is set in CH☐ Logging data setting.	Set CH☐ Logging data setting to Digital output value (0) or Digital operation value (1).
1D4☐H	Post-trigger logging points setting range error	A value out of the range of "1 to (the value set in CH☐ Logging data points setting) × 100" is set in CH☐ Post-trigger logging points.	Set CH☐ Post-trigger logging points to a value within the range of "1 to (the value set in CH☐ Logging data points setting) × 100".

Error code (Hex)	Error name	Description and cause	Action
1D5☐H	Level trigger condition setting range error	A value out of the range is set in CH☐ Level trigger condition setting.	■Normal mode (low speed: 20μs/CH) Set CH☐ Level trigger condition setting to Disable (0) to Process alarm (upper limit warning/lower limit warning) (6). ■Normal mode (high speed: 1μs/CH) Set CH☐ Level trigger condition setting to Disable (0) to Level trigger (Rise and fall) (3).
1D6☐H	Trigger data setting range error	A value other than 0 to 9999 is set in CH☐ Trigger data.	Set CH☐ Trigger data to 0 to 9999.
1D8☐H	Loading interrupt enable/ disable setting range error	A value other than Enable (0) and Disable (1) is set in CH☐ Loading interrupt enable/disable setting.	Set CH☐ Loading interrupt enable/disable setting to Enable (0) or Disable (1).
1D9☐H	Logging read points setting value range error	A value out of the range of "1 to (the value set in CH☐ Logging data points setting)" is set in CH☐ Logging read points setting value.	Set CH☐ Logging read points setting value to a value within the range of "1 to (the value set in CH☐ Logging data points setting)".
1DA☐H	Logging data points setting range error	A value other than 0 to 900 is set in CH☐ Logging data points setting.	Set CH☐ Logging data points setting to 0 to 900.
1DB0H	Logging data points setting total range error	The total of values set in CH☐ Logging data points setting is beyond 900.	Set values so that the total of values set in CH☐ Logging data points setting of all channels becomes 900 or less.
1DC☐H	Logging enable error (logging points setting 0)	For the channel where CH☐ Logging enable/disable setting is set to Normal logging (0) or High speed logging (3), 0 is set in CH☐ Logging data points setting.	■Normal mode (low speed: 20μs/CH) When using the normal logging function, set CH☐ Logging data points setting to 1 to 900. When not using the normal logging function, set CH☐ Logging enable/disable setting to Disable (1). ■Normal mode (high speed: 1μs/CH) When using the high speed logging function, set CH☐ Logging data points setting to 1 to 900. When not using the high speed logging function, set CH☐ Logging enable/disable setting to Disable (1).
1DD☐H	Level trigger condition process alarm setting error	CH☐ Level trigger condition setting is set to Process alarm (upper limit warning) (4) to Process alarm (upper limit warning/lower limit warning) (6) while CH☐ Warning output setting (Process alarm) is set to Disable (1).	When setting CH☐ Level trigger condition setting to Process alarm (upper limit warning) (4) to Process alarm (upper limit warning/lower limit warning) (6), set CH☐ Warning output setting (Process alarm) to Enable (0).
1DE0H	Across channels logging setting error	A value set in CH☐ Logging enable/disable setting is High speed continuous logging (2) for one channel, and High speed logging (3) for another channel.	The high speed continuous logging function and the high speed logging function cannot be used together. When using the high speed continuous logging function or the high speed logging function, set CH☐ Logging enable/disable setting to a same value (High speed continuous logging (2) or High speed logging (3)) across all the channels used for the logging.
1E50H	Offset/gain setting channel specification error	In the offset/gain setting, Setting channel (1) is set for both CH☐ Offset/gain setting mode (offset specification) and CH☐ Offset/gain setting mode (gain specification), or Disable (0) is set for both CH☐ Offset/gain setting mode (offset specification) and CH☐ Offset/gain setting mode (gain specification) of all channels.	Correctly set CH☐ Offset/gain setting mode (offset specification) and CH☐ Offset/gain setting mode (gain specification).
1E51H	User range data invalid (CH identification disabled)	An invalid value is set in the offset/gain setting. The number of the channel in which this error occurs cannot be identified.	Perform the offset/gain setting again for all channels where the user range setting is used. If the error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
1E6☐H	User range data invalid (CH identification enabled)	An invalid value is set in the offset/gain setting for CH☐.	Perform the offset/gain setting again for the channels where the error has occurred. If the error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
1E7☐H	Offset/gain value inversion error	The offset value and gain value to be saved in the flash memory are as follows: Offset value ≥ Gain value	Perform the offset/gain setting again so that the following condition is satisfied: Offset value < Gain value

Error code (Hex)	Error name	Description and cause	Action
1E8☐H	Offset/gain setting channel range error	A value other than Disable (0) and Setting channel (1) is set in CH☐ Offset/gain setting mode (offset specification) and CH☐ Offset/gain setting mode (gain specification).	Set CH☐ Offset/gain setting mode (offset specification) and CH☐ Offset/gain setting mode (gain specification) to Disable (0) or Setting channel (1).
1EA0H	Synchronization cycle time setting enabled range error	When the oversampling mode is enabled, the inter-module synchronization cycle setting of system parameter is set to either of the following: • The fixed scan interval setting is other than 0.05ms unit. • Inter-module synchronization cycle setting > 1ms	When enabling the oversampling mode, set the inter-module synchronization cycle setting of system parameter so that the following conditions are satisfied. • The fixed scan interval setting is set to 0.05ms unit. • Inter-module synchronization cycle setting ≤ 1ms
2610H	Inter-module synchronization signal error	Synchronization loss is detected with the inter-module synchronization function operating.	The module may be affected by noise. Check and adjust the cable wiring and the installation environment of the programmable controllers, and restart the system. If the error reoccurs even after the adjustment, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
3001H	Hardware failure (moderate)	A hardware failure (moderate) has occurred in the module.	Power off and on the module. If the error occurs again, the possible cause is a failure of the module. Please consult your local Mitsubishi representative.
3030H	Flash memory error	The data in the flash memory is abnormal.	Check the digital output values. If the values are abnormal, please consult your local Mitsubishi representative.

*1 The error code is not stored in 'Latest error code' (Un\G0). It is written to Completion status area (S)+1 of the G(P).OGSTOR instruction. In addition, 'Error flag' (XF) does not turn on.

3.5 List of Alarm Codes

If an alarm occurs during operation, the A/D converter module stores the alarm code into 'Latest alarm code' (Un\G2) of the buffer memory. Turning on 'Error clear request' (YF) allows clearing of the alarm code of 'Latest alarm code' (Un\G2).
The following table lists the alarm codes that may be stored.
☐ in an alarm code: This symbol indicates the number of the channel where an alarm has occurred. A numerical value of 0 to 3 is used to correspond to CH1 to 4.
(CH1: 0, CH2: 1, CH3: 2, CH4: 3)

Alarm code (Hex)	Alarm name	Description and cause	Action
080☐H	Process alarm (upper limit)	The process alarm (upper limit) has occurred in CH☐.	Adjust CH☐ Digital operation value to fall within the range. As a result, the corresponding bit of CH☐ Warning output flag (Process alarm upper limit) or CH☐ Warning output flag (Process alarm lower limit), and 'Warning output signal' (X8) turn off automatically.
081☐H	Process alarm (lower limit)	The process alarm (lower limit) has occurred in CH☐.	
082☐H	Rate alarm (upper limit)	The rate alarm (upper limit) has occurred in CH☐.	Adjust the change rate in CH☐ Digital output value to fall within the range. As a result, the corresponding bit of CH☐ Warning output flag (Rate alarm upper limit) or CH☐ Warning output flag (Rate alarm lower limit), and 'Warning output signal' (X8) turn off automatically.
083☐H	Rate alarm (lower limit)	The rate alarm (lower limit) has occurred in CH☐.	
090☐H	Input signal error detection (upper limit)	An input signal error (upper limit) has been detected in CH☐.	The following operations are performed by turning on and off 'Error clear request' (YF) after the analog input value returns within the setting range. • All bits of Input signal error detection flag turn to Normal (0). • 'Input signal error detection signal' (XC) turns off. • 'Latest alarm code' (Un\G2) is cleared.
091☐H	Input signal error detection (lower limit)	An input signal error (lower limit) has been detected in CH☐.	
0A0☐H	Input signal error detection (disconnection)	An input signal error (disconnection) has been detected in CH☐.	
0B00H	Operating condition setting error during continuous logging	'Operating condition setting request' (Y9) has been turned on during continuous logging operation.	■Simultaneous conversion mode, inter-module synchronization mode 'Operating condition setting request' (Y9) cannot be turned on during continuous logging operation. Therefore, stop the continuous logging before turning on 'Operating condition setting request' (Y9). ■Normal mode (high speed: 1μs/CH) 'Operating condition setting request' (Y9) cannot be turned on during high speed continuous logging operation. Therefore, stop the high speed continuous logging before turning on 'Operating condition setting request' (Y9).
0D00H	Mode switching request error	Mode switching has been attempted in the situation where it is not allowed.	When the module satisfies any of the following conditions, the switching to the offset/gain setting mode is not allowed. • The inter-module synchronization target module is set. • The operation mode is set to the normal mode (high speed: 1μs/CH). • The operation mode is set to the simultaneous conversion mode. When performing the offset/gain setting, set the module as a synchronization non-target in the system parameters, or change the operation mode to the normal mode (medium speed: 10μs/CH) or normal mode (low speed: 20μs/CH). Then shift to the offset/gain setting mode. Turn on and off 'Error clear request' (YF) to clear the alarm.

APPENDICES

Appendix 1 Module Label

The functions of the A/D converter module can be set by using module labels.

Module labels of I/O signals

The module label name of an I/O signal is defined with the following structure:
"Module name"_"Module number".b"Label name" or "Module name"_"Module number".b"Label name"_D

Ex.
R60ADH_1.bModuleREADY_D

■Module name

The character string of a module model name is given.

■Module number

A number starting from 1 is added to identify modules that have the same module name.

■Label name

The label identifier unique to a module is given.

■_D

This string indicates that the module label is for the direct access input (DX) or direct access output (DY). A module label without the string is for the input (X) or output (Y) of the refresh processing.

Module labels of buffer memory areas

The module label name of a buffer memory area is defined with the following structure:
"Module name"_"Module number"."Data type"_D["(Channel)"]."Data format""Label name"_D

Ex.
R60ADH_1.stnMonitor_D[0].wDigitalOutputValue_D

■Module name

The character string of a module model name is given.

■Module number

A number starting from 1 is added to identify modules that have the same module name.

■Data type

The data type to sort a buffer memory area is given. Each data type is as follows:

Data type	Description
stnMonitor	Monitor
stnControl	Control
stnSetting	Setting

■Channel

The channel number corresponding to a module label is given. A numerical value of 0 to 3 is used to correspond to CH1 to 4. (CH1: 0, CH2: 1, CH3: 2, CH4: 3)

■Data format

The string that represents the data size of a buffer memory area is given. Each data format is as follows:

Data format	Description
u	Word [Unsigned]/Bit string [16-bit]
w	Word [Signed]
d	Double word [Signed]
ud	Double word [Unsigned]/Bit string [32-bit]

■Label name

The label identifier unique to a module is given.

■_D

This string indicates that the module label is for the direct access. A module label without the string is for the auto refresh. The following table shows the differences between the auto refresh and direct access.

Type	Description	Access timing	Example
Auto refresh	Values that are read from or written to the module label are reflected in the module collectively at the auto refresh. The run time of the program can be reduced. To use the auto refresh, set "Target" to "Module Label" in "Refresh settings" of "Module Parameter".	At auto refresh	R60ADH_1.stnMonitor[0].wDigitalOutputValue
Direct access	Values that are read from or written to the module label are reflected in the module instantly. Compared with the auto refresh, the run time of the program becomes longer. However, the responsiveness is high. For the instruction processing time, refer to the following. MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks)	At reading/writing from/to the module label	R60ADH_1.stnMonitor_D[0].wDigitalOutputValue_D

Appendix 2 I/O Signals

List of I/O signals

The following table lists the I/O signals of the A/D converter module.
For details on the I/O signals, refer to the following.
☞ Page 194 Details of input signals
☞ Page 201 Details of output signals

Point

- The I/O number (X/Y) described below shows the case when the start I/O number of the A/D converter module is set to "0".
- Do not use the "Use prohibited" signals shown below because the system uses them. If users use (turn off and on) the signals, the functions of the A/D converter module cannot be guaranteed.

Input signal

Device number	Signal name
X0	Module READY
X1 to X7	Use prohibited
X8	Warning output signal
X9	Operating condition setting completed flag
XA	Offset/gain setting mode status flag
XB	Channel change completed flag
XC	Input signal error detection signal
XD	Maximum value/minimum value reset completed flag
XE	A/D conversion completed flag
XF	Error flag

Output signal

Device number	Signal name
Y0	Use prohibited
Y1	CH1 Logging hold request
Y2	CH2 Logging hold request
Y3	CH3 Logging hold request
Y4	CH4 Logging hold request
Y5 to Y8	Use prohibited
Y9	Operating condition setting request
YA	User range write request
YB	Channel change request
YC	Use prohibited
YD	Maximum value/minimum value reset request
YE	Use prohibited
YF	Error clear request

Details of input signals

The following describes the details of the input signals for the A/D converter module which are assigned to the CPU module. The I/O numbers (X/Y) described in this section are for the case when the start I/O number of the A/D converter module is set to 0.

Point

This section describes buffer memory addresses for CH1. For details on the buffer memory addresses for CH2 and later, refer to the following.

☞ Page 204 List of buffer memory addresses

Module READY

Common

Module READY (X0) turns on to indicate the preparation for the A/D conversion is completed after the power-on or after the reset operation of the CPU module.

In the following cases, 'Module READY' (X0) turns off.

- In the offset/gain setting mode (In this case, the A/D conversion is performed.)
- When a watchdog timer error occurs in the A/D converter module (In this case, the A/D conversion is not performed.)

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4
Module READY	X0			

Warning output signal

Medium speed | Low speed | Simultaneous conversion | Synchronization

'Warning output signal' (X8) turns on when the process alarm or rate alarm has been detected. When the warning output function is disabled for all channels, 'Warning output signal' (X8) is always off.

■Device number

The following shows the device number of this input signal.

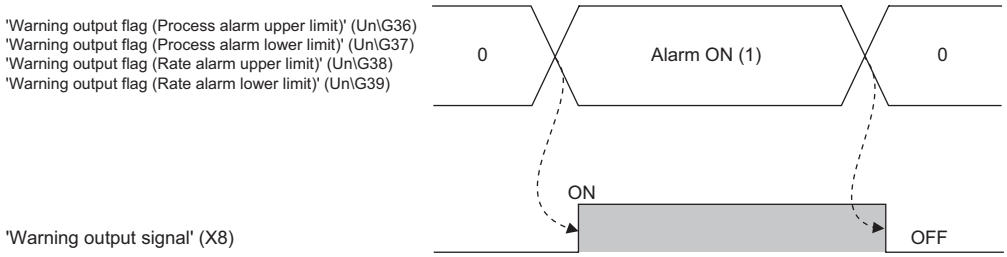
Signal name	CH1	CH2	CH3	CH4
Warning output signal	X8			

■Process alarm

- 'Warning output signal' (X8) turns on when digital output values or digital operation values of the A/D conversion enabled channels exceed the ranges of the process alarm lower lower limit value to the process alarm upper upper limit value after 'CH1 Warning output setting (Process alarm)' (Un\G512) is set to Enable (0). The ALM LED also turns on.
- 'Warning output signal' (X8) turns off when the digital output values or digital operation values fall within the setting range in all the A/D conversion enabled channels. The ALM LED also turns off.

■Rate alarm

- 'Warning output signal' (X8) turns on when the change rate of digital output values of the A/D conversion enabled channels exceed the ranges of the rate alarm lower limit value to rate alarm upper limit value after 'CH1 Warning output setting (Rate alarm)' (Un\G513) is set to Enable (0). The ALM LED also turns on.
- 'Warning output signal' (X8) turns off when the change rate of the digital output values fall within the setting range in all the A/D conversion enabled channels. The ALM LED also turns off.



Performed by the A/D converter module.

Operating condition setting completed flag

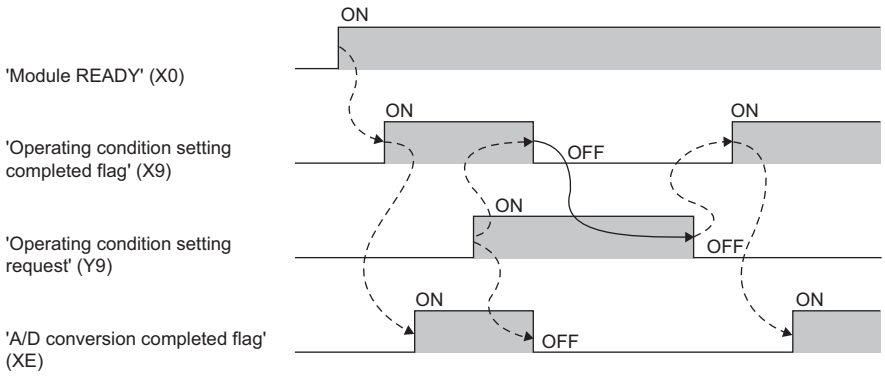
Common

When changing values of the buffer memory, use 'Operating condition setting completed flag' (X9) as an interlock condition to turn on and off 'Operating condition setting request' (Y9). For the buffer memory addresses that require turning on and off of 'Operating condition setting request' (Y9) to enable the new values, refer to the following.

☞ Page 204 List of buffer memory addresses

When 'Operating condition setting completed flag' (X9) is off, the A/D conversion is not performed.

When 'Operating condition setting request' (Y9) is on, 'Operating condition setting completed flag' (X9) turns off.



Performed by the A/D converter module.

Performed by a program.

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4
Operating condition setting completed flag	X9			

Offset/gain setting mode status flag

Medium speed Low speed

■Device number

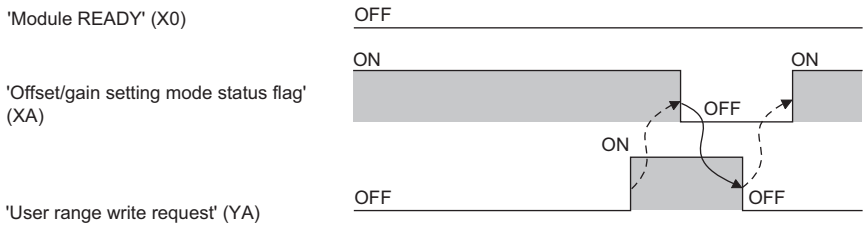
The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4
Offset/gain setting mode status flag	XA			

■In the offset/gain setting mode

When registering the value, which has been adjusted with the offset/gain setting, use 'Offset/gain setting mode status flag' (XA) as an interlock condition to turn on and off 'User range write request' (YA).

When the offset/gain setting is configured from the offset/gain setting window of an engineering tool, the setting is performed properly on the window. Therefore, a program is not required to perform the setting.

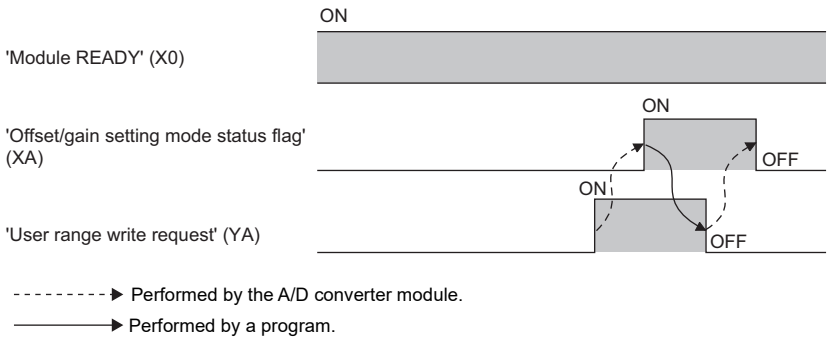


■In the normal mode (medium speed: 10μs/CH) and normal mode (low speed: 20μs/CH)

In the user range setting restoration, use 'Offset/gain setting mode status flag' (XA) as an interlock condition to turn on and off 'User range write request' (YA).

For user range setting restoration, refer to the following.

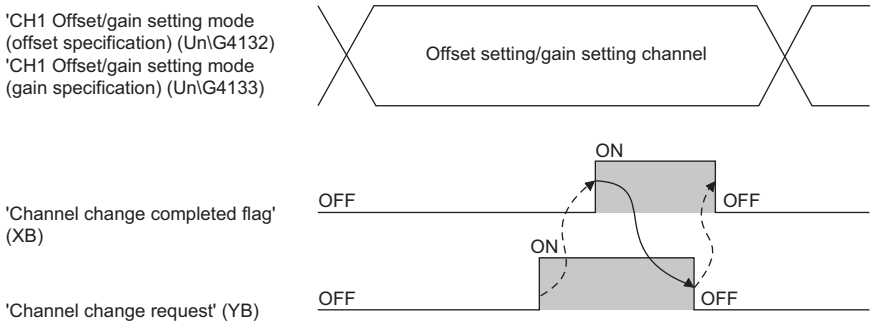
☞ Page 162 Backing up, Saving, and Restoring Offset/Gain Values



Channel change completed flag

Medium speed Low speed

When changing a channel to perform the offset/gain setting, use 'Channel change completed flag' (XB) as an interlock condition to turn on and off 'Channel change request' (YB). When the offset/gain setting is configured from the offset/gain setting window of an engineering tool, the setting is performed properly on the window. Therefore, a program is not required to perform the setting.



■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4
Channel change completed flag	XB			

A

Input signal error detection signal

Medium speed | Low speed | Simultaneous conversion | Synchronization

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4
Input signal error detection signal	XC			

■Turning on 'Input signal error detection signal' (XC)

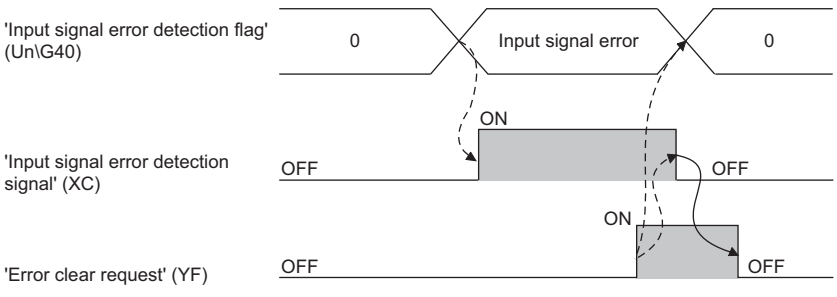
'Input signal error detection signal' (XC) turns on when an analog input value exceeds the range set with 'CH1 Input signal error detection lower limit setting value' (Un\G529) and 'CH1 Input signal error detection upper limit setting value' (Un\G530) in any of A/D conversion enabled channels, after the detection condition is set in 'CH1 Input signal error detection setting' (Un\G528). When the simple disconnection detection is set, the signal ignores the settings of 'CH1 Input signal error detection lower limit setting value' (Un\G529) and 'CH1 Input signal error detection upper limit setting value' (Un\G530) and turns on at the disconnection detection.

When 'Input signal error detection signal' (XC) turns on, the following operations are performed.

- 'CH1 Digital output value' (Un\G400) and 'CH1 Digital operation value' (Un\G402) hold the digital values just before the error was detected.
- The ALM LED flashes.

■Turning off 'Input signal error detection signal' (XC)

Turning off of 'Input signal error detection signal' (XC) varies depending on the setting of 'Input signal error detection auto-clear enable/disable setting' (Un\G302).

'Input signal error detection auto-clear enable/disable setting' (Un\G302)	Operation of when 'Input signal error detection signal' (XC) is off
Enable (0)	When the cause of the input signal error is eliminated and the analog input value falls within the setting range, 'Input signal error detection signal' (XC) automatically turns off. When 'Input signal error detection signal' (XC) turns off, the following operations are performed. • The ALM LED turns off. • 'Input signal error detection flag' (Un\G40) turns off.
Disable (1)	'Input signal error detection signal' (XC) turns off by turning on and off 'Error clear request' (YF) after the cause of the input signal error is eliminated and the analog input value falls within the setting range. When 'Input signal error detection signal' (XC) turns off, the following operations are performed. • The ALM LED turns off. • 'Input signal error detection flag' (Un\G40) turns off. • 'Latest alarm code' (Un\G2) is cleared. 

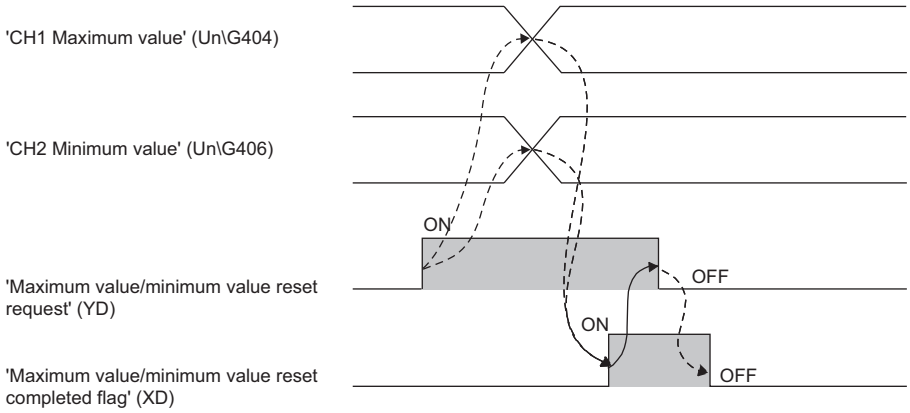
Point

- When the analog input value falls within the setting range, the A/D conversion is restarted regardless of turning on and off of 'Error clear request' (YF). However, the on state of 'Input signal error detection signal' (XC) and the flashing state of the ALM LED are not cleared.
- Averaging processing starts from the beginning after the A/D conversion is restarted.
- 'Input signal error detection signal' (XC) operates only when the input signal error detection function is enabled. When the input signal error detection function is disabled, 'Input signal error detection signal' (XC) is always off.

Maximum value/minimum value reset completed flag

Medium speed | Low speed | Simultaneous conversion | Synchronization

'Maximum value/minimum value reset completed flag' (XD) turns on after the maximum and minimum values stored in 'CH1 Maximum value' (Un\G404) and 'CH1 Minimum value' (Un\G406) are reset by turning on and off 'Maximum value/minimum value reset request' (YD).



■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4
Maximum value/minimum value reset completed flag	XD			

A/D conversion completed flag

Common

'A/D conversion completed flag' (XE) turns on when the first A/D conversion of all the channels where the A/D conversion is enabled is completed. To read digital output values, use this signal or 'A/D conversion completed flag' (Un\G42) as an interlock.

■Device number

The following shows the device number of this input signal.

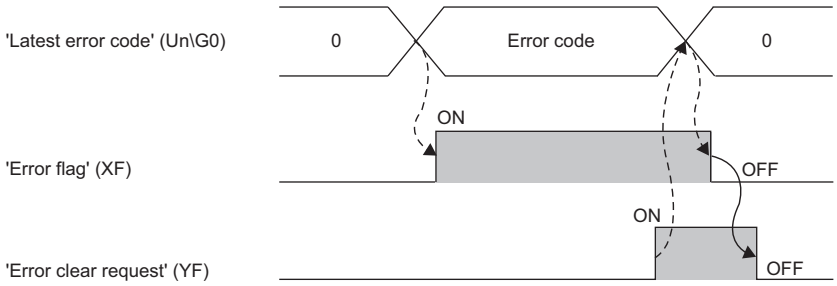
Signal name	CH1	CH2	CH3	CH4
A/D conversion completed flag	XE			

Error flag

Common

'Error flag' (XF) turns on when an error occurs.

Turn on and off 'Error clear request' (YF) to clear 'Latest error code' (Un\G0) and 'Latest alarm code' (Un\G2).



Performed by the A/D converter module.

Performed by a program.

■Device number

The following shows the device number of this input signal.

Signal name	CH1	CH2	CH3	CH4
Error flag	XF			

Details of output signals

The following describes the details of the output signals for the A/D converter module which are assigned to the CPU module. The I/O numbers (X/Y) described in this section are for the case when the start I/O number of the A/D converter module is set to 0.

Point

This section describes buffer memory addresses for CH1. For details on the buffer memory addresses for CH2 and later, refer to the following.

☞ Page 204 List of buffer memory addresses

CH1 Logging hold request

High speed Low speed

Use this signal as a trigger to hold (stop) logging at any timing during the normal logging or high speed logging.

When 'CH1 Logging enable/disable setting' (Un\G535) is set to Disable (1) or High speed continuous logging (2), the on or off of 'CH1 Logging hold request' (Y1) is ignored.

For details on each logging function, refer to the following.

☞ Page 74 Normal Logging Function

☞ Page 98 High Speed Logging Function

■Device number

The following shows the device number of this output signal.

Signal name	CH1	CH2	CH3	CH4
Logging hold request	Y1	Y2	Y3	Y4

■Operation of the logging hold processing

- When 'CH1 Level trigger condition setting' (Un\G542) is set to Disable (0), the logging hold processing starts by turning on 'CH1 Logging hold request' (Y1).
- When 'CH1 Level trigger condition setting' (Un\G542) is not set to Disable (0), the logging hold processing starts when the set trigger condition is satisfied after turning on 'CH1 Logging hold request' (Y1). When the level trigger is enabled, use this signal as an interlock condition to operate the level trigger.
- If 'CH1 Logging hold request' (Y1) is turned off during the logging hold processing, the hold (stop) state is cleared and the logging restarts.

Point

The stop state of the logging can be checked with 'CH1 Logging hold flag' (Un\G409).

Operating condition setting request

Common

Turn on and off 'Operating condition setting request' (Y9) to enable the setting of the A/D converter module.

For the timing of turning on and off the signal, refer to the following.

☞ Page 195 Operating condition setting completed flag

For details on the buffer memory areas to be enabled, refer to the following.

☞ Page 204 List of buffer memory addresses

■Device number

The following shows the device number of this output signal.

Signal name	CH1	CH2	CH3	CH4
Operating condition setting request	Y9			

User range write request

Medium speed | Low speed

■Device number

The following shows the device number of this output signal.

Signal name	CH1	CH2	CH3	CH4
User range write request	YA			

■In the offset/gain setting mode

Turn on and off 'User range write request' (YA) to register values adjusted with the offset/gain setting in the A/D converter module. The data is written to the flash memory when this signal is turned on from off.

For the timing of turning on and off the signal, refer to the following.

☞ Page 196 Offset/gain setting mode status flag

■In the normal mode (medium speed: 10μs/CH) and normal mode (low speed: 20μs/CH)

Turn on and off 'User range write request' (YA) to restore the user range.

For the timing of turning on and off the signal, refer to the following.

☞ Page 196 Offset/gain setting mode status flag

Channel change request

Medium speed | Low speed

Turn on and off 'Channel change request' (YB) to change a channel to perform the offset/gain setting.

For the timing of turning on and off the signal, refer to the following.

☞ Page 197 Channel change completed flag

■Device number

The following shows the device number of this output signal.

Signal name	CH1	CH2	CH3	CH4
Channel change request	YB			

Maximum value/minimum value reset request

Medium speed | Low speed | Simultaneous conversion | Synchronization

Turn on and off 'Maximum value/minimum value reset request' (YD) to clear the maximum and minimum values stored in 'CH1 Maximum value' (Un\G404) and 'CH1 Minimum value' (Un\G406).

For the timing of turning on and off the signal, refer to the following.

☞ Page 199 Maximum value/minimum value reset completed flag

■Device number

The following shows the device number of this output signal.

Signal name	CH1	CH2	CH3	CH4
Maximum value/minimum value reset request	YD			

Error clear request

Common

Turn on and off 'Error clear request' (YF) to clear 'Error flag' (XF), 'Input signal error detection signal' (XC), 'Latest error code' (Un\G0), and 'Latest alarm code' (Un\G2). For the timing of turning on and off the signal, refer to the following.

☞ Page 198 Input signal error detection signal
☞ Page 200 Error flag

■Device number

The following shows the device number of this output signal.

Signal name	CH1	CH2	CH3	CH4
Error clear request	YF			

Appendix 3 Buffer Memory Areas

List of buffer memory addresses

This section shows the lists of buffer memory addresses of the A/D converter module. For details on the buffer memory addresses, refer to the following.

☞ Page 213 Details of buffer memory addresses

The buffer memory areas of the A/D converter module are classified by the following data types.

Data type	Description	
Setting data	Description	Set this data according to the connected device and the application of the system.
	Write/read attribute	Data can be read and written from/to this area.
	Setting method	Set this data using an engineering tool or a program.
	Setting timing	After changing values, turn on and off 'Operating condition setting request' (Y9) to enable the set values.
Control data	Description	Use this data to control the A/D converter module.
	Write/read attribute	Data can be read and written from/to this area.
	Setting method	Set this data using an engineering tool or a program.
	Setting timing	As soon as values are changed, the set values are enabled.
Monitor data	Description	Use this data to monitor the status of the A/D converter module.
	Write/read attribute	Reading data is only allowed. Writing data is not allowed.
	Setting method	—
	Setting timing	—
User range setting data	Description	Use this data to update the user range setting of the A/D converter module.
	Write/read attribute	Data can be read and written from/to this area.
	Setting method	Set this data using an engineering tool or a program.
	Setting timing	After changing values, turn on and off 'User range write request' (YA) to enable the set values.

Point

Do not write data to the system areas and areas whose data types are monitor in the buffer memory. Writing data into these areas can cause the malfunction of the module.

Un\G0 to Un\G399

Address (decimal)	Address (hexadecimal)	Name	Default value	Data type	Auto refresh
0	0H	Latest error code	0	Monitor	○
1	1H	Latest address of error history	0	Monitor	○
2	2H	Latest alarm code	0	Monitor	○
3	3H	Latest address of alarm history	0	Monitor	○
4 to 19	4H to 13H	Interrupt factor detection flag [n]*1	0	Monitor	○
20 to 35	14H to 23H	System area	—	—	—
36	24H	Warning output flag (Process alarm upper limit)	0000H	Monitor	○
37	25H	Warning output flag (Process alarm lower limit)	0000H	Monitor	○
38	26H	Warning output flag (Rate alarm upper limit)	0000H	Monitor	○
39	27H	Warning output flag (Rate alarm lower limit)	0000H	Monitor	○
40	28H	Input signal error detection flag	0000H	Monitor	○
41	29H	System area	—	—	—
42	2AH	A/D conversion completed flag	0000H	Monitor	○
43 to 59	2BH to 3BH	System area	—	—	—
60	3CH	Operation mode monitor	2	Monitor	×
61	3DH	Continuous logging status monitor	0	Monitor	×
62 to 69	3EH to 45H	System area	—	—	—
70	46H	RUN LED status monitor	0000H	Monitor	×
71	47H	ERR LED status monitor	0000H	Monitor	×
72	48H	ALM LED status monitor	0000H	Monitor	×
73 to 89	49H to 59H	System area	—	—	—
90	5AH	Level data 0	0	Control	○
91	5BH	Level data 1	0	Control	○
92	5CH	Level data 2	0	Control	○
93	5DH	Level data 3	0	Control	○
94	5EH	Level data 4	0	Control	○
95	5FH	Level data 5	0	Control	○
96	60H	Level data 6	0	Control	○
97	61H	Level data 7	0	Control	○
98	62H	Level data 8	0	Control	○
99	63H	Level data 9	0	Control	○
100	64H	Continuous logging start/stop request	0	Control	×
101 to 123	65H to 7BH	System area	—	—	—
124 to 139	7CH to 8BH	Interrupt factor mask [n]*1	0	Control	×
140 to 155	8CH to 9BH	System area	—	—	—
156 to 171	9CH to ABH	Interrupt factor reset request [n]*1	0	Control	×
172 to 199	ACH to C7H	System area	—	—	—
200 to 215	C8H to D7H	Interrupt factor generation setting [n]*1	0	Setting	×
216 to 231	D8H to E7H	System area	—	—	—
232 to 247	E8H to F7H	Condition target setting [n]*1	0	Setting	×
248 to 263	F8H to 107H	System area	—	—	—
264 to 279	108H to 117H	Condition target channel setting [n]*1	0	Setting	×
280	118H	Continuous logging cycle setting value	1	Setting	×
281 to 295	119H to 127H	System area	—	—	—
296, 297	128H, 129H	Mode switching setting	0	Setting	×
298 to 301	12AH to 12DH	System area	—	—	—
302	12EH	Input signal error detection auto-clear enable/disable setting	1	Setting	×
303 to 399	12FH to 18FH	System area	—	—	—

*1 [n] in the table indicates an interrupt setting number. (n = 1 to 16)

Un\G400 to Un\G3599

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
400 (190H)	600 (258H)	800 (320H)	1000 (3E8H)	CH□ Digital output value	0	Monitor	○
401 (191H)	601 (259H)	801 (321H)	1001 (3E9H)	System area	—	—	—
402 (192H)	602 (25AH)	802 (322H)	1002 (3EAH)	CH□ Digital operation value	0	Monitor	○
403 (193H)	603 (25BH)	803 (323H)	1003 (3EBH)	System area	—	—	—
404 (194H)	604 (25CH)	804 (324H)	1004 (3ECH)	CH□ Maximum value	0	Monitor	○
405 (195H)	605 (25DH)	805 (325H)	1005 (3EDH)	System area	—	—	—
406 (196H)	606 (25EH)	806 (326H)	1006 (3EEH)	CH□ Minimum value	0	Monitor	○
407 (197H)	607 (25FH)	807 (327H)	1007 (3EFH)	System area	—	—	—
408 (198H)	608 (260H)	808 (328H)	1008 (3F0H)	CH□ Difference conversion status flag	0	Monitor	○
409 (199H)	609 (261H)	809 (329H)	1009 (3F1H)	CH□ Logging hold flag	0	Monitor	○
410 to 429 (19AH to 1ADH)	610 to 629 (262H to 275H)	810 to 829 (32AH to 33DH)	1010 to 1029 (3F2H to 405H)	System area	—	—	—
430 (1AEH)	630 (276H)	830 (33EH)	1030 (406H)	CH□ Range setting monitor	0	Monitor	×
431 (1AFH)	631 (277H)	831 (33FH)	1031 (407H)	System area	—	—	—
432 (1B0H)	632 (278H)	832 (340H)	1032 (408H)	CH□ Difference conversion reference value	0	Monitor	×
433 (1B1H)	633 (279H)	833 (341H)	1033 (409H)	System area	—	—	—
434 (1B2H)	634 (27AH)	834 (342H)	1034 (40AH)	CH□ Logging start address monitor (L)	0	Monitor	×
435 (1B3H)	635 (27BH)	835 (343H)	1035 (40BH)	CH□ Logging start address monitor (H)			
436 (1B4H)	636 (27CH)	836 (344H)	1036 (40CH)	CH□ Head pointer (L)	0	Monitor	×
437 (1B5H)	637 (27DH)	837 (345H)	1037 (40DH)	CH□ Head pointer (H)			
438 (1B6H)	638 (27EH)	838 (346H)	1038 (40EH)	CH□ Latest pointer (L)	0	Monitor	×
439 (1B7H)	639 (27FH)	839 (347H)	1039 (40FH)	CH□ Latest pointer (H)			
440 (1B8H)	640 (280H)	840 (348H)	1040 (410H)	CH□ Number of logging data (L)	0	Monitor	×
441 (1B9H)	641 (281H)	841 (349H)	1041 (411H)	CH□ Number of logging data (H)			
442 (1BAH)	642 (282H)	842 (34AH)	1042 (412H)	CH□ Trigger pointer (L)	0	Monitor	×
443 (1BBH)	643 (283H)	843 (34BH)	1043 (413H)	CH□ Trigger pointer (H)			
444 (1BCH)	644 (284H)	844 (34CH)	1044 (414H)	CH□ Current logging read pointer (L)	-1	Monitor	×
445 (1BDH)	645 (285H)	845 (34DH)	1045 (415H)	CH□ Current logging read pointer (H)			
446 (1BEH)	646 (286H)	846 (34EH)	1046 (416H)	CH□ Previous logging read pointer (L)	-1	Monitor	×
447 (1BFH)	647 (287H)	847 (34FH)	1047 (417H)	CH□ Previous logging read pointer (H)			
448 (1C0H)	648 (288H)	848 (350H)	1048 (418H)	CH□ Logging read points monitor value (L)	0	Monitor	×
449 (1C1H)	649 (289H)	849 (351H)	1049 (419H)	CH□ Logging read points monitor value (H)			
450 (1C2H)	650 (28AH)	850 (352H)	1050 (41AH)	CH□ Logging cycle monitor value (s)	0	Monitor	×
451 (1C3H)	651 (28BH)	851 (353H)	1051 (41BH)	CH□ Logging cycle monitor value (ms)	0	Monitor	×
452 (1C4H)	652 (28CH)	852 (354H)	1052 (41CH)	CH□ Logging cycle monitor value (μs)	0	Monitor	×
453 (1C5H)	653 (28DH)	853 (355H)	1053 (41DH)	CH□ Trigger generation time (First/Last two digits of the year)	0	Monitor	×
454 (1C6H)	654 (28EH)	854 (356H)	1054 (41EH)	CH□ Trigger generation time (Month/Day)	0	Monitor	×
455 (1C7H)	655 (28FH)	855 (357H)	1055 (41FH)	CH□ Trigger generation time (Hour/Minute)	0	Monitor	×
456 (1C8H)	656 (290H)	856 (358H)	1056 (420H)	CH□ Trigger generation time (Second/Day of the week)	0	Monitor	×
457 (1C9H)	657 (291H)	857 (359H)	1057 (421H)	CH□ Trigger generation time (Millisecond)	0	Monitor	×
458 (1CAH)	658 (292H)	858 (35AH)	1058 (422H)	CH□ Logging status monitor value	000FH	Monitor	×
459 (1CBH)	659 (293H)	859 (35BH)	1059 (423H)	CH□ A/D conversion status monitor	0	Monitor	×
460 (1CCH)	660 (294H)	860 (35CH)	1060 (424H)	CH□ Averaging process status monitor	0	Monitor	×
461 to 468 (1CDH to 1D4H)	661 to 668 (295H to 29CH)	861 to 868 (35DH to 364H)	1061 to 1068 (425H to 42CH)	System area	—	—	—
469 (1D5H)	669 (29DH)	869 (365H)	1069 (42DH)	CH□ High speed continuous logging status monitor	0	Monitor	×

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
470 (1D6H)	670 (29EH)	870 (366H)	1070 (42EH)	CH□ Difference conversion trigger	0	Control	○
471 (1D7H)	671 (29FH)	871 (367H)	1071 (42FH)	System area	—	—	—
472 (1D8H)	672 (2A0H)	872 (368H)	1072 (430H)	CH□ Conversion value shift amount	0	Control	○
473 (1D9H)	673 (2A1H)	873 (369H)	1073 (431H)	System area	—	—	—
474 (1DAH)	674 (2A2H)	874 (36AH)	1074 (432H)	CH□ Continuous logging data A side storage flag	0	Control	×
475 (1DBH)	675 (2A3H)	875 (36BH)	1075 (433H)	CH□ Continuous logging data B side storage flag	0	Control	×
476 (1DCH)	676 (2A4H)	876 (36CH)	1076 (434H)	CH□ High speed continuous logging data A side storage flag	0	Control	×
477 (1DDH)	677 (2A5H)	877 (36DH)	1077 (435H)	CH□ High speed continuous logging data B side storage flag	0	Control	×
478 (1DEH)	678 (2A6H)	878 (36EH)	1078 (436H)	CH□ High speed continuous logging start/stop request	0	Control	×
479 (1DFH)	679 (2A7H)	879 (36FH)	1079 (437H)	System area	—	—	—
480 (1E0H)	680 (2A8H)	880 (370H)	1080 (438H)	CH□ Maximum value reset request	0	Control	×
481 (1E1H)	681 (2A9H)	881 (371H)	1081 (439H)	CH□ Minimum value reset request	0	Control	×
482 to 499 (1E2H to 1F3H)	682 to 699 (2AAH to 2BBH)	882 to 899 (372H to 383H)	1082 to 1099 (43AH to 44BH)	System area	—	—	—
500 (1F4H)	700 (2BCH)	900 (384H)	1100 (44CH)	CH□ A/D conversion enable/disable setting	1	Setting	×
501 (1F5H)	701 (2BDH)	901 (385H)	1101 (44DH)	CH□ Averaging process specification	0	Setting	×
502 (1F6H)	702 (2BEH)	902 (386H)	1102 (44EH)	CH□ Time average/Count average/Moving average/Primary delay filter constant setting	0	Setting	×
503 (1F7H)	703 (2BFH)	903 (387H)	1103 (44FH)	System area	—	—	—
504 (1F8H)	704 (2C0H)	904 (388H)	1104 (450H)	CH□ Scaling enable/disable setting	1	Setting	×
505 (1F9H)	705 (2C1H)	905 (389H)	1105 (451H)	System area	—	—	—
506 (1FAH)	706 (2C2H)	906 (38AH)	1106 (452H)	CH□ Scaling upper limit value	0	Setting	×
507 (1FBH)	707 (2C3H)	907 (38BH)	1107 (453H)	System area	—	—	—
508 (1FCH)	708 (2C4H)	908 (38CH)	1108 (454H)	CH□ Scaling lower limit value	0	Setting	×
509 (1FDH)	709 (2C5H)	909 (38DH)	1109 (455H)	System area	—	—	—
510 (1FEH)	710 (2C6H)	910 (38EH)	1110 (456H)	CH□ Digital clipping enable/disable setting	1	Setting	×
511 (1FFH)	711 (2C7H)	911 (38FH)	1111 (457H)	System area	—	—	—
512 (200H)	712 (2C8H)	912 (390H)	1112 (458H)	CH□ Warning output setting (Process alarm)	1	Setting	×
513 (201H)	713 (2C9H)	913 (391H)	1113 (459H)	CH□ Warning output setting (Rate alarm)	1	Setting	×
514 (202H)	714 (2CAH)	914 (392H)	1114 (45AH)	CH□ Process alarm upper upper limit value	0	Setting	×
515 (203H)	715 (2CBH)	915 (393H)	1115 (45BH)	System area	—	—	—
516 (204H)	716 (2CCH)	916 (394H)	1116 (45CH)	CH□ Process alarm upper lower limit value	0	Setting	×
517 (205H)	717 (2CDH)	917 (395H)	1117 (45DH)	System area	—	—	—
518 (206H)	718 (2CEH)	918 (396H)	1118 (45EH)	CH□ Process alarm lower upper limit value	0	Setting	×
519 (207H)	719 (2CFH)	919 (397H)	1119 (45FH)	System area	—	—	—
520 (208H)	720 (2D0H)	920 (398H)	1120 (460H)	CH□ Process alarm lower lower limit value	0	Setting	×
521 (209H)	721 (2D1H)	921 (399H)	1121 (461H)	System area	—	—	—
522 (20AH)	722 (2D2H)	922 (39AH)	1122 (462H)	CH□ Rate alarm warning detection cycle setting	0	Setting	×
523 (20BH)	723 (2D3H)	923 (39BH)	1123 (463H)	System area	—	—	—
524 (20CH)	724 (2D4H)	924 (39CH)	1124 (464H)	CH□ Rate alarm upper limit value	0	Setting	×
525 (20DH)	725 (2D5H)	925 (39DH)	1125 (465H)	System area	—	—	—
526 (20EH)	726 (2D6H)	926 (39EH)	1126 (466H)	CH□ Rate alarm lower limit value	0	Setting	×
527 (20FH)	727 (2D7H)	927 (39FH)	1127 (467H)	System area	—	—	—
528 (210H)	728 (2D8H)	928 (3A0H)	1128 (468H)	CH□ Input signal error detection setting	0	Setting	×
529 (211H)	729 (2D9H)	929 (3A1H)	1129 (469H)	CH□ Input signal error detection lower limit setting value	50	Setting	×
530 (212H)	730 (2DAH)	930 (3A2H)	1130 (46AH)	CH□ Input signal error detection upper limit setting value	50	Setting	×

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
531 to 534 (213H to 216H)	731 to 734 (2DBH to 2DEH)	931 to 934 (3A3H to 3A6H)	1131 to 1134 (46BH to 46EH)	System area	—	—	—
535 (217H)	735 (2DFH)	935 (3A7H)	1135 (46FH)	CH□ Logging enable/disable setting	1	Setting	×
536 (218H)	736 (2E0H)	936 (3A8H)	1136 (470H)	CH□ Logging data points setting	200	Setting	×
537 (219H)	737 (2E1H)	937 (3A9H)	1137 (471H)	CH□ Logging data setting	1	Setting	×
538 (21AH)	738 (2E2H)	938 (3AAH)	1138 (472H)	CH□ Logging cycle setting value	4	Setting	×
539 (21BH)	739 (2E3H)	939 (3ABH)	1139 (473H)	CH□ Logging cycle unit setting	1	Setting	×
540 (21CH)	740 (2E4H)	940 (3ACH)	1140 (474H)	CH□ Post-trigger logging points (L)	10000	Setting	×
541 (21DH)	741 (2E5H)	941 (3ADH)	1141 (475H)	CH□ Post-trigger logging points (H)			
542 (21EH)	742 (2E6H)	942 (3AEH)	1142 (476H)	CH□ Level trigger condition setting	0	Setting	×
543 (21FH)	743 (2E7H)	943 (3AFH)	1143 (477H)	CH□ Trigger data	*1	Setting	×
544 (220H)	744 (2E8H)	944 (3B0H)	1144 (478H)	CH□ Trigger setting value	0	Setting	×
545 (221H)	745 (2E9H)	945 (3B1H)	1145 (479H)	CH□ Trigger judgment count setting value	1	Setting	×
546 (222H)	746 (2EAH)	946 (3B2H)	1146 (47AH)	CH□ Loading interrupt enable/disable setting	1	Setting	×
547 (223H)	747 (2EBH)	947 (3B3H)	1147 (47BH)	CH□ Logging read points setting value	10	Setting	×
548 to 559 (224H to 22FH)	748 to 759 (2ECH to 2F7H)	948 to 959 (3B4H to 3BFH)	1148 to 1159 (47CH to 487H)	System area	—	—	—
560 (230H)	760 (2F8H)	960 (3C0H)	1160 (488H)	CH□ LPF Pass band edge frequency	0	Setting	×
561 (231H)	761 (2F9H)	961 (3C1H)	1161 (489H)	System area	—	—	—
562 (232H)	762 (2FAH)	962 (3C2H)	1162 (48AH)	CH□ HPF Pass band edge frequency	0	Setting	×
563 (233H)	763 (2FBH)	963 (3C3H)	1163 (48BH)	System area	—	—	—
564 (234H)	764 (2FCH)	964 (3C4H)	1164 (48CH)	CH□ BPF Pass band edge frequency (Low)	0	Setting	×
565 (235H)	765 (2FDH)	965 (3C5H)	1165 (48DH)	System area	—	—	—
566 (236H)	766 (2FEH)	966 (3C6H)	1166 (48EH)	CH□ BPF Pass band edge frequency (High)	0	Setting	×
567 (237H)	767 (2FFH)	967 (3C7H)	1167 (48FH)	System area	—	—	—
568 (238H)	768 (300H)	968 (3C8H)	1168 (490H)	CH□ Attenuation band width	0	Setting	×
569 to 589 (239H to 24DH)	769 to 789 (301H to 315H)	969 to 989 (3C9H to 3DDH)	1169 to 1189 (491H to 4A5H)	System area	—	—	—
590 (24EH)	790 (316H)	990 (3DEH)	1190 (4A6H)	CH□ High speed continuous logging cycle setting value	1	Setting	×
591 to 597 (24FH to 255H)	791 to 797 (317H to 31DH)	991 to 997 (3DFH to 3E5H)	1190 to 1197 (4A7H to 4ADH)	System area	—	—	—
598 (256H)	798 (31EH)	998 (3E6H)	1198 (4AEH)	CH□ Range setting	0	Setting	×
599 (257H)	799 (31FH)	999 (3E7H)	1199 (4AFH)	System area	—	—	—
1200 to 3599 (4B0H to E0FH)				System area	—	—	—

*1 The following shows the default values.
CH1: 402, CH2: 602, CH3: 802, CH4: 1002

Error history and alarm history (Un\G3600 to Un\G3999)

Address (decimal)	Address (hexadecimal)	Name				Default value	Data type	Auto refresh
3600	E10H	Error history 1	Error code			0	Monitor	×
3601	E11H		Error time	First two digits of the year	Last two digits of the year			
3602	E12H			Month	Day			
3603	E13H			Hour	Minute			
3604	E14H			Second	Day of the week			
3605	E15H			Millisecond				
3606 to 3609	E16H to E19H	System area				—	—	—
3610 to 3615	E1AH to E1FH	Error history 2	Same as error history 1			0	Monitor	×
3616 to 3619	E20H to E23H	System area				—	—	—
3620 to 3625	E24H to E29H	Error history 3	Same as error history 1			0	Monitor	×
3626 to 3629	E2AH to E2DH	System area				—	—	—
3630 to 3635	E2EH to E33H	Error history 4	Same as error history 1			0	Monitor	×
3636 to 3639	E34H to E37H	System area				—	—	—
3640 to 3645	E38H to E3DH	Error history 5	Same as error history 1			0	Monitor	×
3646 to 3649	E3EH to E41H	System area				—	—	—
3650 to 3655	E42H to E47H	Error history 6	Same as error history 1			0	Monitor	×
3656 to 3659	E48H to E4BH	System area				—	—	—
3660 to 3665	E4CH to E51H	Error history 7	Same as error history 1			0	Monitor	×
3666 to 3669	E52H to E55H	System area				—	—	—
3670 to 3675	E56H to E5BH	Error history 8	Same as error history 1			0	Monitor	×
3676 to 3679	E5CH to E5FH	System area				—	—	—
3680 to 3685	E60H to E65H	Error history 9	Same as error history 1			0	Monitor	×
3686 to 3689	E66H to E69H	System area				—	—	—
3690 to 3695	E6AH to E6FH	Error history 10	Same as error history 1			0	Monitor	×
3696 to 3699	E70H to E73H	System area				—	—	—
3700 to 3705	E74H to E79H	Error history 11	Same as error history 1			0	Monitor	×
3706 to 3709	E7AH to E7DH	System area				—	—	—
3710 to 3715	E7EH to E83H	Error history 12	Same as error history 1			0	Monitor	×
3716 to 3719	E84H to E87H	System area				—	—	—
3720 to 3725	E88H to E8DH	Error history 13	Same as error history 1			0	Monitor	×
3726 to 3729	E8EH to E91H	System area				—	—	—
3730 to 3735	E92H to E97H	Error history 14	Same as error history 1			0	Monitor	×
3736 to 3739	E98H to E9BH	System area				—	—	—
3740 to 3745	E9CH to EA1H	Error history 15	Same as error history 1			0	Monitor	×
3746 to 3749	EA2H to EA5H	System area				—	—	—
3750 to 3755	EA6H to EABH	Error history 16	Same as error history 1			0	Monitor	×
3756 to 3759	EACH to EAFH	System area				—	—	—
3760	EB0H	Alarm history 1	Alarm code			0	Monitor	×
3761	EB1H		Alarm time	First two digits of the year	Last two digits of the year			
3762	EB2H			Month	Day			
3763	EB3H			Hour	Minute			
3764	EB4H			Second	Day of the week			
3765	EB5H			Millisecond				
3766 to 3769	EB6H to EB9H	System area				—	—	—
3770 to 3775	EBAH to EBFH	Alarm history 2	Same as alarm history 1			0	Monitor	×
3776 to 3779	EC0H to EC3H	System area				—	—	—
3780 to 3785	EC4H to EC9H	Alarm history 3	Same as alarm history 1			0	Monitor	×

A

Address (decimal)	Address (hexadecimal)	Name		Default value	Data type	Auto refresh
3786 to 3789	ECAH to ECDH	System area		—	—	—
3790 to 3795	ECEH to ED3H	Alarm history 4	Same as alarm history 1	0	Monitor	×
3796 to 3799	ED4H to ED7H	System area		—	—	—
3800 to 3805	ED8H to EDDH	Alarm history 5	Same as alarm history 1	0	Monitor	×
3806 to 3809	EDEH to EE1H	System area		—	—	—
3810 to 3815	EE2H to EE7H	Alarm history 6	Same as alarm history 1	0	Monitor	×
3816 to 3819	EE8H to EEBH	System area		—	—	—
3820 to 3825	EECH to EF1H	Alarm history 7	Same as alarm history 1	0	Monitor	×
3826 to 3829	EF2H to EF5H	System area		—	—	—
3830 to 3835	EF6H to EFBH	Alarm history 8	Same as alarm history 1	0	Monitor	×
3836 to 3839	EFCH to EFFH	System area		—	—	—
3840 to 3845	F00H to F05H	Alarm history 9	Same as alarm history 1	0	Monitor	×
3846 to 3849	F06H to F09H	System area		—	—	—
3850 to 3855	F0AH to F0FH	Alarm history 10	Same as alarm history 1	0	Monitor	×
3856 to 3859	F10H to F13H	System area		—	—	—
3860 to 3865	F14H to F19H	Alarm history 11	Same as alarm history 1	0	Monitor	×
3866 to 3869	F1AH to F1DH	System area		—	—	—
3870 to 3875	F1EH to F23H	Alarm history 12	Same as alarm history 1	0	Monitor	×
3876 to 3879	F24H to F27H	System area		—	—	—
3880 to 3885	F28H to F2DH	Alarm history 13	Same as alarm history 1	0	Monitor	×
3886 to 3889	F2EH to F31H	System area		—	—	—
3890 to 3895	F32H to F37H	Alarm history 14	Same as alarm history 1	0	Monitor	×
3896 to 3899	F38H to F3BH	System area		—	—	—
3900 to 3905	F3CH to F41H	Alarm history 15	Same as alarm history 1	0	Monitor	×
3906 to 3909	F42H to F45H	System area		—	—	—
3910 to 3915	F46H to F4BH	Alarm history 16	Same as alarm history 1	0	Monitor	×
3916 to 3929	F4CH to F59H	System area		—	—	—
3930	F5AH	Clear setting of error history		0	Setting*1	×
3931 to 3999	F5CH to F9FH	System area		—	—	—

*1 As soon as a setting value is input, the setting is enabled. Turning on and off 'Operating condition setting request' (Y9) is not required.

Offset/gain setting (Un\G4000 to Un\G9499)

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
4000, 4001 (FA0H, FA1H)				System area	—	—	—
4002 (FA2H)				Save data type setting	0000H	Setting	×
4003 (FA3H)				System area	—	—	—
4004 (FA4H)	4008 (FA8H)	4012 (FACH)	4016 (FB0H)	CH□ Factory default setting offset value (L)	0	User range setting	×
4005 (FA5H)	4009 (FA9H)	4013 (FADH)	4017 (FB1H)	CH□ Factory default setting offset value (H)	0	User range setting	×
4006 (FA6H)	4010 (FAAH)	4014 (FAEH)	4018 (FB2H)	CH□ Factory default setting gain value (L)	0	User range setting	×
4007 (FA7H)	4011 (FABH)	4015 (FAFH)	4019 (FB3H)	CH□ Factory default setting gain value (H)	0	User range setting	×
4020 (FB4H)	4024 (FA8H)	4028 (FACH)	4032 (FC0H)	CH□ User range setting offset value (L)	0	User range setting	×
4021 (FB5H)	4025 (FA9H)	4029 (FADH)	4033 (FC1H)	CH□ User range setting offset value (H)	0	User range setting	×
4022 (FB6H)	4026 (FAAH)	4030 (FAEH)	4034 (FC2H)	CH□ User range setting gain value (L)	0	User range setting	×
4023 (FB7H)	4027 (FABH)	4031 (FAFH)	4035 (FC3H)	CH□ User range setting gain value (H)	0	User range setting	×
4036 to 4131 (FC4H to 1023H)				System area	—	—	—
4132 (1024H)	4134 (1026H)	4136 (1028H)	4138 (102AH)	CH□ Offset/gain setting mode (offset specification)	0	User range setting	×
4133 (1025H)	4135 (1027H)	4137 (1029H)	4139 (102BH)	CH□ Offset/gain setting mode (gain specification)	0	User range setting	×
4140 to 4163 (102CH to 1043H)				System area	—	—	—
4164 (1044H)	4165 (1045H)	4166 (1046H)	4167 (1047H)	CH□ Offset/gain setting mode (range specification)	0	User range setting	×
4168 to 9499 (1048H to 251BH)				System area	—	—	—

Inter-module synchronization (Un\G9500 to Un\G9999)

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
9500 (251CH)	9502 (251EH)	9504 (2520H)	9506 (2522H)	CH□ Synchronization digital output value	0	Monitor	○
9501 (251DH)	9503 (251FH)	9505 (2521H)	9507 (2523H)	System area	—	—	—
9508 to 9599 (2524H to 257FH)				System area	—	—	—
9600 (2580H)				Synchronization status monitor	0	Monitor	○
9601 (2581H)				Oversampling mode monitor	0	Monitor	×
9602 to 9999 (2582H to 270FH)				System area	—	—	—

A

Logging data (Un\G10000 to Un\G99999)

■When the normal logging function or high speed logging function is used

Address (decimal)	Address (hexadecimal)	Name	Default value	Data type	Auto refresh
10000 to 99999	2710H to 1869FH	Logging data area	0	Monitor	×

■When the continuous logging function is used

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
10000 to 19999 (2710H to 4E1FH)	20000 to 29999 (4E20H to 752FH)	30000 to 39999 (7530H to 9C3FH)	40000 to 49999 (9C40H to C34FH)	CH□ Logging data area	0	Monitor	×
50000 to 99999 (C350H to 1869FH)				System area	—	—	—

■When the high speed continuous logging function is used

Address Decimal (hexadecimal)				Name	Default value	Data type	Auto refresh
CH1	CH2	CH3	CH4				
10000 to 29999 (2710H to 752FH)	30000 to 49999 (7530H to C34FH)	50000 to 69999 (C350H to 1116FH)	70000 to 89999 (11170H to 15F8FH)	CH□ Logging data area	0	Monitor	×
90000 to 99999 (15F90H to 1869FH)				System area	—	—	—

Details of buffer memory addresses

The following describes the details of the buffer memory addresses of the A/D converter module.

Point

This chapter describes I/O signals and buffer memory addresses for CH1. For details on the I/O signals for CH2 and later, refer to the following.

☞ Page 193 List of I/O signals

Latest error code

Common

The latest error code detected in the A/D converter module is stored. For details, refer to the following.

☞ Page 183 List of Error Codes

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Latest error code	0			

■Clearing an error

Turn on and off 'Error clear request' (YF) or 'Operating condition setting request' (Y9). However, when 'Operating condition setting request' (Y9) is turned on and off, the A/D conversion is reset and the processing is started from the beginning.

Latest address of error history

Common

Among Error history ☐ (Un\G3600 to Un\G3759), a buffer memory address which stores the latest error code is stored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Latest address of error history	1			

Latest alarm code

Common

The latest alarm code detected in the A/D converter module is stored. For details, refer to the following.

☞ Page 190 List of Alarm Codes

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Latest alarm code	2			

■Clearing an alarm

Turn on and off 'Error clear request' (YF) or 'Operating condition setting request' (Y9). However, when 'Operating condition setting request' (Y9) is turned on and off, the A/D conversion is reset and the processing is started from the beginning.

Latest address of alarm history

Common

Among Alarm history □ (Un\G3760 to Un\G3919), a buffer memory address which stores the latest alarm code is stored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Latest address of alarm history	3			

Interrupt factor detection flag [n]

High speed | Low speed | Simultaneous conversion | Synchronization

The detection status of the interrupt factor is stored.

Monitored value	Description
0	No interrupt factor
1	Interrupt factor

When an interrupt factor occurs, an interrupt request is sent to the CPU module at the same time as when 'Interrupt factor detection flag [n]' (Un\G4 to Un\G19) is turned to Interrupt factor (1).
"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

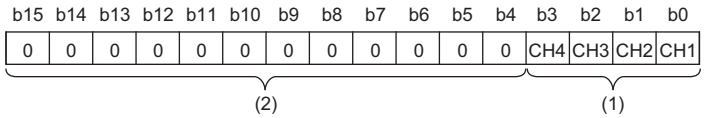
The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor detection flag [n]	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Warning output flag (Process alarm upper limit)

Medium speed | Low speed | Simultaneous conversion | Synchronization

The upper limit warning of the process alarm can be checked for each channel.



(1) 0: Normal, 1: Alarm ON
(2) b4 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Warning output flag (Process alarm upper limit)	36			

■Warning output flag status

- When a value is out of the range specified in 'CH1 Process alarm upper upper limit value' (Un\G514), Alarm ON (1) is stored in the corresponding bit of 'Warning output flag (Process alarm upper limit)' (Un\G36).
- When a warning is detected in any channel where the A/D conversion and the warning output setting (process alarm) are enabled, 'Warning output signal' (X8) also turns on.

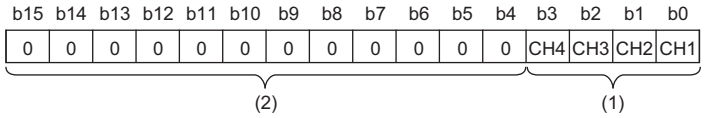
■Clearing Warning output flag

- When the digital operation value falls within the set range, the flag is automatically cleared.
- When 'Operating condition setting request' (Y9) is turned on and off, the flag is cleared.

Warning output flag (Process alarm lower limit)

Medium speed | Low speed | Simultaneous conversion | Synchronization

The lower limit warning of the process alarm can be checked for each channel.



(1) 0: Normal, 1: Alarm ON

(2) b4 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Warning output flag (Process alarm lower limit)	37			

■Warning output flag status

- When a value is out of the range specified in 'CH1 Process alarm lower lower limit value' (Un\G520), Alarm ON (1) is stored in the corresponding bit of 'Warning output flag (Process alarm lower limit)' (Un\G37).
- When a warning is detected in any channel where the A/D conversion and the warning output setting (process alarm) are enabled, 'Warning output signal' (X8) also turns on.

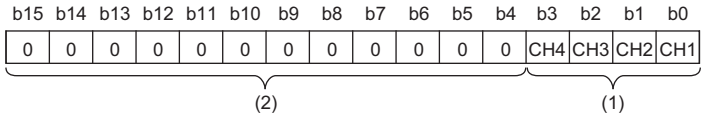
■Clearing Warning output flag

- When the digital operation value falls within the set range, the flag is automatically cleared.
- When 'Operating condition setting request' (Y9) is turned on and off, the flag is cleared.

Warning output flag (Rate alarm upper limit)

Medium speed | Low speed

The upper limit warning of the rate alarm can be checked for each channel.



(1) 0: Normal, 1: Alarm ON

(2) b4 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Warning output flag (Rate alarm upper limit)	38			

■Warning output flag status

- When a value is out of the range specified in 'CH1 Rate alarm upper limit value' (Un\G524), Alarm ON (1) is stored in the corresponding bit of 'Warning output flag (Rate alarm upper limit)' (Un\G38).
- When a warning is detected in any channel where the A/D conversion and the warning output setting (rate alarm) are enabled, 'Warning output signal' (X8) also turns on.

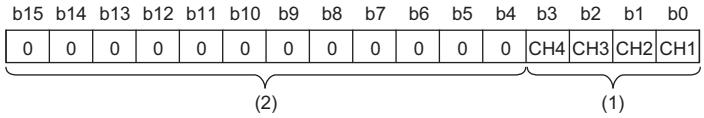
■Clearing Warning output flag

- When the change rate of the digital output value falls within the set range, the flag is automatically cleared.
- When 'Operating condition setting request' (Y9) is turned on and off, the flag is cleared.

Warning output flag (Rate alarm lower limit)

Medium speed | Low speed

The lower limit warning of the rate alarm can be checked for each channel.



(1) 0: Normal, 1: Alarm ON

(2) b4 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Warning output flag (Rate alarm lower limit)	39			

■Warning output flag status

- When a value is out of the range specified in 'CH1 Rate alarm lower limit value' (Un\G526), Alarm ON (1) is stored in the corresponding bit of 'Warning output flag (Rate alarm lower limit)' (Un\G39).
- When a warning is detected in any channel where the A/D conversion and the warning output setting (rate alarm) are enabled, 'Warning output signal' (X8) also turns on.

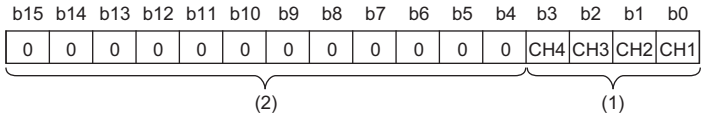
■Clearing Warning output flag

- When the change rate of the digital output value falls within the set range, the flag is automatically cleared.
- When 'Operating condition setting request' (Y9) is turned on and off, the flag is cleared.

Input signal error detection flag

Medium speed | Low speed | Simultaneous conversion | Synchronization

The status of an input signal can be checked for each channel.



(1) 0: Normal, 1: Input signal error

(2) b4 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Input signal error detection flag	40			

■Input signal error detection flag status

- When an analog input value out of the range set with 'CH1 Input signal error detection lower limit setting value' (Un\G529) and 'CH1 Input signal error detection upper limit setting value' (Un\G530) is detected, Input signal error (1) is stored in the corresponding bit of 'Input signal error detection flag' (Un\G40).
- When an error is detected in any channel where the A/D conversion and the input signal error detection are enabled, 'Input signal error detection signal' (XC) turns on.

■Clearing Input signal error detection flag

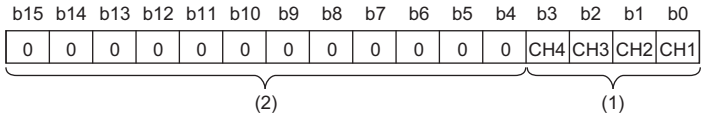
Turning off of 'Input signal error detection flag' (Un\G40) varies depending on the setting of 'Input signal error detection auto-clear enable/disable setting' (Un\G302).

'Input signal error detection auto-clear enable/disable setting' (Un\G302)	Operations when 'Input signal error detection flag' (Un\G40) is turned off
Enable (0)	When the cause of the input signal error is eliminated and the analog input value falls within the set range, 'Input signal error detection flag' (Un\G40) automatically turns off. When 'Input signal error detection flag' (Un\G40) turns off, the following operations are performed. • The ALM LED turns off. • 'Input signal error detection signal' (XC) turns off.
Disable (1)	When 'Error clear request' (YF) is turned on and off after the cause of the input signal error is eliminated and the analog input value falls within the set range, 'Input signal error detection flag' (Un\G40) turns off. When 'Input signal error detection flag' (Un\G40) turns off, the following operations are performed. • The ALM LED turns off. • 'Input signal error detection signal' (XC) turns off. • 'Latest alarm code' (Un\G2) is cleared. Turning on and off 'Operating condition setting request '(Y9) also clears 'Input signal error detection flag' (Un\G40). However, the A/D conversion is reset and the processing is started from the beginning.

A/D conversion completed flag

Common

The A/D conversion status can be checked.



(1) 0: During A/D conversion or unused, 1: A/D conversion completed

(2) b4 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
A/D conversion completed flag	42			

■A/D conversion completed flag status

When the first A/D conversion is completed in the channel where the A/D conversion is enabled, the flag turns to A/D conversion completed (1). 'A/D conversion completed flag' (XE) turns on when the conversion in all the channels where the A/D conversion is enabled is completed.

■Clearing A/D conversion completed flag

Turning on and off 'Operating condition setting request' (Y9) turns the flag back to the default (During A/D conversion or unused (0)), and when the first A/D conversion is completed, the flag turns to A/D conversion completed (1) again.

Operation mode monitor

Common

The current operation mode is stored.

Monitored value	Description
0	Normal mode (high speed: 1μs/CH)
1	Normal mode (medium speed: 10μs/CH)
2	Normal mode (low speed: 20μs/CH)
3	Simultaneous conversion mode (5μs/4CH)
4	Inter-module synchronization mode
5	Offset/gain setting mode

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Operation mode monitor	60			

Continuous logging status monitor

Simultaneous conversion Synchronization

The execution status of the continuous logging function is stored.

Monitored value	Description
0	Continuous logging disable status
1	Continuous logging start request waiting
2	Continuous logging in process

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Continuous logging status monitor	61			

RUN LED status monitor

Common

The current status of the RUN LED is stored.

Monitored value	Description
0	Off
1	On
2	Flashing (1s cycle)
3	Flashing (400ms cycle)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
RUN LED status monitor	70			

ERR LED status monitor

Common

The current status of the ERR LED is stored.

Monitored value	Description
0	Off
1	On

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
ERR LED status monitor	71			

ALM LED status monitor

Common

The current status of the ALM LED is stored.

Monitored value	Description
0	Off
1	On
2	Flashing

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
ALM LED status monitor	72			

Level data 0 to 9

Low speed

This area stores data to be monitored when a level trigger of the normal logging function is used. Ten types of data are available: 'Level data 0' (Un\G90) to 'Level data 9' (Un\G99). Use the area to generate triggers while monitoring the values in devices other than the A/D converter module.

For details on the normal logging function, refer to the following.

☞ Page 74 Normal Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	0	1	2	3	4	5	6	7	8	9
Level data□	90	91	92	93	94	95	96	97	98	99

■Setting range

The setting range is from -32768 to 32767.

■Default value

The default value is 0 for all areas.

Continuous logging start/stop request

Simultaneous conversion | Synchronization

Starting or stopping of continuous logging can be set collectively for all channels.

For details on the continuous logging function, refer to the following.

☞ Page 112 Continuous Logging Function

Setting value	Setting details
0	Stop
1	Start

- Changing 'Continuous logging start/stop request' (Un\G100) from Stop (0) to Start (1) starts the continuous logging.
- Changing 'Continuous logging start/stop request' (Un\G100) from Start (1) to Stop (0) stops the continuous logging.
- If a value other than the above is set, the request is ignored and the operation of continuous logging does not change.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Continuous logging start/stop request	100			

■Default value

The default value is Stop (0).

Interrupt factor mask [n]

High speed | Low speed | Simultaneous conversion | Synchronization

Set whether to mask interrupt factors.

Setting value	Setting details
0	Mask (Interrupt unused)
1	Mask clear (Interrupt used)

When 'Interrupt factor mask [n]' (Un\G124 to Un\G139) is changed to Mask clear (Interrupt used) (1) and an interrupt factor occurs, an interrupt request is sent to the CPU module. When the set value is two or larger, the setting is regarded as Mask clear (Interrupt used) (1).

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor mask [n]	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139

■Default value

The default value is Mask (Interrupt unused) (0) for all areas.

Interrupt factor reset request [n]

High speed | Low speed | Simultaneous conversion | Synchronization

Set whether to send the interrupt factor reset request.

Setting value	Setting details
0	No reset request
1	Reset request

When Reset request (1) is set in 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) corresponding to the interrupt factor, the interrupt factor of the specified interrupt is reset. After that, 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) turns to No reset request (0). When the set value is two or larger, the setting is regarded as Reset request (1).
Interrupt factors can be reset by turning on and off 'Operating condition setting request' (Y9).
"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor reset request [n]	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171

■Default value

The default value is No reset request (0) for all areas.

Interrupt factor generation setting [n]

High speed | Low speed | Simultaneous conversion | Synchronization

Set whether to send an interrupt request when the same interrupt factor occurs during the interrupt factor detection.

Setting value	Setting details
0	Interrupt resend request
1	No interrupt resend request

- If a value other than the above is set, an interrupt factor generation setting range error (error code: 180△H) occurs.
- When an interrupt factor generation setting range error (error code: 180△H) occurs in the normal mode (high speed: 1μs/CH), the A/D conversion stops in all channels.
- When 'Interrupt factor generation setting [n]' (Un\G200 to Un\G215) is Interrupt resend request (0) and the same interrupt factor occurs while the interrupt factor has been detected, an interrupt request is sent to the CPU module again.
- When 'Interrupt factor generation setting [n]' (Un\G200 to Un\G215) is No interrupt resend request (1) and the same interrupt factor occurs while the interrupt factor has been detected, an interrupt request is not sent to the CPU module. To send an interrupt request to the CPU module, do it after setting Reset request (1) in 'Interrupt factor reset request [n]' (Un\G156 to Un\G171) and resetting the interrupt factor.

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interrupt factor generation setting [n]	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Interrupt resend request (0) for all areas.

Condition target setting [n]

High speed | Low speed | Simultaneous conversion | Synchronization

Set an interrupt factor to be detected.

Setting value	Setting details	Available operation mode
0	Disable	High speed Low speed Simultaneous conversion Synchronization
1	Error flag (XF)	Low speed Synchronization
2	Warning output flag (Process alarm)	
3	Warning output flag (Rate alarm)	
4	Input signal error detection flag	
5	A/D conversion completed	
6	Logging hold flag	
7	Logging read	
8	Continuous logging data storage	High speed Simultaneous conversion

- When a value out of the setting range for each operation mode is set, a condition target setting range error (error code: 181△H) occurs.
- When an input signal (X) or a buffer memory area set in 'Condition target setting [n]' (Un\G232 to Un\G247) turns on, an interrupt request is sent to the CPU module. However, when A/D conversion completed (5) is set, turning on 'A/D conversion completed flag' (Un\G42) sends an interrupt request to the CPU module.
- The same combination of the settings in 'Condition target setting [n]' (Un\G232 to Un\G247) and 'Condition target channel setting [n]' (Un\G264 to Un\G279) cannot be used for multiple interrupt settings (1 to 16). If the same setting combination is used for two or more interrupt settings, an interrupt condition setting overlap error (error code: 183△H) occurs. Note that setting All channels (0) in 'Condition target channel setting [n]' (Un\G264 to Un\G279) is regarded the same as setting CH1 (1), CH2 (2), CH3 (3), or CH4 (4) in 'Condition target channel setting [n]' (Un\G264 to Un\G279). Thus, the condition target where all channels are specified cannot be used for multiple interrupt settings.
- When a condition target setting range error (error code: 181△H) or an interrupt condition setting overlap error (error code: 183△H) occurs in the normal mode (high speed: 1μs/CH), the A/D conversion stops in all channels.

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Condition target setting [n]	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Disable (0) for all areas.

Condition target channel setting [n]

High speed | Low speed | Simultaneous conversion | Synchronization

Set a channel where an interrupt is detected.

Setting value	Setting details
0	All channels
1	CH1
2	CH2
3	CH3
4	CH4

When an interrupt factor with channel specification is set in 'Condition target setting [n]' (Un\G232 to Un\G247), an interrupt factor is monitored in the channel set by this area. When an input signal (X) is set as an interrupt factor, the setting in this area is ignored.

If a value other than the above is set, a condition target channel setting range error (error code: 182△H) occurs. When a condition target channel setting range error (error code: 182△H) occurs in the normal mode (high speed: 1μs/CH), the A/D conversion stops in all channels.

"n" indicates an interrupt setting number. (n = 1 to 16)

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Condition target channel setting [n]	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is All channels (0) for all areas.

Continuous logging cycle setting value

Simultaneous conversion

Set a cycle for storing data logged by the continuous logging function collectively for all channels.

■Setting range

The setting range is from 1 to 1000.

- The value 0 is regarded as 1.
- A value within the range of 1001 to 65535 is regarded as 1000.

The continuous logging cycle is the value obtained by the value in this area × 5μs (conversion cycle). Thus, the actual continuous logging cycle can be set within the range of 5μs to 5000μs.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Continuous logging cycle setting value	280			

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 1.

Mode switching setting

Medium speed | Low speed

Set a setting value for the mode to be switched.

Switching mode	Setting value	
Buffer memory address	**296**	**297**
Normal mode	5260H	4144H
Offset/gain setting mode	4144H	5260H

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Mode switching setting	296, 297			

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■After the mode is switched

When the mode is switched, this area is cleared to 0 and 'Operating condition setting completed flag' (X9) turns off.

After checking that 'Operating condition setting completed flag' (X9) is off, turn off 'Operating condition setting request' (Y9).

Point

- If a value other than the above is set, the mode is not switched but only the operating condition is changed.
- In the normal mode (high speed: 1μs/CH), the simultaneous conversion mode, or the inter-module synchronization mode, a mode switching request error (alarm code: 0D00H) occurs when 'Operating condition setting request' (Y9) is turned on and the mode is not switched.

Input signal error detection auto-clear enable/disable setting

Medium speed | Low speed | Simultaneous conversion | Synchronization

Set whether to enable or disable the auto-clearing of an input signal error detected with the input signal error detection function.

For details on the input signal error detection function, refer to the following.

☞ Page 63 Input Signal Error Detection Function

Setting value	Setting details
0	Enable
1	Disable

If a value other than the above is set, the value is regarded as Disable (1).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Input signal error detection auto-clear enable/disable setting	302			

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

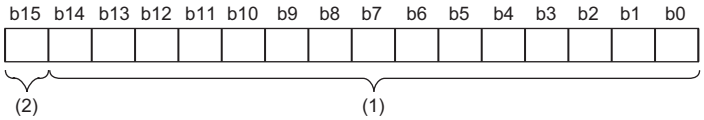
■Default value

The default value is Disable (1).

CH1 Digital output value

Medium speed | Low speed | Simultaneous conversion | Synchronization

The A/D-converted digital output value is stored as a 16-bit signed binary value.



(1) Data section

(2) Sign bit 0: Positive, 1: Negative

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Digital output value	400	600	800	1000

■Updating cycle

The updating cycle of this area varies depending on the mode.

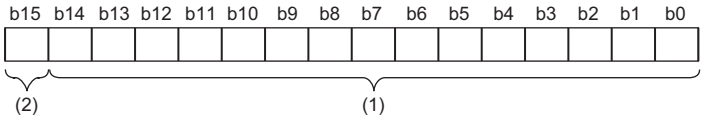
Mode	Updating cycle
Normal mode (medium speed: 10μs/CH) Normal mode (low speed: 20μs/CH)	When time average or count average is performed, values are updated at every averaging process cycle. When the processing other than them is performed, values are updated at every sampling cycle.
Simultaneous conversion mode	Values are always updated every 5μs cycle. However, when the continuous logging function is used, values are updated every time 'CH1 Continuous logging data A side storage flag' (Un\G474) or 'CH1 Continuous logging data B side storage flag' (Un\G475) is turned on.
Inter-module synchronization mode	Values are not updated at the same timing as 'CH1 Synchronization digital output value' (Un\G9500). Thus, the values cannot be referred to with the interrupt program executed by the CPU module at the synchronization cycle.

A

CH1 Digital operation value

High speed | Medium speed | Low speed

A digital operation value obtained by the scaling function, shift function, digital clipping function, or difference conversion function is stored as a 16-bit signed binary value.



(1) Data section

(2) Sign bit 0: Positive, 1: Negative

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Digital operation value	402	602	802	1002

■Updating cycle

When time average or count average is performed, values are updated at every averaging process cycle. When the processing other than them is performed, values are updated at every sampling cycle.

High speed

If CH☐ Logging enable/disable setting is set to High speed continuous logging (2) or High speed logging (3) for any channel, the digital operation values are simultaneously updated in all channels at intervals of 5ms.

Point

When the scaling function, shift function, digital clipping function, or difference conversion function is not used, a value same as the one in 'CH1 Digital output value' (Un\G400) is stored. However, when the normal mode (high speed: 1μs/CH) is used, the same value is not stored since 'CH1 Digital output value' (Un\G400) cannot be used. 0 is always stored in 'CH1 Digital output value' (Un\G400).

CH1 Maximum value, CH1 Minimum value

Medium speed | Low speed | Simultaneous conversion | Synchronization

The maximum value and minimum value of digital operation values or digital output values are stored as 16-bit signed binary values.

The maximum value or the minimum value can be reset. For details, refer to the following.

☞ Page 54 Resetting the maximum value and the minimum value

■Stored value

The value to be stored varies depending on the mode.

Mode	Stored value
Normal mode (medium speed: 10μs/CH) Normal mode (low speed: 20μs/CH)	The maximum and minimum values of the digital operation values are stored.
Simultaneous conversion mode Inter-module synchronization mode	The maximum and minimum values of the digital output values are stored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Maximum value	404	604	804	1004
CH☐ Minimum value	406	606	806	1006

Point

- For the channel to which the averaging processing is specified, the maximum and minimum values are stored at every averaging processing time.
- When the scaling function, shift function, digital clipping function, or difference conversion function is used, values calculated by each function are stored in Maximum value and Minimum value.

CH1 Difference conversion status flag

Medium speed | Low speed

The difference conversion status can be checked.

Monitored value	Description
0	Not converted
1	Converting difference

When the difference conversion starts after 'CH1 Difference conversion trigger' (Un\G470) is changed from No request (0) to Trigger request (1), 'CH1 Difference conversion status flag' (Un\G408) turns to Converting difference (1).

When 'CH1 Difference conversion trigger' (Un\G470) is changed from Trigger request (1) to No request (0), 'CH1 Difference conversion status flag' (Un\G408) is changed from Converting difference (1) to Not converted (0).

'CH1 Difference conversion status flag' (Un\G408) is Converting difference (1) during the difference conversion; Not converted (0) while the difference conversion is not in process.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Difference conversion status flag	408	608	808	1008

CH1 Logging hold flag

High speed Low speed

When the normal logging function or high speed logging function is used, the logging holding status can be checked.
For details on each logging function, refer to the following.
☞ Page 74 Normal Logging Function
☞ Page 98 High Speed Logging Function

Monitored value	Description
0	OFF
1	ON

When the state in which data is being collected in Logging data area (Un\G10000 to Un\G99999) changes to the stop state, 'CH1 Logging hold flag' (Un\G409) turns to ON (1).
When 'CH1 Logging hold request' (Y1) is changed from ON (1) to OFF (0) to restart logging, 'CH1 Logging hold flag' (Un\G409) turns to OFF (0).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Logging hold flag	409	609	809	1009

CH1 Range setting monitor

Common

The input range value set in the input range setting or 'CH1 Range setting' (Un\G598) can be checked.

Monitored value	Description
0H	4 to 20mA
1H	0 to 20mA
2H	1 to 5V
3H	0 to 5V
4H	-10 to 10V
5H	0 to 10V
AH	4 to 20mA (extended mode)
BH	1 to 5V (extended mode)
FH	User range setting

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Range setting monitor	430	630	830	1030

Restriction

The stored value in this area is not updated for a channel where A/D conversion disable is set since the input range cannot be switched for that channel. For details, refer to the following.
☞ Page 23 Range Switching Function

CH1 Difference conversion reference value

Medium speed Low speed

This area stores the value in 'CH1 Digital operation value' (Un\G402) at the start of the difference conversion as the difference conversion reference value.
The difference conversion reference value is updated when 'CH1 Difference conversion trigger' (Un\G470) is changed from No request (0) to Trigger request (1).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Difference conversion reference value	432	632	832	1032

■Storage range

The storage range is from -32768 to 32767.

Point

Even if 'CH1 Difference conversion status flag' (Un\G408) is changed from Converting difference (1) to Not converted (0), 'CH1 Difference conversion reference value' (Un\G432) is not cleared.

CH1 Logging start address monitor

High speed Low speed

When the normal logging function or high speed logging function is used, the start address of Logging data area (Un\G10000 to Un\G99999) of each channel can be checked. When the high speed continuous logging function is used, a value of this buffer memory area is always 0.

■Stored value

Values are updated when 'CH1 Logging data points setting' (Un\G536) is updated.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Logging start address monitor	434, 435	634, 635	834, 835	1034, 1035

CH1 Head pointer

High speed Low speed

When the normal logging function or high speed logging function is used, the buffer memory address of the oldest data of each channel in Logging data area (Un\G10000 to Un\G99999) can be checked with this buffer memory area.
The offset value counted from the start address of each channel is stored.

■Buffer memory address

The following shows the buffer memory address of this area.

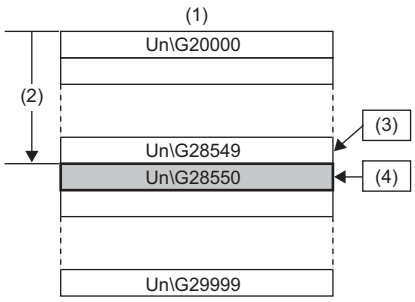
Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Head pointer	436, 437	636, 637	836, 837	1036, 1037

Ex.

When the value of 'CH2 Head pointer' (Un\G636, Un\G637) is 8550 with the following settings

- 'CH1 Logging data points setting' (Un\G536): 100 (10000 points)
- 'CH2 Logging data points setting' (Un\G736): 100 (10000 points)

In this case, the start address of CH2 is Un\G20000.



(1) Logging data area
(2) Head pointer: 8550 (Offset value counted from Un\G20000)
(3) The latest data
(4) The oldest data (28550 = 20000 + 8550)

Point

- When the normal logging function is used, at the first round of data logging, while data is being logged for the number of data points set in 'CH1 Logging data points setting' (Un\G536), the oldest data is stored in the start address of Logging data area (Un\G10000 to Un\G99999). Thus, the value of 'CH1 Head pointer' (Un\G436, Un\G437) has been fixed to 0. As for data logging for points set in 'CH1 Logging data points setting' (Un\G536) + 1 and larger, the value in 'CH1 Head pointer' (Un\G436, Un\G437) increases by one every time the data is stored.
- When the high speed logging function is used, the oldest data is always stored to the start address of Logging data area (Un\G10000 to Un\G99999). Thus, the value of 'CH1 Head pointer' (Un\G436, Un\G437) is fixed to 0.
- When 'CH1 Logging hold request' (Y1) is turned off, 'CH1 Head pointer' (Un\G436, Un\G437) is cleared to 0.
- When the high speed continuous logging function is used, a value of this buffer memory area is always 0.

CH1 Latest pointer

High speed Low speed

When the normal logging function or high speed logging function is used, the buffer memory address of the latest data of each channel in Logging data area (Un\G10000 to Un\G99999) can be checked with this buffer memory area.
The offset value counted from the start address of each channel is stored.

■Buffer memory address

The following shows the buffer memory address of this area.

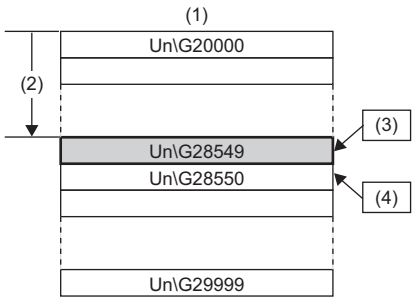
Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Latest pointer	438, 439	638, 639	838, 839	1038, 1039

Ex.

When the value of 'CH2 Latest pointer' (Un\G638, Un\G639) is 8549 with the following settings

- 'CH1 Logging data points setting' (Un\G536): 100 (10000 points)
- 'CH2 Logging data points setting' (Un\G736): 100 (10000 points)

In this case, the start address of CH2 is Un\G20000.



(1) Logging data area
(2) Latest pointer: 8549 (Offset value counted from Un\G20000)
(3) The latest data (28549 = 20000 + 8549)
(4) The oldest data

Point

- When the normal logging function is used, 'CH1 Latest pointer' (Un\G438, Un\G439) increases by one every time data is stored after the start of the logging.
- When the high speed logging function is used, data is updated when 'CH1 Logging hold flag' (Un\G409) is turned on with the stop of high speed logging after turning on of 'CH1 Logging hold request' (Y1).
- When 'CH1 Logging hold request' (Y1) is turned off, 'CH1 Latest pointer' (Un\G438, Un\G439) is cleared to 0.
- When the high speed continuous logging function is used, a value of this buffer memory area is always 0.

A

CH1 Number of logging data

High speed | Low speed | Simultaneous conversion | Synchronization

The number of logging data points stored in Logging data area of each channel can be checked during the logging.

■Updating the number of logging data

The process of update varies depending on the logging function in use.

Logging function in use	Updating the number of logging data
Normal logging function	• The value in 'CH1 Number of logging data' (Un\G440, Un\G441) increases by one every time data is stored after the start of the logging. When the number of logging data points reaches the value set in 'CH1 Logging data points setting' (Un\G536) × 100, the logging data area is overwritten with new data from the start address. Thus, the value in 'CH1 Number of logging data' (Un\G440, Un\G441) is fixed to the value of 'CH1 Logging data points setting' (Un\G536) × 100. • When 'CH1 Logging hold request' (Y1) is turned off, 'CH1 Number of logging data' (Un\G440, Un\G441) is cleared to 0.
High speed logging function	The number of logging data is not updated during high speed logging. It is updated when 'CH1 Logging hold flag' (Un\G409) is turned on with the stop of high speed logging after turning on of 'CH1 Logging hold request' (Y1).
Continuous logging function	• When continuous logging is started, Number of logging data increases by 5000 every time logging data of 5000 points is stored. When the data count reaches to 720000000, Number of logging data returns to 0 and then increases by 5000 again. • When 'Continuous logging start/stop request' (Un\G100) is changed from Stop (0) to Start (1), 'CH1 Number of logging data' (Un\G440, Un\G441) is cleared to 0.
High speed continuous logging function	• When high speed continuous logging is started, Number of logging data increases by 10000 every time logging data of 10000 points is stored. When the data count reaches to 3600000000, Number of logging data returns to 0 and then increases by 10000 again. • When 'CH1 High speed continuous logging start/stop request' (Un\G478) is changed from Stop (0) to Start (1), 'CH1 Number of logging data' (Un\G440, Un\G441) is cleared to 0.

For details on each logging function, refer to the following.

☞ Page 74 Normal Logging Function
☞ Page 98 High Speed Logging Function
☞ Page 112 Continuous Logging Function
☞ Page 131 High Speed Continuous Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Number of logging data	440, 441	640, 641	840, 841	1040, 1041

CH1 Trigger pointer

High speed Low speed

When the normal logging function or high speed logging function is used, this buffer memory area enables users to check which buffer memory address of Logging data area (Un\G10000 to Un\G99999) stores the data at the hold trigger generation. Trigger pointer stores the difference between the address storing the data at the hold trigger generation and the start address of Logging data area (Un\G10000 to Un\G99999).

For details on each logging function, refer to the following.

☞ Page 74 Normal Logging Function

☞ Page 98 High Speed Logging Function

■Updating data

- When the normal logging function is used, data is updated when the hold trigger is detected.
- When the high speed logging function is used, data is updated when 'CH1 Logging hold flag' (Un\G409) is turned on with the stop of high speed logging after turning on of 'CH1 Logging hold request' (Y1).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Trigger pointer	442, 443	642, 643	842, 843	1042, 1043

Point

- When 'CH1 Logging hold request' (Y1) is turned off, 'CH1 Trigger pointer' (Un\G442, Un\G443) is cleared to 0.
- When the high speed continuous logging function is used, a value of this buffer memory area is always 0.

A

CH1 Current logging read pointer

Low speed

Every time data is logged for the amount equivalent to the logging read points monitor value, a value calculated by the following formula is stored in this area.

CH1 Current logging read pointer = CH1 Latest pointer - CH1 Logging read points monitor value + 1

For details on the normal logging function, refer to the following.

☞ Page 74 Normal Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Current logging read pointer	444, 445	644, 645	844, 845	1044, 1045

CH1 Previous logging read pointer

Low speed

Immediately before an interrupt request is sent to the CPU module, the value in Current logging read pointer, which is not yet updated by the interrupt, is stored in this area.

For details on the normal logging function, refer to the following.

☞ Page 74 Normal Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Previous logging read pointer	446, 447	646, 647	846, 847	1046, 1047

CH1 Logging read points monitor value

Low speed

The number of the actual logging read points is stored.

When 'Operating condition setting request' (Y9) is turned on and off, the value is not stored in the corresponding area of the channel where the logging read function is disabled.

For details on the normal logging function, refer to the following.

☞ Page 74 Normal Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Logging read points monitor value	448, 449	648, 649	848, 849	1048, 1049

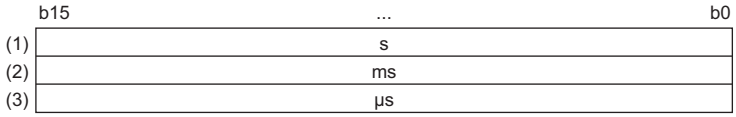
CH1 Logging cycle monitor value

High speed | Low speed | Simultaneous conversion | Synchronization

This area stores the actual logging cycle that is calculated from the updating cycle of data to be logged.
When 'Operating condition setting request' (Y9) is turned on and off, the actual logging cycle is stored in Logging cycle monitor value in the corresponding channel where a logging function is enabled.
For details on each logging function, refer to the following.

☞ Page 74 Normal Logging Function
☞ Page 98 High Speed Logging Function
☞ Page 112 Continuous Logging Function
☞ Page 131 High Speed Continuous Logging Function

The following values are stored in 'CH1 Logging cycle monitor value' (Un\G450 to Un\G452).



(1) 'CH1 Logging cycle monitor value (s)' (Un\G450)*1
(2) 'CH1 Logging cycle monitor value (ms)' (Un\G451)*1
(3) 'CH1 Logging cycle monitor value (µs)' (Un\G452)

*1 Logging cycle monitor value is not updated in the normal mode (high speed: 1µs/CH), the simultaneous conversion mode, or the inter-module synchronization mode.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Logging cycle monitor value (s)	450	650	850	1050
CH☐ Logging cycle monitor value (ms)	451	651	851	1051
CH☐ Logging cycle monitor value (µs)	452	652	852	1052

CH1 Trigger generation time

High speed | Low speed | Simultaneous conversion | Synchronization

When the normal logging function or high speed logging function is used, the time when a trigger was generated is recorded. When the continuous logging function or the high speed continuous logging function is used, the time when the logging has started is recorded.

For details on each logging function, refer to the following.

☞ Page 74 Normal Logging Function
☞ Page 98 High Speed Logging Function
☞ Page 112 Continuous Logging Function
☞ Page 131 High Speed Continuous Logging Function

	b15 ... b8	b7 ... b0
Un\G453	First two digits of the year	Last two digits of the year
Un\G454	Month	Day
Un\G455	Hour	Minute
Un\G456	Second	Day of the week
Un\G457	Millisecond (higher-order digits)	Millisecond (lower-order digits)

Item		Storage contents	Storage example*1
First two digits of the year	Last two digits of the year	Stored in BCD code.	2015H
Month	Day		1224H
Hour	Minute		1234H
Second			56H
Day of the week		One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3 Thursday: 4, Friday: 5, Saturday: 6	4H
Millisecond (upper)		Stored in BCD code.	7H
Millisecond (lower)			89H

*1 Values stored when a trigger is generated at 12:34:56.789 on Saturday, December 24th, 2015.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Trigger generation time (First/Last two digits of the year)	453	653	853	1053
CH☐ Trigger generation time (Month/Day)	454	654	854	1054
CH☐ Trigger generation time (Hour/Minute)	455	655	855	1055
CH☐ Trigger generation time (Second/Day of the week)	456	656	856	1056
CH☐ Trigger generation time (Millisecond)	457	657	857	1057

CH1 Logging status monitor value

High speed Low speed

When the normal logging function or high speed logging function is used, this area stores the execution status of logging.
For details on each logging function, refer to the following.

☞ Page 74 Normal Logging Function
☞ Page 98 High Speed Logging Function

Execution status of logging	Stored value
Stop (disabled)	FH
Logging hold request waiting (during logging)	0H
Level trigger waiting (during logging)	1H
Trigger existing (during logging)	2H
Logging hold completed (stop)	3H

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Logging status monitor value	458	658	858	1058

CH1 A/D conversion status monitor

Common

This area stores the A/D conversion status.

A/D conversion status	Description	Stored value
Conversion disabled	The A/D conversion is disabled. The A/D conversion in the corresponding channel is not executed.	0
Conversion started	Status until the completion of the first A/D conversion after the A/D conversion is enabled	1
Conversion completed	Status after the completion of the first A/D conversion The A/D conversion is being executed.	2
Input signal error detected	Status when an input signal error has been detected.	3

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ A/D conversion status monitor	459	659	859	1059

CH1 Averaging process status monitor

Common

This area stores the A/D conversion method that is being executed.

Averaging processing status	Stored value
Sampling processing	0
Time average	1
Count average	2
Moving average	3
Primary delay filter	4
Low pass filter	5
High pass filter	6
Band pass filter	7

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Averaging process status monitor	460	660	860	1060

CH1 High speed continuous logging status monitor

High speed

The execution status of the high speed continuous logging function is stored.

For details on the high speed continuous logging function, refer to the following.

☞ Page 131 High Speed Continuous Logging Function

Monitored value	Description
0	High speed continuous logging disable status
1	High speed continuous logging start request waiting
2	High speed continuous logging in process

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ High speed continuous logging status monitor	469	669	869	1069

CH1 Difference conversion trigger

Medium speed Low speed

Use this buffer memory area as a trigger to start or stop the difference conversion.
For details on the difference conversion function, refer to the following.
☞ Page 50 Difference Conversion Function

Setting value	Setting details
0	No request
1	Trigger request

If a value other than the above is set, the value is regarded as Trigger request (1).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Difference conversion trigger	470	670	870	1070

■Starting and stopping the difference conversion

- When 'CH1 Difference conversion trigger' (Un\G470) is changed from No request (0) to Trigger request (1), the difference conversion starts.
- When 'CH1 Difference conversion trigger' (Un\G470) is changed from Trigger request (1) to No request (0), the difference conversion stops.

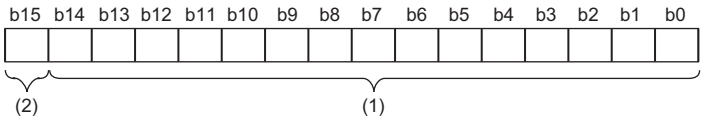
■Default value

The default value is No request (0) for all channels.

CH1 Conversion value shift amount

Medium speed Low speed

Set the conversion value shift amount to be used by the shift function.
The digital operation value to which the conversion value shift amount is applied is stored in 'CH1 Digital operation value' (Un\G402).
For details on the shift function, refer to the following.
☞ Page 45 Shift Function



(1) Data section
(2) Sign bit 0: Positive, 1: Negative

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Conversion value shift amount	472	672	872	1072

■Setting range

The setting range is from -32768 to 32767.

■Enabling the setting

Regardless of turning on and off 'Operating condition setting request' (Y9), the conversion value shift amount becomes enabled when it is set.

■Default value

The default value is 0 for all channels.

CH1 Continuous logging data storage flag

Simultaneous conversion | Synchronization

Use this buffer memory area to check that data of 5000 points is stored in Logging data area of each channel during continuous logging.

This area has two flags; 'CH1 Continuous logging data A side storage flag' (Un\G474) for checking that data is stored in the first 5000 points area (A side) of Logging data area and 'CH1 Continuous logging data B side storage flag' (Un\G475) for checking that data is stored in the last 5000 points area (B side) of Logging data area.

For details on the continuous logging function, refer to the following.

☞ Page 112 Continuous Logging Function

Setting value	Setting details
0	• Logging data storage in A side not completed • Logging data storage in B side not completed
1	• Logging data storage in A side completed • Logging data storage in B side completed

- Logging data storage completed (1) is stored every time logging data for the first 5000 points (A side) or the last 5000 points (B side) has been stored.
- When logging data storage in the file registers of the CPU module is completed, Logging data storage not completed (0) is stored in this area. With this timing, the area becomes ready to accept the next storage flag.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Continuous logging data A side storage flag	474	674	874	1074
CH☐ Continuous logging data B side storage flag	475	675	875	1075

■Default value

The default value is 0 for all channels.

CH1 High speed continuous logging data storage flag

High speed

Use this buffer memory area to check that data of 10000 points is stored in Logging data area of each channel during high speed continuous logging.
This area has two flags; 'CH1 High speed continuous logging data A side storage flag' (Un\G476) for checking that data is stored in the first 10000 points area (A side) of Logging data area and 'CH1 High speed continuous logging data B side storage flag' (Un\G477) for checking that data is stored in the last 10000 points area (B side) of Logging data area.
For details on the high speed continuous logging function, refer to the following.
☞ Page 131 High Speed Continuous Logging Function

Setting value	Setting details
0	• Logging data storage in A side not completed • Logging data storage in B side not completed
1	• Logging data storage in A side completed • Logging data storage in B side completed

- Logging data storage completed (1) is stored every time logging data for the first 10000 points (A side) or the last 10000 points (B side) has been stored.
- When logging data storage in the file registers of the CPU module is completed, Logging data storage not completed (0) is stored in this area. With this timing, the area becomes ready to accept the next storage flag.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ High speed continuous logging data A side storage flag	476	676	876	1076
CH☐ High speed continuous logging data B side storage flag	477	677	877	1077

■Default value

The default value is 0 for all channels.

CH1 High speed continuous logging start/stop request

High speed

Set whether to start or stop the high speed continuous logging for each channel.
For details on the high speed continuous logging function, refer to the following.
☞ Page 131 High Speed Continuous Logging Function

Setting value	Setting details
0	Stop
1	Start

- Changing 'CH1 High speed continuous logging start/stop request' (Un\G478) from Stop (0) to Start (1) starts the high speed continuous logging.
- Changing 'CH1 High speed continuous logging start/stop request' (Un\G478) from Start (1) to Stop (0) stops the high speed continuous logging.
- If a value other than the above is set, the request is ignored and the operation of high speed continuous logging does not change.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ High speed continuous logging start/stop request	478	678	878	1078

■Default value

The default value is Stop (0).

CH1 Maximum value reset request

Medium speed | Low speed | Simultaneous conversion | Synchronization

Use this buffer memory area to reset 'CH1 Maximum value' (Un\G404).

Setting value	Setting details
0	No request
1	Reset request

Changing 'CH1 Maximum value reset request' (Un\G480) from No request (0) to Reset request (1) updates 'CH1 Maximum value' (Un\G404) to the current value, and stores No request (0) in 'CH1 Maximum value reset request' (Un\G480).
If a value other than the above is set, a maximum value reset request setting range error (error code: 1A8☐H) occurs, and 'CH1 Maximum value' (Un\G404) is not reset.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Maximum value reset request	480	680	880	1080

■Default value

The default value is No request (0) for all channels.

CH1 Minimum value reset request

Medium speed | Low speed | Simultaneous conversion | Synchronization

Use this buffer memory area to reset 'CH1 Minimum value' (Un\G406).

Setting value	Setting details
0	No request
1	Reset request

Changing 'CH1 Minimum value reset request' (Un\G481) from No request (0) to Reset request (1) updates 'CH1 Minimum value' (Un\G406) to the current value, and stores No request (0) in 'CH1 Minimum value reset request' (Un\G481).
If a value other than the above is set, a minimum value reset request setting range error (error code: 1A9☐H) occurs, and 'CH1 Minimum value' (Un\G406) is not reset.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Minimum value reset request	481	681	881	1081

■Default value

The default value is No request (0) for all channels.

CH1 A/D conversion enable/disable setting

Common

Set whether to enable or disable the A/D conversion.

For details on the A/D conversion enable/disable setting function, refer to the following.

☞ Page 24 A/D Conversion Enable/Disable Setting Function

Setting value	Setting details
0	A/D conversion enable
1	A/D conversion disable

When a value other than the above is set, the value is regarded as A/D conversion disable (1).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ A/D conversion enable/disable setting	500	700	900	1100

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is A/D conversion disable (1) for all channels.

CH1 Averaging process specification

Common

Set the processing to be performed among the sampling processing, averaging processing, and filter processing.

The available processing varies depending on the mode.

Setting value*1	Setting details	Available mode	
0	Sampling processing	Common	
1	Time average*2	Medium speed	Low speed
2	Count average*2		
3	Moving average	Common	
4	Primary delay filter*2	Medium speed	Low speed
5	Low pass filter*2		
6	High pass filter*2		
7	Band pass filter*2		

*1 If a value other than the setting values is set, an averaging process specification setting range error (error code: 191☐H) occurs.

*2 If a value other than Sampling processing (0) or Moving average (3) is set in the normal mode (high speed: 1μs/CH), the simultaneous conversion mode, or the inter-module synchronization mode, an averaging process specification setting range error (error code: 191☐H) occurs. When an averaging process specification setting range error (error code: 191☐H) occurs in any channel, the A/D conversion stops in all channels.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Averaging process specification	501	701	901	1101

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Sampling processing (0) for all channels.

CH1 Time average/Count average/Moving average/Primary delay filter constant setting

Common

Set the time (for averaging), count (for averaging), moving average count, and primary delay filter constant for when Time average (1), Count average (2), Moving average (3), or Primary delay filter (4) is set in 'CH1 Averaging process specification' (Un\G501).

The following table lists the setting ranges.

Setting value	Setting details
1 to 5000 (ms)	Time average
4 to 62500 (times)	Count average
2 to 1000 (times)	Moving average
1 to 500 (times)	Primary delay filter constant

- If a value other than the above is set, any of a time average setting range error (error code: 192☐H), count average setting range error (error code: 193☐H), moving average setting range error (error code: 194☐H), or primary delay filter constant setting range error (error code: 195☐H) occurs, and the A/D conversion processing is performed with the setting before the occurrence of the error.
- When a moving average setting range error (error code: 194☐H) occurs in any channel in the normal mode (high speed: 1μs/CH), the simultaneous conversion mode, or the inter-module synchronization mode, the A/D conversion stops in all channels.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Time average/Count average/Moving average/Primary delay filter constant setting	502	702	902	1102

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

Point

- Set a primary delay filter constant for the primary delay filter. The value of the time constant (ms) is the product of the primary delay filter constant and the sampling cycle.
- Since the default value is 0, change the value depending on the processing.
- When Sampling processing (0), Low pass filter (5), High pass filter (6), or Band pass filter (7) is set in 'CH1 Averaging process specification' (Un\G501), the setting of this area is ignored.

CH1 Scaling enable/disable setting

High speed | Medium speed | Low speed

Set whether to enable or disable the scaling.

For details on the scaling function, refer to the following.

☞ Page 41 Scaling Function

Setting value	Setting details
0	Enable
1	Disable

- If a value other than the above is set, a scaling enable/disable setting range error (error code: 1A0□H) occurs.
- When a scaling enable/disable setting range error (error code: 1A0□H) occurs in any channel in the normal mode (high speed: 1 μs/CH), the A/D conversion stops in all channels.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Scaling enable/disable setting	504	704	904	1104

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Disable (1) for all channels.

CH1 Scaling upper limit value

High speed | Medium speed | Low speed

Set an upper limit value for the range of the scale conversion.

For details on the scaling function, refer to the following.

☞ Page 41 Scaling Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Scaling upper limit value	506	706	906	1106

■Setting range

- The setting range is from -32000 to 32000.
- In the channel where a set value does not satisfy the condition "the scaling upper limit value ≠ the scaling lower limit value", a scaling upper/lower limit value setting error (error code: 1A2□H) occurs.
- In the channel where a value out of the setting range is set, a scaling setting range error (error code: 1A1□H) occurs.
- When a scaling upper/lower limit value setting error (error code: 1A2□H) or a scaling setting range error (error code: 1A1□H) occurs in any channel in the normal mode (high speed: 1μs/CH), the A/D conversion stops in all channels.
- When 'CH1 Scaling enable/disable setting' (Un\G504) is set to Disable (1), the setting of 'CH1 Scaling upper limit value' (Un\G506) is ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Scaling lower limit value

High speed | Medium speed | Low speed

Set a lower limit value for the range of the scale conversion.

For details on the scaling function, refer to the following.

☞ Page 41 Scaling Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Scaling lower limit value	508	708	908	1108

■Setting range

- The setting range is from -32000 to 32000.
- In the channel where a set value does not satisfy the condition "the scaling upper limit value ≠ the scaling lower limit value", a scaling upper/lower limit value setting error (error code: 1A2☐H) occurs.
- In the channel where a value out of the setting range is set, a scaling setting range error (error code: 1A1☐H) occurs.
- When a scaling upper/lower limit value setting error (error code: 1A2☐H) or a scaling setting range error (error code: 1A1☐H) occurs in any channel in the normal mode (high speed: 1μs/CH), the A/D conversion stops in all channels.
- When 'CH1 Scaling enable/disable setting' (Un\G504) is set to Disable (1), the setting of 'CH1 Scaling lower limit value' (Un\G508) is ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Digital clipping enable/disable setting

Medium speed | Low speed

Set whether to enable or disable the digital clipping function.

For details on the digital clipping function, refer to the following.

☞ Page 48 Digital Clipping Function

Setting value	Setting details
0	Enable
1	Disable

If a value other than the above is set, a digital clipping enable/disable setting range error (error code: 1A5☐H) occurs.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Digital clipping enable/disable setting	510	710	910	1110

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Disable (1) for all channels.

CH1 Warning output setting (Process alarm)

Medium speed | Low speed | Simultaneous conversion | Synchronization

Set whether to enable or disable the warning output of a process alarm.

For details on the warning output function (process alarm), refer to the following.

☞ Page 55 Process alarm

Setting value	Setting details
0	Enable
1	Disable

If a value other than the above is set, a warning output setting (Process alarm) range error (error code: 1B0☐H) occurs.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Warning output setting (Process alarm)	512	712	912	1112

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Disable (1) for all channels.

CH1 Warning output setting (Rate alarm)

Medium speed | Low speed

Set whether to enable or disable the warning output of a rate alarm.

For details on the warning output function (rate alarm), refer to the following.

☞ Page 58 Rate alarm

Setting value	Setting details
0	Enable
1	Disable

If a value other than the above is set, a warning output setting (Rate alarm) range error (error code: 1B8☐H) occurs.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Warning output setting (Rate alarm)	513	713	913	1113

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Disable (1) for all channels.

CH1 Process alarm upper upper limit value

Medium speed | Low speed | Simultaneous conversion | Synchronization

Set an upper upper limit value of the warning output function (process alarm).

For details on the warning output function (process alarm), refer to the following.

☞ Page 55 Process alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Process alarm upper upper limit value	514	714	914	1114

■Setting range

The setting range is from -32768 to 32767.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Process alarm upper lower limit value

Medium speed | Low speed | Simultaneous conversion | Synchronization

Set an upper lower limit value of the warning output function (process alarm).

For details on the warning output function (process alarm), refer to the following.

☞ Page 55 Process alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Process alarm upper lower limit value	516	716	916	1116

■Setting range

The setting range is from -32768 to 32767.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Process alarm lower upper limit value

Medium speed | Low speed | Simultaneous conversion | Synchronization

Set a lower upper limit value of the warning output function (process alarm).

For details on the warning output function (process alarm), refer to the following.

☞ Page 55 Process alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Process alarm lower upper limit value	518	718	918	1118

■Setting range

The setting range is from -32768 to 32767.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Process alarm lower lower limit value

Medium speed | Low speed | Simultaneous conversion | Synchronization

Set a lower lower limit value of the warning output function (process alarm).

For details on the warning output function (process alarm), refer to the following.

☞ Page 55 Process alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Process alarm lower lower limit value	520	720	920	1120

■Setting range

The setting range is from -32768 to 32767.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

Point

- When using the process alarm, configure the 4-step settings of the process alarm upper upper limit value, upper lower limit value, lower upper limit value, and lower lower limit value.
- In the channel where a set value does not satisfy the condition "the upper upper limit value ≥ the upper lower limit value ≥ the lower upper limit value ≥ the lower lower limit value", a process alarm upper lower limit value setting range error (error code: 1B△☐H) occurs.
- Since the default value is 0, change the value.
- When the scaling function, shift function, digital clipping function, or difference conversion function is used, warning targets are digital operation values to which the operation of each function was reflected. Be sure to consider operation results of each function to set values.

CH1 Rate alarm warning detection cycle setting

Medium speed Low speed

Set the cycle to check the change rate of digital output values.
The value of the cycle to detect a rate alarm warning is the product of the value in 'CH1 Rate alarm warning detection cycle setting' (Un\G522) and the conversion cycle.
For details on the warning output function (rate alarm), refer to the following.
☞ Page 58 Rate alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Rate alarm warning detection cycle setting	522	722	922	1122

■Setting range

The setting range is from 1 to 32000 (times).
In the channel where a value out of the range is set, a rate alarm warning detection cycle setting range error (error code: 1B9☐H) occurs.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Rate alarm upper limit value

Medium speed Low speed

For rate alarm, the digital output value is checked at every warning detection cycle and the change rate is calculated from the check result. Use this area to set an upper limit value of the change rate of digital output values for each channel.
For details on the warning output function (rate alarm), refer to the following.
☞ Page 58 Rate alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Rate alarm upper limit value	524	724	924	1124

■Setting range

The setting range is from -32768 to 32767 (-3276.8 to 3276.7%). (Set it in increments of 0.1%.)

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Rate alarm lower limit value

Medium speed | Low speed

For rate alarm, the digital output value is checked at every warning detection cycle and the change rate is calculated from the check result. Use this area to set a lower limit value of the change rate of digital output values for each channel.

For details on the warning output function (rate alarm), refer to the following.

☞ Page 58 Rate alarm

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Rate alarm lower limit value	526	726	926	1126

■Setting range

The setting range is from -32768 to 32767 (-3276.8 to 3276.7%). (Set it in increments of 0.1%.)

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

Point

- When using rate alarms, configure the 2-step settings of the rate alarm upper limit value and lower limit value.
- In the channel where a set value satisfies the condition the "rate alarm lower limit value ≥ the rate alarm upper limit value", a rate alarm upper/lower limit setting value inversion error (error code: 1BA□H) occurs.
- Since the default value is 0, change the value.

CH1 Input signal error detection setting

Medium speed | Low speed | Simultaneous conversion | Synchronization

Set a condition for detecting an input signal error.

For details on the input signal error detection function, refer to the following.

☞ Page 63 Input Signal Error Detection Function

Setting value	Setting details
0	Disable
1	Upper and lower limit detection
2	Lower limit detection
3	Upper limit detection
4	Simple disconnection detection

If a value other than the above is set, an input signal error detection setting range error (error code: 1C0□H) occurs. If Simple disconnection detection (4) is selected for the channel where the set input range is other than the extended mode, a disconnection detection enabled range setting range error (error code: 1C6□H) occurs.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Input signal error detection setting	528	728	928	1128

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Input signal error detection lower limit setting value

Medium speed | Low speed | Simultaneous conversion | Synchronization

Set a lower limit setting value to detect an error for the input analog value.

For details on the input signal error detection function, refer to the following.

☞ Page 63 Input Signal Error Detection Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Input signal error detection lower limit setting value	529	729	929	1129

■Setting range

The setting range is from 0 to 250 (0 to 25.0%). Set it in increments of 1 (0.1%).

In the channel where a value out of the range is set, an input signal error detection setting value range error (error code: 1C1□H) occurs.

■How to calculate the input signal error detection lower limit value

The input signal error detection lower limit value is calculated based on the input signal error detection lower limit setting value as follows. The input signal error detection lower limit value to be calculated varies depending on the input range used.

- Input signal error detection lower limit value = Lower limit value of each range - (Gain value of each range - Offset value of each range) × (Input signal error detection lower limit setting value/1000)

Ex.

When 'CH1 Input signal error detection lower limit setting value' (Un\G529) is set to 100 (10%) with the input range of 4 to 20mA, the input signal error detection lower limit value is calculated as follows:

- Input signal error detection lower limit value = 4 - (20 - 4) × (100/1000) = 2.4mA

■Detection condition

Detection conditions vary depending on the setting of 'CH1 Input signal error detection setting' (Un\G528) as follows:

- When 'CH1 Input signal error detection setting' (Un\G528) is set to Upper and lower limit detection (1), the detection is performed with both the input signal error detection upper limit value and input signal error detection lower limit value.
- When 'CH1 Input signal error detection setting' (Un\G528) is set to Lower limit detection (2), the detection is performed only with the input signal error detection lower limit value.
- When 'CH1 Input signal error detection setting' (Un\G528) is set to Upper limit detection (3), the value set in this area is ignored.
- When 'CH1 Input signal error detection setting' (Un\G528) is set to Simple disconnection detection (4), the value set in this area is ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 50 for all channels.

CH1 Input signal error detection upper limit setting value

Medium speed | Low speed | Simultaneous conversion | Synchronization

Set an upper limit setting value to detect an error for the input analog value.
For details on the input signal error detection function, refer to the following.
☞ Page 63 Input Signal Error Detection Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Input signal error detection upper limit setting value	530	730	930	1130

■Setting range

The setting range is from 0 to 250 (0 to 25.0%). Set it in increments of 1 (0.1%).
In the channel where a value out of the range is set, an input signal error detection setting value range error (error code: 1C1□H) occurs.

■How to calculate the input signal error detection upper limit value

The input signal error detection upper limit value is calculated based on the input signal error detection upper limit setting value as follows. The input signal error detection upper limit value to be calculated varies depending on the input range used.

- Input signal error detection upper limit value = Gain value of each range + (Gain value of each range - Offset value of each range) × (Input signal error detection upper limit setting value/1000)

Ex.
When 'CH1 Input signal error detection upper limit setting value' (Un\G530) is set to 100 (10%) with the input range of 4 to 20mA, the input signal error detection upper limit value is calculated as follows:

- Input signal error detection upper limit value = 20 + (20 - 4) × (100/1000) = 21.6mA

■Detection condition

Detection conditions vary depending on the setting of 'CH1 Input signal error detection setting' (Un\G528) as follows:

- When 'CH1 Input signal error detection setting' (Un\G528) is set to Upper and lower limit detection (1), the detection is performed with both the input signal error detection upper limit value and input signal error detection lower limit value.
- When 'CH1 Input signal error detection setting' (Un\G528) is set to Lower limit detection (2), the value set in this area is ignored.
- When 'CH1 Input signal error detection setting' (Un\G528) is set to Upper limit detection (3), the detection is performed only with the input signal error detection upper limit value.
- When 'CH1 Input signal error detection setting' (Un\G528) is set to Simple disconnection detection (4), the value set in this area is ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 50 for all channels.

CH1 Logging enable/disable setting

High speed Low speed

Set the logging function to be used for each channel. For details on the available logging functions, refer to the following.

☞ Page 74 Normal Logging Function
☞ Page 98 High Speed Logging Function
☞ Page 131 High Speed Continuous Logging Function

Setting value	Setting details
0	Normal logging
1	Disable
2	High speed continuous logging
3	High speed logging

- In the normal mode (high speed: 1μs/CH), if a value other than Disable (1), High speed continuous logging (2), or High speed logging (3) is set, a logging enable/disable setting range error (error code: 1D0□H) occurs. When a logging enable/disable setting range error (error code: 1D0□H) occurs in any channel, the A/D conversion stops in all channels.
- In the normal mode (high speed: 1μs/CH), High speed continuous logging (2) and High speed logging (3) cannot be set together across channels. If they are set, an across channels logging setting error (error code: 1DE0H) occurs. When an across channels logging setting error (error code: 1DE0H) occurs, the A/D conversion stops in all channels.
- In the normal mode (low speed: 20μs/CH), if a value other than Disable (1) or Normal logging (0) is set, a logging enable/disable setting range error (error code: 1D0□H) occurs. Logging cannot be performed.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Logging enable/disable setting	535	735	935	1135

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Disable (1) for all channels.

CH1 Logging data points setting

High speed Low speed

When the normal logging function or high speed logging function is used, set the number of logging data points for each channel.

For details on each logging function, refer to the following.

☞ Page 74 Normal Logging Function

☞ Page 98 High Speed Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Logging data points setting	536	736	936	1136

■Setting range

- The setting range is from 0 to 900 (0 to 90000 points). Set it in increments of 1 (100 points). The areas that store the data logged are distributed to each channel for the number of logging data points set in this area.
- In the channel where a value out of the range is set, a logging data points setting range error (error code: 1DA□H) occurs. Logging cannot be performed.
- Regardless of whether the normal logging function and high speed logging function are used or not, set the number of logging data points for each channel so that the total of values set in this area does not exceed 900 (90000 points). If the total of the values is greater than 900, a logging data points setting total range error (error code: 1DB0H) occurs.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 200 (20000 points) for all channels.

A

CH1 Logging data setting

Low speed

In the normal logging function, determine the target to be collected: digital output value or digital operation value.
For details on the normal logging function, refer to the following.
☞ Page 74 Normal Logging Function

Setting value	Setting details
0	Digital output value
1	Digital operation value

If a value other than the above is set, a logging data setting range error (error code: 1D3☐H) occurs. Logging cannot be performed.
When 'CH1 Logging enable/disable setting' (Un\G535) is set to Disable (1), the setting of 'CH1 Logging data setting' (Un\G537) is ignored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Logging data setting	537	737	937	1137

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Digital operation value (1) for all channels.

CH1 Logging cycle setting value

High speed Low speed

When the normal logging function or high speed logging function is used, set a cycle for storing logging data.
For details on each logging function, refer to the following.
☞ Page 74 Normal Logging Function
☞ Page 98 High Speed Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Logging cycle setting value	538	738	938	1138

■Setting range

The setting range varies depending on the logging function to be used and setting in 'CH1 Logging cycle unit setting' (Un\G539).

Logging function	'CH1 Logging cycle unit setting' (Un\G539)	Setting range
Normal logging function	μs(0)	20 to 32767 (μs)
	ms(1)	1 to 32767 (ms)
	s(2)	1 to 3600 (s)
High speed logging function	—	1 to 1000

- If a value out of the range is set, a logging cycle setting value range error (error code: 1D1□H) occurs. Logging cannot be performed.
- When the normal logging function is used, if the set logging cycle is below the updating cycle of data to be logged, a logging cycle setting disable error (error code: 1D2□H) occurs. Logging cannot be performed.
- When the high speed logging function is used, the logging cycle is Conversion cycle × Value set in 'CH1 Logging cycle setting value' (Un\G538).

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 4 for all channels.

CH1 Logging cycle unit setting

Low speed

Set a cycle unit for storing logging data in the normal logging function.
For details on the normal logging function, refer to the following.
☞ Page 74 Normal Logging Function

Setting value	Setting details
0	μs
1	ms
2	s

- If a value out of the range is set, a logging cycle setting value range error (error code: 1D1☐H) occurs. Logging cannot be performed.
- If the set logging cycle is below the updating cycle of data to be logged, a logging cycle setting disable error (error code: 1D2☐H) occurs. Logging cannot be performed.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Logging cycle unit setting	539	739	939	1139

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default is ms (1) for all channels.

CH1 Post-trigger logging points

High speed Low speed

When the normal logging function or high speed logging function is used, set the number of data points to be collected for the time period from the occurrence of a hold trigger to when logging stops.
For details on each logging function, refer to the following.
☞ Page 74 Normal Logging Function
☞ Page 98 High Speed Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Post-trigger logging points	540, 541	740, 741	940, 941	1140, 1141

■Setting range

The setting range is from 1 to (setting value of 'CH1 Logging data points setting' (Un\G536)) × 100.
If a value out of the range is set, a post-trigger logging points setting range error (error code: 1D4☐H) occurs. Logging cannot be performed.
When 'CH1 Logging enable/disable setting' (Un\G535) is set to Disable (1), the setting of 'CH1 Post-trigger logging points' (Un\G540, Un\G541) is ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 10000 for all channels.

CH1 Level trigger condition setting

High speed Low speed

Set the condition to generate a hold trigger when using the level trigger in the normal logging function or high speed logging function.

For details on each logging function, refer to the following.

☞ Page 74 Normal Logging Function

☞ Page 98 High Speed Logging Function

To use the level trigger, set Level trigger condition setting to one of the following values except Disable (0).

Setting value	Setting details
0	Disable
1	Level trigger (Rise)
2	Level trigger (Fall)
3	Level trigger (Rise and fall)
4	Process alarm (upper limit warning)*1
5	Process alarm (lower limit warning)*1
6	Process alarm (upper limit warning/lower limit warning)*1

*1 This value cannot be set when the high speed logging function is used.

If a value other than the above is set, a level trigger condition setting range error (error code: 1D5☐H) occurs.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Level trigger condition setting	542	742	942	1142

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Disable (0) for all channels.

A

CH1 Trigger data

Low speed

Set a buffer memory address to be monitored for a level trigger in the normal logging function. Set the buffer memory address where the monitoring target data is stored.

For details on the normal logging function, refer to the following.

☞ Page 74 Normal Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Trigger data	543	743	943	1143

■Setting range

The setting range is from 0 to 9999.

If a value out of the above setting range is set, a trigger data setting range error (error code: 1D6□H) occurs. Logging cannot be performed.

When 'CH1 Logging enable/disable setting' (Un\G535) is set to Disable (1), the setting of 'CH1 Trigger data' (Un\G543) is ignored.

When 'CH1 Level trigger condition setting' (Un\G542) is set to Process alarm (upper limit warning) (4), Process alarm (lower limit warning) (5), Process alarm (upper limit warning/lower limit warning) (6), the setting of 'CH1 Trigger data' (Un\G543) is ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default values are set as shown below.

Channel	Default value	Buffer memory area to be monitored
CH1	402	'CH1 Digital operation value' (Un\G402)
CH2	602	'CH2 Digital operation value' (Un\G602)
CH3	802	'CH3 Digital operation value' (Un\G802)
CH4	1002	'CH4 Digital operation value' (Un\G1002)

CH1 Trigger setting value

High speed Low speed

When the normal logging function or high speed logging function is used, set a level to generate a level trigger.

For details on each logging function, refer to the following.

☞ Page 74 Normal Logging Function

☞ Page 98 High Speed Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ Trigger setting value	544	744	944	1144

■Setting range

The setting range is from -32768 to 32767.

When 'CH1 Level trigger condition setting' (Un\G542) is set to Process alarm (upper limit warning) (4), Process alarm (lower limit warning) (5), Process alarm (upper limit warning/lower limit warning) (6), the setting of 'CH1 Trigger setting value' (Un\G544) is ignored.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Trigger judgment count setting value

High speed Low speed

When the normal logging function or high speed logging function is used, set the timing of detecting a hold trigger after the number of the generated level triggers is counted. When level triggers are generated for the set number of times, a hold trigger is generated.

For details on each logging function, refer to the following.

☞ Page 74 Normal Logging Function

☞ Page 98 High Speed Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Trigger judgment count setting value	545	745	945	1145

■Setting range

The setting range is from 1 to 10 (times).

When a value out of the range is set, the value is regarded as 1 (time).

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 1 (time) for all channels.

CH1 Loading interrupt enable/disable setting

Low speed

Set whether to enable or disable the logging read function.

For details on the logging read function, refer to the following.

☞ Page 92 Logging read function

Setting value	Setting details
0	Enable
1	Disable

- If a value other than the above is set, a loading interrupt enable/disable setting range error (error code: 1D8☐H) occurs. Logging cannot be performed.
- When 'CH1 Loading interrupt enable/disable setting' (Un\G546) is set to Enable (0), a read pointer is set every time data is logged for the amount equivalent to the logging read points setting value, and an interrupt is generated and sent to the CPU module.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Loading interrupt enable/disable setting	546	746	946	1146

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is Disable (1) for all channels.

CH1 Logging read points setting value

Low speed

An interrupt is generated and sent to the CPU module every time data is logged for the set number of data points with the logging read function.

For details on the logging read function, refer to the following.

☞ Page 92 Logging read function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Logging read points setting value	547	747	947	1147

■Setting range

The setting range is from 1 to (setting value of 'CH1 Logging data points setting' (Un\G536)). Set it in increments of 1 (100 points). Thus, the actual range of Logging read points setting value is from 100 to 90000 at a maximum.

If a value out of the range is set, a logging read points setting value range error (error code: 1D9☐H) occurs. Logging cannot be performed.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 10 (1000 points) for all channels.

CH1 LPF Pass band edge frequency

Medium speed Low speed

Set a pass band edge frequency for the low pass filter.

For details on the digital filters, refer to the following.

☞ Page 33 Digital filter

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ LPF Pass band edge frequency	560	760	960	1160

■Setting range

For the setting range, refer to the following.

☞ Page 35 How to use the digital filters

If a value out of the range is set, a low pass filter setting range error (error code: 196☐H) occurs.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 HPF Pass band edge frequency

Medium speed Low speed

Set a pass band edge frequency for the high pass filter.

For details on the digital filters, refer to the following.

☞ Page 33 Digital filter

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ HPF Pass band edge frequency	562	762	962	1162

■Setting range

For the setting range, refer to the following.

☞ Page 35 How to use the digital filters

If a value out of the range is set, a high pass filter setting range error (error code: 197☐H) occurs.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 BPF Pass band edge frequency (Low)

Medium speed Low speed

Set a pass band edge frequency at the low frequency side for the band pass filter.

For details on the digital filters, refer to the following.

☞ Page 33 Digital filter

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ BPF Pass band edge frequency (Low)	564	764	964	1164

■Setting range

For the setting range, refer to the following.

☞ Page 35 How to use the digital filters

If a value out of the range is set, a band pass filter setting range error (error code: 198☐H) occurs.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 BPF Pass band edge frequency (High)

Medium speed Low speed

Set a pass band edge frequency at the high frequency side for the band pass filter.

For details on the digital filters, refer to the following.

☞ Page 33 Digital filter

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ BPF Pass band edge frequency (High)	566	766	966	1166

■Setting range

For the setting range, refer to the following.

☞ Page 35 How to use the digital filters

If a value out of the range is set, a band pass filter setting range error (error code: 198☐H) occurs.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 Attenuation band width

Medium speed Low speed

Specify the attenuation band width for each digital filter.

For details on the digital filters, refer to the following.

☞ Page 33 Digital filter

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Attenuation band width	568	768	968	1168

■Setting range

For the setting range, refer to the following.

☞ Page 35 How to use the digital filters

If a value out of the range is set, any of a low pass filter setting range error (error code: 196☐H), high pass filter setting range error (error code: 197☐H), or band pass filter setting range error (error code: 198☐H) occurs.

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 0 for all channels.

CH1 High speed continuous logging cycle setting value

High speed

Set a cycle for storing data logged by the high speed continuous logging function for each channel. When the high speed logging function is used, a setting of this buffer memory area is ignored.

For details on the high speed continuous logging function, refer to the following.

☞ Page 131 High Speed Continuous Logging Function

■Setting range

The setting range is from 1 to 1000.

- The value 0 is regarded as 1.
- A value within the range of 1001 to 65535 is regarded as 1000.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH□ High speed continuous logging cycle setting value	590	790	990	1190

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 1.

CH1 Range setting

Common

This area is for setting an input range.

Setting value	Setting details
0H	4 to 20mA
1H	0 to 20mA
2H	1 to 5V
3H	0 to 5V
4H	-10 to 10V
5H	0 to 10V
AH	4 to 20mA (extended mode)
BH	1 to 5V (extended mode)
FH	User range setting

- If a value other than the above is set, a range setting range error (error code: 190☐H) occurs. When a range setting range error (error code: 190☐H) occurs, the A/D conversion in the channel where the error occurs stops.
- The input range cannot be switched for the channel where A/D conversion disable is set. To switch the input range, set 'CH1 A/D conversion enable/disable setting' (Un\G500) to A/D conversion enable (0) and turn on and off 'Operating condition setting request' (Y9).
- When a range setting range error (error code: 190☐H) occurs in any channel in the normal mode (high speed: 1μs/CH), the A/D conversion stops in all channels.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Range setting	598	798	998	1198

■Enabling the setting

Turn on and off 'Operating condition setting request' (Y9).

■Default value

The default value is 4 to 20mA (0H) for all channels.

A

Error history

Common

Up to 16 errors that occurred in the module are recorded.

Ex.

For error history 1

	b15 ... b8	b7 ... b0
Un\G3600	Error code	
Un\G3601	First two digits of the year	Last two digits of the year
Un\G3602	Month	Day
Un\G3603	Hour	Minute
Un\G3604	Second	Day of the week
Un\G3605	Millisecond (higher-order digits)	Millisecond (lower-order digits)
Un\G3606 ⋮ Un\G3609	System area	

Item		Storage contents	Storage example*1
Error code		An error code is stored.	3030H
First two digits of the year	Last two digits of the year	Stored in BCD code.	2015H
Month	Day		1224H
Hour	Minute		1234H
Second			56H
Day of the week		One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3 Thursday: 4, Friday: 5, Saturday: 6	4H
Millisecond (upper)		Stored in BCD code.	7H
Millisecond (lower)			89H
System area		—	—

*1 Values stored when a flash memory error (error code: 3030H) occurs at 12:34:56.789 on Thursday, December 24th, 2015.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	No.1 to No.16
Error history	3600 to 3759

Alarm history

Common

Up to 16 alarms that occurred in the module are recorded.

Ex.

For alarm history 1

	b15 ... b8	b7 ... b0
Un\G3760	Alarm code	
Un\G3761	First two digits of the year	Last two digits of the year
Un\G3762	Month	Day
Un\G3763	Hour	Minute
Un\G3764	Second	Day of the week
Un\G3765	Millisecond (higher-order digits)	Millisecond (lower-order digits)
Un\G3766 ⋮ Un\G3769	System area	

Item		Storage contents	Storage example*1
Alarm code		An alarm code is stored.	0D00H
First two digits of the year	Last two digits of the year	Stored in BCD code.	2015H
Month	Day		1224H
Hour	Minute		1234H
Second			56H
Day of the week		One of the following values is stored in BCD code. Sunday: 0, Monday: 1, Tuesday: 2, Wednesday: 3 Thursday: 4, Friday: 5, Saturday: 6	4H
Millisecond (upper)		Stored in BCD code.	7H
Millisecond (lower)			89H
System area		—	—

*1 Values stored when a mode switching request error (alarm code: 0D00H) occurs at 12:34:56.789 on Thursday, December 24th, 2015.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	No.1 to No.16
Alarm history	3760 to 3919

A

Clear setting of error history

Common

Set whether to clear Error history 1 to 16 (Un\G3600 to Un\G3759) and Alarm history 1 to 16 (Un\G3760 to Un\G3919) when 'Error clear request' (YF) or 'Operating condition setting request' (Y9) is turned on.

Setting value	Setting details
0	Not clear
1	Clear

When a value other than the above is set, the value is regarded as Not clear (0).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Clear setting of error history	3930			

■Enabling the setting

As soon as a setting value is input, the setting is enabled. Turning on and off 'Operating condition setting request' (Y9) is not required.

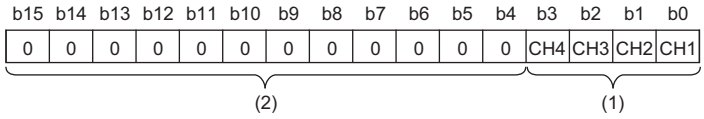
■Default value

The default value is Not clear (0) for all channels.

Save data type setting

Medium speed Low speed

This area saves and restores the offset/gain setting value in the user range setting. Specify the data type of the offset/gain value to be saved and restored: voltage or current.



(1) 0: Voltage, 1: Current

(2) b4 to b15 are fixed to 0.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Save data type setting	4002			

■Default value

The default value is Voltage (0) for all channels.

CH1 Factory default setting offset/gain value

Medium speed Low speed

This area restores the offset/gain setting value in the user range setting. For details, refer to the following.

☞ Page 271 CH1 User range setting offset/gain value

CH1 User range setting offset/gain value

Medium speed Low speed

This area restores the offset/gain setting value in the user range setting.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Factory default setting offset value (L)	4004	4008	4012	4016
CH☐ Factory default setting offset value (H)	4005	4009	4013	4017
CH☐ Factory default setting gain value (L)	4006	4010	4014	4018
CH☐ Factory default setting gain value (H)	4007	4011	4015	4019
CH☐ User range setting offset value (L)	4020	4024	4028	4032
CH☐ User range setting offset value (H)	4021	4025	4029	4033
CH☐ User range setting gain value (L)	4022	4026	4030	4034
CH☐ User range setting gain value (H)	4023	4027	4031	4035

When the following operations are performed, the data to be used is stored (saved).

- Writing the initial setting with an engineering tool
- Turning on 'Operating condition setting request' (Y9) (Data is not saved when the mode is switched from the normal mode to the offset/gain setting mode by 'Mode switching setting' (Un\G296, Un\G297).)
- Writing an offset/gain value in the offset/gain setting mode (When 'User range write request' (YA) is turned on)

When restoring the offset/gain setting value in the user range setting, set the same data as the saved data in this area to the corresponding area of the A/D converter module that is the restoration destination.

For the offset/gain setting, refer to the following.

MELSEC iQ-R High Speed Analog-Digital Converter Module User's Manual (Startup)

■Default value

The default value is 0 for all channels.

A

CH1 Offset/gain setting mode

Medium speed Low speed

Specify the channel where the offset/gain setting is adjusted.

- Offset/gain setting mode (offset specification): Channel where the offset value is adjusted
- Offset/gain setting mode (gain specification): Channel where the gain value is adjusted

Setting value	Setting details
0	Disable
1	Setting channel

Set one of the offset specification or gain specification to Setting channel (1), and the other to Disable (0). When a value other than 0 and 1 is set, an offset/gain setting channel range error (error code: 1E8☐H) occurs.

Multiple channels can be set at the same time. In that case, do not set both the offset specification and gain specification of multiple channels to Setting channel (1).

When 'Channel change request' (YB) is turned on and the following settings are enabled, an offset/gain setting channel specification error (error code: 1E50H) occurs.

- When both the offset specification and gain specification of the same channel are set to Setting channel (1)
- When both the offset specification and gain specification of all channels are set to Disable (0)
- When both the offset specification and gain specification of multiple channels are set to Setting channel (1) at the same time

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Offset/gain setting mode (offset specification)	4132	4134	4136	4138
CH☐ Offset/gain setting mode (gain specification)	4133	4135	4137	4139

■Enabling the setting

Turn on 'Channel change request' (YB).

■Default value

The default value is Disable (0) for all channels.

CH1 Offset/gain setting mode (range specification)

Medium speed Low speed

In the offset/gain setting, specify the current input or voltage input for each channel.

Setting value	Setting details
0	Voltage
1	Current

When a value other than 0 and 1 is set, the value is regarded as Current (1).

- When an offset/gain value is written in the offset/gain setting mode (when 'User range write request' (YA) is turned on), this setting is written to a flash memory.
- When the mode is switched to the offset/gain setting mode or 'Operating condition setting request' (Y9) is turned on, the value stored in the flash memory is set.
- This setting is saved in the module-specific backup parameter at the online module change. After the module replacement, the factory default setting to be referred to is determined according to this setting when the offset/gain setting is restored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Offset/gain setting mode (range specification)	4164	4165	4166	4167

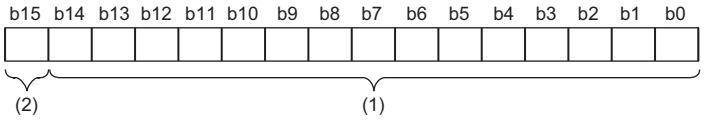
■Default value

The default value is Voltage (0) for all channels.

CH1 Synchronization digital output value

Synchronization

When the module is set as the target of the inter-module synchronization function, a digital output value is stored at the timing of the inter-module synchronization cycle. The digital output value is stored as a 16-bit signed binary value.



(1) Data section

(2) Sign bit 0: Positive, 1: Negative

When the module is not set as the target of the inter-module synchronization function, 0 is always stored.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
CH☐ Synchronization digital output value	9500	9502	9504	9506

A

Synchronization status monitor

Synchronization

The status of the inter-module synchronization and whether the currently checked module is the target of the inter-module synchronization function can be checked.

Monitored value	Description
0	Not inter-module synchronization target
1	Inter-module synchronization target (synchronization stopped)
2	Inter-module synchronization target (synchronization in process)

If the currently checked module is not the inter-module synchronization target, the monitor value is Not inter-module synchronization target (0).
If the currently checked module is the inter-module synchronization target and the inter-module synchronization is being executed, the monitor value is Inter-module synchronization target (synchronization in process) (2).
When an error occurs in the CPU module or the A/D converter module and the synchronization stops, the monitor value is Inter-module synchronization target (synchronization stopped) (1).

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Synchronization status monitor	9600			

Oversampling mode monitor

Synchronization

When the continuous logging function is used in the inter-module synchronization mode, whether the oversampling mode is enabled or disabled can be checked.

Monitored value	Description
0	Oversampling mode disabled
1	Oversampling mode enabled

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Oversampling mode monitor	9601			

Logging data area

High speed Low speed

When the normal logging function or high speed logging function is used, this area stores the logged data. The area of 90000 points can be distributed to each channel by setting 'CH1 Logging data points setting' (Un\G536).

For details on each logging function, refer to the following.

☞ Page 74 Normal Logging Function

☞ Page 98 High Speed Logging Function

■Updating data

- When the normal logging function is used, after the number of stored data points reaches the points set in 'CH1 Logging data points setting' (Un\G536), data is continuously collected overwriting the data in the start address and later.
- When the high speed logging function is used, data is updated when 'CH1 Logging hold flag' (Un\G409) is turned on with the stop of high speed logging after turning on of 'CH1 Logging hold request' (Y1). The data is not updated during the high speed logging.

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Logging data area	10000 to 99999			

Point

- When 'Operating condition setting request' (Y9) is turned on, the logging data in all the channels are cleared.
- When 'CH1 Logging hold request' (Y1) is turned off while 'CH1 Logging hold flag' (Un\G409) is on, data logging resumes. In this case, the logged data is not cleared.

CH1 Logging data area

Simultaneous conversion Synchronization

This area stores the data logged with the continuous logging function. Up to 10000 points of data can be stored per channel.

For details on the continuous logging function, refer to the following.

☞ Page 112 Continuous Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Logging data area	10000 to 19999	20000 to 29999	30000 to 39999	40000 to 49999

■Updating data

The update timing of this area varies depending on the operation mode.

- In the simultaneous conversion mode, data is updated every time logging 5000 points of data is completed.
- In the inter-module synchronization mode, data is updated at every inter-module synchronization cycle.

Point

When 'Operating condition setting request' (Y9) is turned on, the logging data in all the channels are cleared.

CH1 Logging data area

High speed

This area stores the data logged with the high speed continuous logging function. Up to 20000 points of data can be stored per channel.

For details on the high speed continuous logging function, refer to the following.

☞ Page 131 High Speed Continuous Logging Function

■Buffer memory address

The following shows the buffer memory address of this area.

Buffer memory name	CH1	CH2	CH3	CH4
Logging data area	10000 to 29999	30000 to 49999	50000 to 69999	70000 to 89999

■Updating data

This area is updated every time logging of 10000 point data is completed.

Point

When 'Operating condition setting request' (Y9) is turned on, the logging data in all the channels are cleared.

Appendix 4 Dedicated Instructions

Instruction list

The following table lists the dedicated instructions that can be used in the A/D converter module.

Instruction	Description
G(P).OFFGAN	Switches the normal mode (medium speed: 10μs/CH) or normal mode (low speed: 20μs/CH) to the offset/gain setting mode. Switches the offset/gain setting mode to the normal mode (medium speed: 10μs/CH) or normal mode (low speed: 20μs/CH).
G(P).OGLOAD	Reads out the offset/gain setting value in the user range setting to write it into the CPU module.
G(P).OGSTOR	Restores the offset/gain setting value in the user range setting stored in the CPU module into the A/D converter module.

For details on the dedicated instructions, refer to the following.

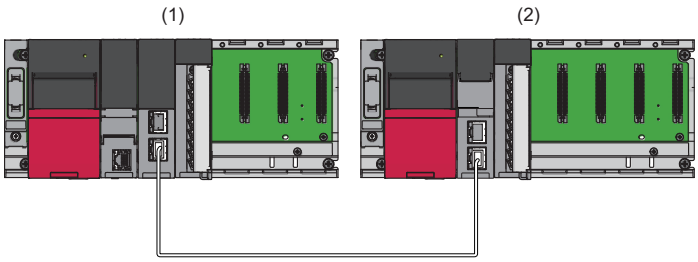
MELSEC iQ-R Programming Manual (Module Dedicated Instructions)

Appendix 5 Operation Examples of When the Remote Head Module Is Mounted

This section describes operation examples of when the remote head module is mounted

System configuration example

The following system configuration is used to explain an example of operation.



(1) Master station (Network number 1, station number 0)
- Power supply module: R61P
- CPU module: R04CPU
- Master/local module: RJ71GF11-T2 (Start I/O number: 0000H to 001FH)
- Input module: RX10 (Start I/O number: 0020H to 002FH)

(2) Intelligent device station (Network number 1, station number 1)
- Power supply module: R61P
- Remote head module: RJ72GF15-T2
- A/D converter module: R60ADH4 (Start I/O number: 0000H to 000FH)*1

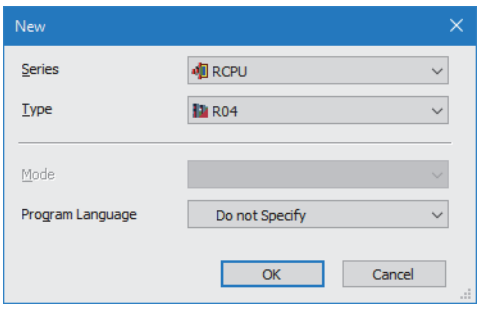
*1 In the RX/RY setting of the master station, set 1000H to 100FH as the start I/O number of the A/D converter module.

Setting in the master station

Connect the engineering tool to the CPU module of the master station and set parameters.

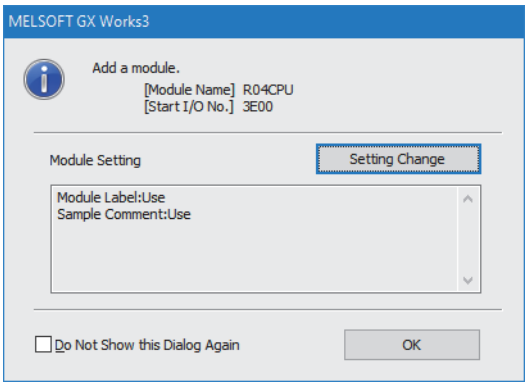
1. Create the project with the following settings.

[Project] ⇨ [New]



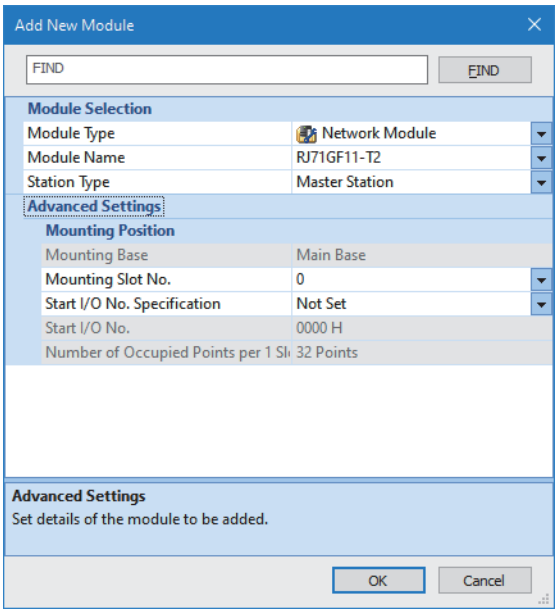
2. Click the [Setting Change] button and set the module to use the module labels.

3. Click the [OK] button in the following window to add the module labels of the CPU module.



4. Add the master/local module with the following settings.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ [Add New Module]



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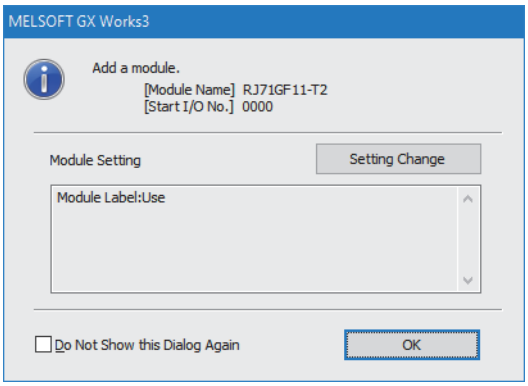
5. Configure the setting to use the module labels and add the module labels of the master/local module.



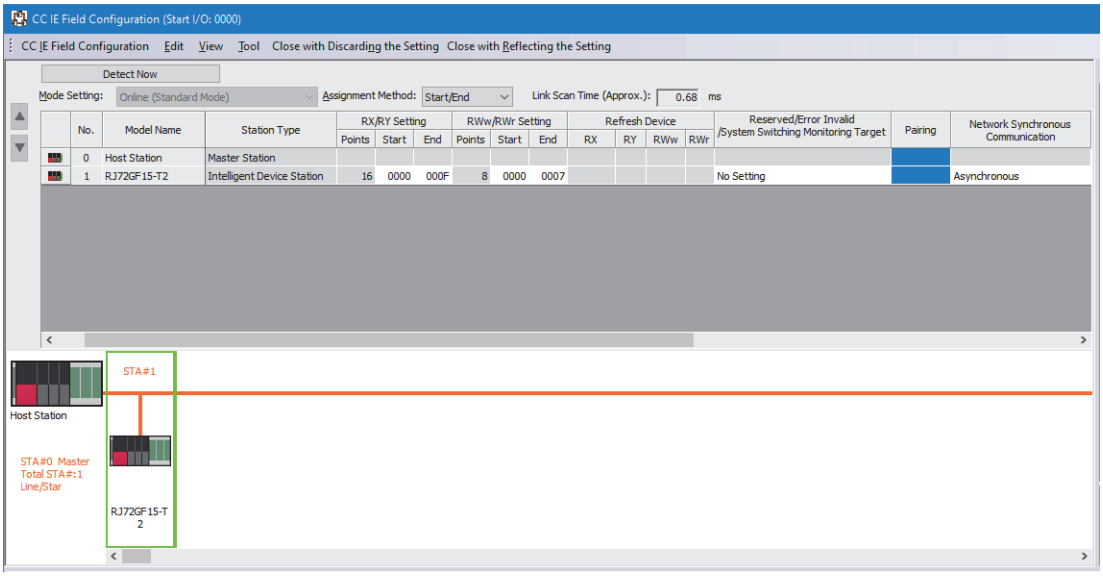
6. Set "Required Settings" of "Module Parameter" of the master/local module as shown below.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [RJ71GF11-T2] ⇨ [Required Settings]

Item	Setting
Station Type	
Station Type	Master Station
Network Number	
Network Number	1
Station Number	
Setting Method	Parameter Editor
Station No.	0
Parameter Setting Method	
Setting Method of Basic/Application Settings	Parameter Editor

7. Set "Network Configuration Settings" of "Module Parameter" of the master/local module as shown below.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [RJ71GF11-T2] ⇨ [Basic Settings] ⇨ [Network Configuration Settings]



8. Click [Close with Reflecting the Setting] button and close the "CC IE Field Configuration" window.

9. Set "Refresh Setting" of "Module Parameter" of the master/local module as shown below.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [RJ71GF11-T2] ⇨ [Basic Settings] ⇨ [Refresh Setting]

No.	Link Side					CPU Side				
	Device Name	Points	Start	End		Target	Device Name	Points	Start	End
-	SB									
-	SW									
1	RX	256	00000	000FF		Specify Devic	X	256	01000	010FF
2	RY	256	00000	000FF		Specify Devic	Y	256	01000	010FF
3	RWw	256	00000	000FF		Specify Devic	W	256	00000	000FF
4	RWr	256	00000	000FF		Specify Devic	W	256	01000	010FF
5										

10. Write the set parameters to the CPU module on the master station. Then reset the CPU module or power off and on the system.

[Online] ⇨ [Write to PLC]

Point

For parameters of the master/local module which are not described in this procedure, set default values. For details on parameters of the master/local module, refer to the following.

MELSEC iQ-R CC-Link IE Field Network User's Manual (Application)

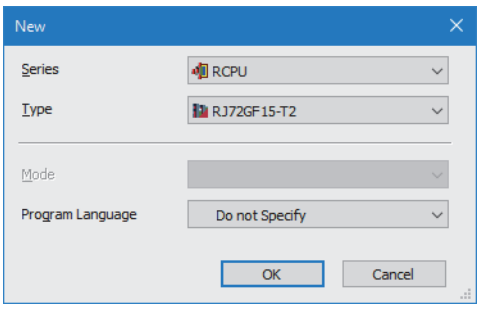
A

Setting in the intelligent device station

Connect the engineering tool to the remote head module of the intelligent device station and set parameters.

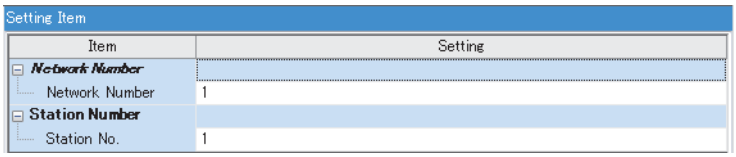
1. Create the project with the following settings.

[Project] ⇨ [New]



2. Set "Network Required Setting" of "CPU Parameter" of the remote head module as shown below.

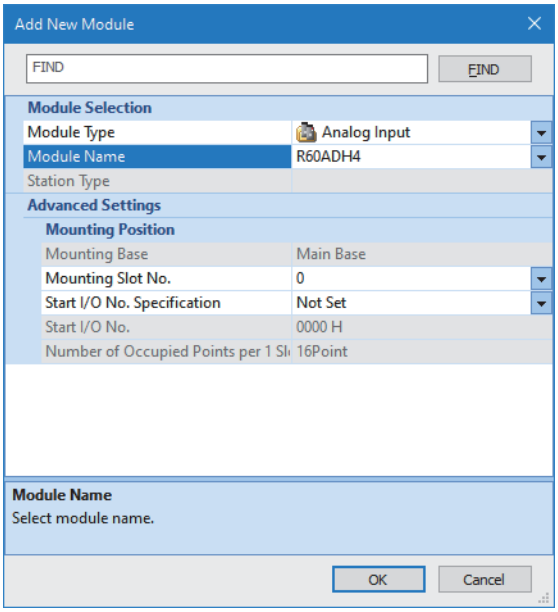
[Navigation window] ⇨ [Parameter] ⇨ [RJ72GF15-T2] ⇨ [CPU Parameter] ⇨ [Network Required Setting]



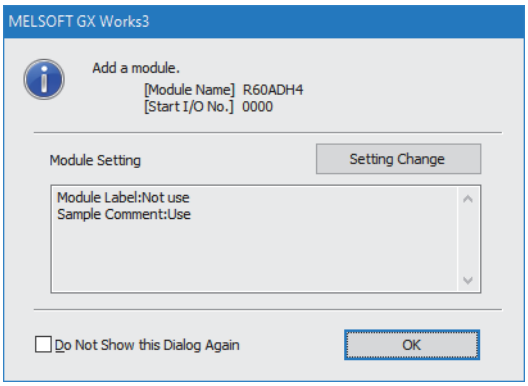
3. Click the [Apply] button.

4. Add the A/D converter module with the following settings.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ [Add New Module]



5. Configure the setting not to use the module labels.



6. Set "Basic setting" of "Module Parameter" of the A/D converter module as shown below.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [R60ADH4] ⇨ [Basic setting]

Setting Item

Item	CH1	CH2	CH3	CH4
Range switching function	**The input range of the analog input can be set for each channel and the input conversion attribute can be changed.**			
Input range setting	0 to 10V	0 to 10V	0 to 20mA	4 to 20mA
Operation mode setting function	**Set the operation mode.**			
Operation mode setting	Normal mode(low speed:20μs/CH)			
A/D conversion enable/disable setting function	**Set whether to enable or disable the output of the A/D conversion value.**			
A/D conversion enable/disable setting	A/D conversion enable	A/D conversion enable	A/D conversion enable	A/D conversion enable
A/D conversion method	**Set the A/D conversion control method.**			
Average processing setting	Sampling processing	Count average	Moving average	Sampling processing
Time average/Count average/Moving average/ Primary delay filter constant setting	0	50 times	10 times	0
LPF Pass band edge frequency	0	0	0	0
HPF Pass band edge frequency	0	0	0	0
BPF Pass band edge frequency (Low)	0	0	0	0
BPF Pass band edge frequency (High)	0	0	0	0
Attenuation band width	0	0	0	0

A

7. Set "Application setting" of "Module Parameter" of the A/D converter module as shown below.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [R60ADH4] ⇨ [Application setting]

Setting Item

Item	CH1	CH2	CH3	CH4
Scaling function	**Configure the setting for the scaling at the A/D conversion.**			
Scaling enable/disable setting	Disable	Disable	Enable	Disable
Scaling upper limit value	0	0	10000	0
Scaling lower limit value	0	0	2000	0
Shift function	**Configure the setting for the shift function at the A/D conversion.**			
Conversion value shift amount	0	0	2000	0
Digital clipping function	**Configure the setting for the digital clipping function at the A/D conversion.**			
Digital clipping enable/disable setting	Disable	Disable	Disable	Disable
Warning output function(Process alarm)	**Set a warning at the A/D conversion.**			
Warning output setting(Process alarm)	Disable	Enable	Disable	Disable
Process alarm upper upper limit value	0	32000	0	0
Process alarm upper lower limit value	0	28000	0	0
Process alarm lower upper limit value	0	4000	0	0
Process alarm lower lower limit value	0	0	0	0
Warning output function(Rate alarm)	**Set a warning at the A/D conversion.**			
Warning output function(Rate alarm)	Enable	Disable	Disable	Disable
Rate alarm detection cycle setting	5 times	0 times	0 times	0 times
Rate alarm upper limit value	25.0 %	0.0 %	0.0 %	0.0 %
Rate alarm lower limit value	-5.0 %	0.0 %	0.0 %	0.0 %
Input signal error detection function	**Configure the setting for the input signal at the A/D conversion.**			
Input signal error detection setting	Upper limit detection	Disable	Disable	Disable
Input signal error detection lower limit setting value	5.0 %	5.0 %	5.0 %	5.0 %
Input signal error detection upper limit setting value	10.0 %	5.0 %	5.0 %	5.0 %
Input signal error detection auto clear enable/disable setting	Disable			
Logging function	**Configure the setting for the logging function at the A/D conversion.**			
Logging enable/disable setting	Disable	Disable	Disable	Disable
Normal logging function/High speed logging function	**Configure the setting for the normal logging function or the high speed logging function at the A/D conversion.**			
Logging data points setting	200	200	200	200
Logging data setting	Digital operation value	Digital operation value	Digital operation value	Digital operation value
Logging cycle setting value	4 ms	4 ms	4 ms	4 ms
Logging cycle unit setting	ms	ms	ms	ms
Level trigger condition setting	Disable	Disable	Disable	Disable
Logging points after trigger	10000	10000	10000	10000
Trigger data	402	602	802	1002
Trigger setting value	0	0	0	0
Trigger judgment count setting value	1 times	1 times	1 times	1 times
Logging loading enable/disable setting	Disable	Disable	Disable	Disable
Logging read points setting value	10	10	10	10
High speed continuous logging function	**Configure the setting for the high speed continuous logging function at the A/D conversion.**			
High speed continuous logging cycle setting value	1	1	1	1
Continuous logging function	**Configure the setting for the continuous logging function at the A/D conversion.**			
Continuous logging cycle setting value	1			
Inter-module synchronization function	**A/D conversion function in accordance with the inter-module synchronization cycle.**			

8. Set "Refresh settings" of "Module Parameter" of the A/D converter module as shown below.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [R60ADH4] ⇨ [Refresh settings]

Setting Item

Target: Device

Number of transfers to intelligent function module: 0
Number of transfers to CPU: 13

Item	CH1	CH2	CH3	CH4
Refresh at the set timing.				
Transfer to the intelligent function module.	**Transfer the buffer memory data to the specified device.**			
Transfer to the CPU.	**Transfer the buffer memory data to the specified device.**			
Latest error code	W1020			
Latest address of error history				
Latest alarm code				
Latest address of alarm history				
Interrupt factor detection flag 1				
Interrupt factor detection flag 2				
Interrupt factor detection flag 3				
Interrupt factor detection flag 4				
Interrupt factor detection flag 5				
Interrupt factor detection flag 6				
Interrupt factor detection flag 7				
Interrupt factor detection flag 8				
Interrupt factor detection flag 9				
Interrupt factor detection flag 10				
Interrupt factor detection flag 11				
Interrupt factor detection flag 12				
Interrupt factor detection flag 13				
Interrupt factor detection flag 14				
Interrupt factor detection flag 15				
Interrupt factor detection flag 16				
Warning output flag (Process alarm upper limit)	W1010			
Warning output flag (Process alarm lower limit)	W1011			
Warning output flag (Rate alarm upper limit)	W1012			
Warning output flag (Rate alarm lower limit)	W1013			
Input signal error detection flag	W1014			
A/D conversion completed flag	W1000			
Digital output value	W1001	W1002		W1004
Digital operation value			W1003	
Maximum value			W1005	
Minimum value			W1006	
Difference conversion state flag				
Logging hold flag				
Refresh Timing	**Set refresh timing.**			
Refresh Timing	-			
Refresh Group [n](n: 1-64)	1			

9. Write the set parameters to the remote head module on the intelligent device station. Then reset the remote head module or power off and on the system.

[Online] ⇨ [Write to PLC]

Point

For parameters of the remote head module which are not described in this procedure, set default values. For details on parameters of the remote head module, refer to the following.

MELSEC iQ-R CC-Link IE Field Network Remote Head Module User's Manual (Application)

Checking the network status

After setting parameters to the master station and the intelligent device station, check whether data link is normally performed between the master station and the intelligent device station. Check the network status using the CC-Link IE Field Network diagnostics of the engineering tool.

For how to perform the CC-Link IE Field Network diagnostics from the master station, refer to the following.

MELSEC iQ-R CC-Link IE Field Network User's Manual (Application)

Program examples

For the program examples, the module labels of the master/local module are used.

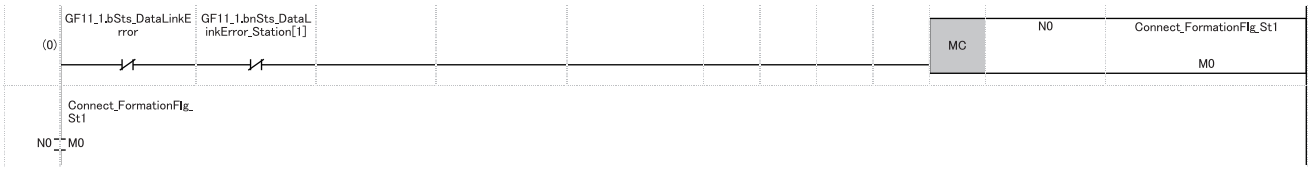
Write the programs to the CPU module on the master station.

Classification	Label name	Description	Device
Module label	GF11_1.bSts_DataLinkError	Data link error status of own station	SB0049
	GF11_1.bnSts_DataLinkError_Station[1]	Data link status of each station (station number 1)	SW00B0.0
Label to be defined	Define global labels as shown below:		

	Label Name	Data Type		Class	Assign (Device/Label)
1	CH1_DigOutValTempArea	Word [Signed]	...	VAR_GLOBAL	D11
2	CH2_DigOutValTempArea	Word [Signed]	...	VAR_GLOBAL	D12
3	CH3_DigCalcValTempArea	Word [Signed]	...	VAR_GLOBAL	D13
4	CH4_DigOutValTempArea	Word [Signed]	...	VAR_GLOBAL	D14
5	CH3_DigMaxValTempArea	Word [Signed]	...	VAR_GLOBAL	D15
6	CH3_DigMinValTempArea	Word [Signed]	...	VAR_GLOBAL	D16
7	CH1_DigOutVal	Word [Signed]	...	VAR_GLOBAL	W1001
8	CH2_DigOutVal	Word [Signed]	...	VAR_GLOBAL	W1002
9	CH3_DigCalcVal	Word [Signed]	...	VAR_GLOBAL	W1003
10	CH4_DigOutVal	Word [Signed]	...	VAR_GLOBAL	W1004
11	CH3_DigMaxVal	Word [Signed]	...	VAR_GLOBAL	W1005
12	CH3_DigMinVal	Word [Signed]	...	VAR_GLOBAL	W1006
13	CH1_A_D_conversionCompletedFlag	Bit	...	VAR_GLOBAL	W1000.0
14	CH2_A_D_conversionCompletedFlag	Bit	...	VAR_GLOBAL	W1000.1
15	CH3_A_D_conversionCompletedFlag	Bit	...	VAR_GLOBAL	W1000.2
16	CH4_A_D_conversionCompletedFlag	Bit	...	VAR_GLOBAL	W1000.3
17	CH2_WarningOutputFlagProcessAlarmUpperLimit	Bit	...	VAR_GLOBAL	W1010.1
18	CH2_WarningOutputFlagProcessAlarmLowerLimit	Bit	...	VAR_GLOBAL	W1011.1
19	CH1_WarningOutputFlagRateAlarmUpperLimit	Bit	...	VAR_GLOBAL	W1012.0
20	CH1_WarningOutputFlagRateAlarmLowerLimit	Bit	...	VAR_GLOBAL	W1013.0
21	CH1_InputSignalErrorDetectionFlag	Bit	...	VAR_GLOBAL	W1014.0
22	CH2_ProcAlmUpLimit	Bit	...	VAR_GLOBAL	F0
23	CH2_ProcAlmLowLimit	Bit	...	VAR_GLOBAL	F1
24	CH1_RateAlmUpLimit	Bit	...	VAR_GLOBAL	F2
25	CH1_RateAlmLowLimit	Bit	...	VAR_GLOBAL	F3
26	CH1_InputSigErr	Bit	...	VAR_GLOBAL	F4
27	DigitOutValSig	Bit	...	VAR_GLOBAL	X20
28	MaxMinReadSig	Bit	...	VAR_GLOBAL	X21
29	MaxMinResetSig	Bit	...	VAR_GLOBAL	X22
30	ErrResetSig	Bit	...	VAR_GLOBAL	X23
31	Connect_FormationFlg_St1	Bit	...	VAR_GLOBAL	M0
32	ModuleREADY	Bit	...	VAR_GLOBAL	X1000
33	InputSignalErrorDetectionSignal	Bit	...	VAR_GLOBAL	X100C
34	MaxValueMinValueResetCompletedFlag	Bit	...	VAR_GLOBAL	X100D
35	A_D_conversionCompletedFlag	Bit	...	VAR_GLOBAL	X100E
36	ErrorFlag	Bit	...	VAR_GLOBAL	X100F
37	OperatingConditionSettingRequest	Bit	...	VAR_GLOBAL	Y1009
38	MaxValueMinValueResetRequest	Bit	...	VAR_GLOBAL	Y100D
39	ErrorClearRequest	Bit	...	VAR_GLOBAL	Y100F

Common program

The following figure shows an example of the program to check the data link status of the remote head module (station number 1).

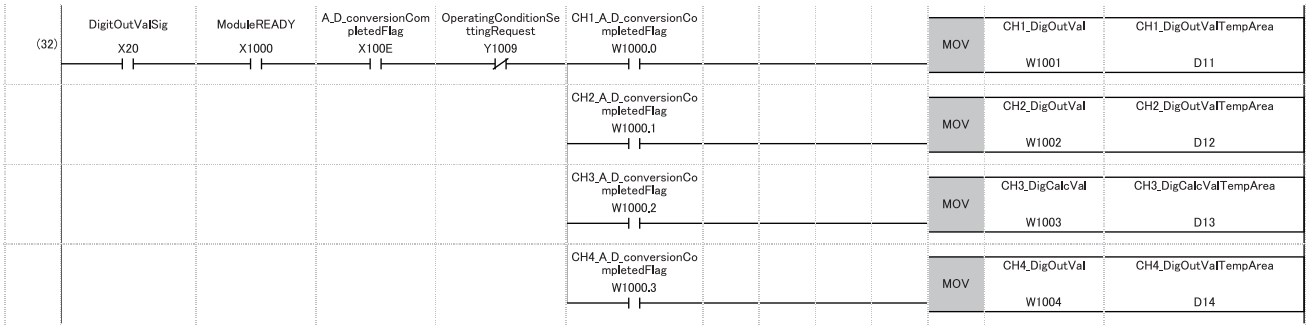


(0) Checks the data link status of the remote head module (station number 1).

When creating programs shown later, add the MCR instruction to the last of the program as shown below.

Program example 1

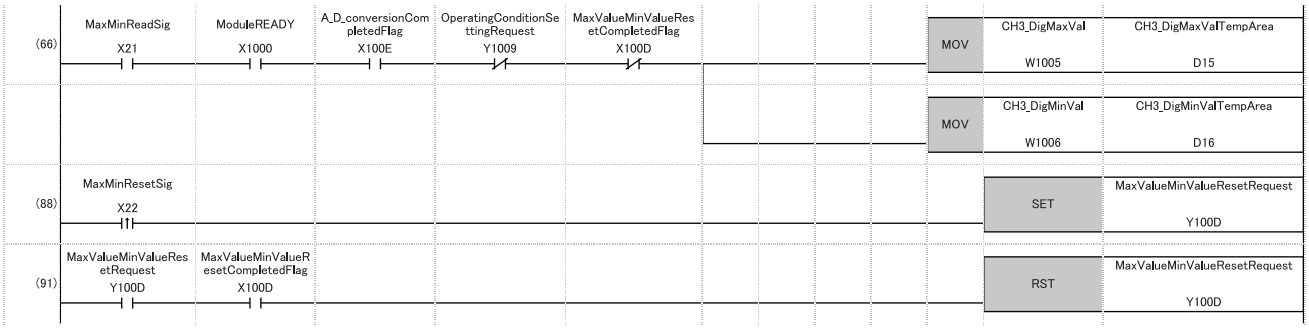
The following figure shows an example of the program to read digital output values of CH1, CH2, and CH4 and digital operation values of CH3 and save them.



(32) Reads values of CH1 Digital output value, CH2 Digital output value, CH3 Digital operation value, and CH4 Digital output value.

Program example 2

The following figure shows an example of the program to read a maximum value and a minimum value of CH3 and reset them.



(66) Reads values of CH3 Maximum value and CH3 Minimum value.

(88) Turns on 'Maximum value/minimum value reset request' (Y100D).

(91) Turns off 'Maximum value/minimum value reset request' (Y100D).

Program example 3

The following figure shows an example of the program to perform operations reacting to a warning if a warning (process alarm upper/lower limit) occurs in CH2.

(94) Performs a processing of when a warning (process alarm upper limit) has occurred in CH2.

(113) Performs a processing of when a warning (process alarm lower limit) has occurred in CH2.

Program example 4

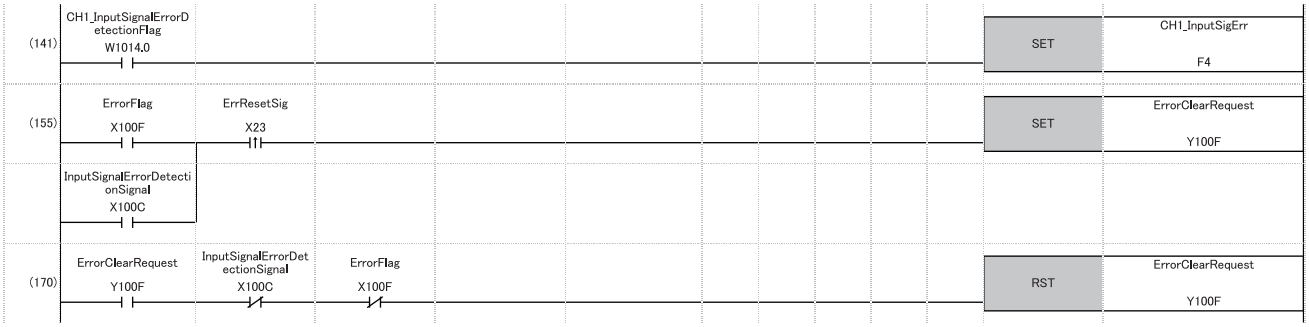
The following figure shows an example of the program to perform operations reacting to a warning if a warning (rate alarm upper/lower limit) occurs in CH1.

(118) Performs a processing of when a warning (rate alarm upper limit) has occurred in CH1.

(136) Performs a processing of when a warning (rate alarm lower limit) has occurred in CH1.

Program example 5

The following figure shows an example of the program to clear Input signal error detection flag, Error flag, and Latest error code if an input signal error is detected in CH1 or an error occurs in any of the channels.



(141) Performs a processing of when an input signal error was detected in CH1.

(155) Turns on 'Error clear request' (Y100F).

(170) Turns off 'Error clear request' (Y100F).

Appendix 6 Using the Module in the Redundant System with Redundant Extension Base Unit

This chapter describes restrictions and precautions for using the A/D converter module that is mounted on the extension base unit in the redundant system.

Restrictions on functions and specifications

Functions

Function	Restriction
Logging function	Cannot be used. When the function is used, proper operation cannot be guaranteed.
Interrupt function	The interrupt program cannot be executed.
Inter-module synchronization function	Cannot be used. When the function is used, proper operation cannot be guaranteed.
Backing up, saving, and restoring offset/gain values	The function cannot be used for either of the following cases. • When using the module-specific backup parameter • When saving and restoring the values using the dedicated instruction instead of the module-specific backup parameter

Dedicated instructions

Any dedicated instructions of the A/D converter module cannot be used.

Module FBs

Name	Availability
M+R60ADH_SetLoggingPARAM	Cannot be used. When the FB is used, proper operation cannot be guaranteed.
M+R60ADH_SaveLogging	
M+R60ADH_SetContinuousLoggingParam	
M+R60ADH_ContinuousLoggingRequest	
M+R60ADH_ReadContinuousLogging	
M+R60ADH_SetHighSpeedContinuousLoggingParam	
M+R60ADH_HighSpeedContinuousLoggingRequest	
M+R60ADH_ReadHighSpeedContinuousLogging	
M+R60ADH_SetHighSpeedLoggingParam	
M+R60ADH_SaveHighSpeedLogging	

Module parameter

■Application setting

Set "Auto restore of Offset/gain setting with the module change" to "Disable".

Precautions

When configuring the offset/gain setting

Connect the engineering tool to the CPU module of the control system.

The engineering tool cannot recognize the A/D converter module if it is connected to the CPU module of the standby system.

Program examples

Unless otherwise specified, program examples provided in this manual and the following manual are for when the module is used in the single CPU system or in the multiple CPU system.

MELSEC iQ-R High Speed Analog-Digital Converter Module User's Manual (Startup)

When using the module in the redundant system, refer to the following manual and observe the precautions on programming for when using the Process CPU (redundant mode).

MELSEC iQ-R Process CPU Module User's Manual

Signal flow tracking setting

When using the module FBs and applying the program examples to an actual system, set "Signal Flow Memory Tracking Setting" to "Transfer". If not, the module FBs and programs may not work properly when system switching occurs.

[CPU Parameter] ⇨ [Redundant System Settings] ⇨ [Tracking Setting]

Appendix 7 Added and Modified Functions

Added functions

The following shows the functions that are added to the A/D converter module and the engineering tool, the firmware version of the corresponding A/D converter module, and the software version of the engineering tool.

Added function	A/D converter module firmware version	Engineering tool software version	Reference
Normal mode (high speed: 1μs/CH)	"04" or later	"1.040S" or later	Page 17 Modes
High speed continuous logging function	"04" or later	"1.040S" or later	Page 131 High Speed Continuous Logging Function
High speed logging function	"05" or later	"1.045X" or later	Page 98 High Speed Logging Function
Resetting CH☐ Maximum value and CH☐ Minimum value for each channel separately	"07" or later	"1.120A" or later	Page 54 Resetting values for each channel separately

Modified function

The following shows the function that is modified in the A/D converter module and the engineering tool, the firmware version of the corresponding A/D converter module, and the software version of the engineering tool.

Modified function	Reference
'CH1 Logging enable/disable setting' (Un\G535)	Page 254 CH1 Logging enable/disable setting

'CH1 Logging enable/disable setting' (Un\G535)

The logging function that can be set varies depending on the A/D converter module firmware version.

■Firmware version "05" or later

- Normal logging (1), High speed continuous logging (2), and High speed logging (3) can be set.
- The engineering tool software version "1.045X" or later supports the setting.

■Firmware version "04"

- Normal logging (1) and High speed continuous logging (2) can be set.
- The engineering tool software version "1.040S" or later supports the setting.
- High speed logging (3) cannot be set. If it is set, a logging enable/disable setting range error (error code: 1D0☐H) occurs.

■Firmware version "03" or earlier

- Only Normal logging (1) can be set.
- High speed continuous logging (2) and High speed logging (3) cannot be set. If they are set, a logging enable/disable setting range error (error code: 1D0☐H) occurs.

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REVISIONS

*The manual number is given on the bottom left of the back cover.

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TRANSLATION OF THE ORIGINAL INSTRUCTIONS

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