MITSUBISHI ELECTRIC

General-Purpose AC Servo

MITSUBISHI SERVO AMPLIFIERS & MOTORS
MELSERVO-JE

Ethernet Interface
SERVO AMPLIFIER INSTRUCTION MANUAL

MR-JE-_C

● Safety Instructions ●

Please read the instructions carefully before using the equipment.

To use the equipment correctly, do not attempt to install, operate, maintain, or inspect the equipment until you have read through this Instruction Manual, Installation guide, and appended documents carefully. Do not use the equipment until you have a full knowledge of the equipment, safety information and instructions.
In this Instruction Manual, the safety instruction levels are classified into "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 medium or slight injury to personnel or may cause physical damage.

Note that the CAUTION level may lead to a serious consequence according to conditions.
Please follow the instructions of both levels because they are important to personnel safety.
What must not be done and what must be done are indicated by the following diagrammatic symbols.

⃠	Indicates what must not be done. For example, "No Fire" is indicated by ⃠ .
●	Indicates what must be done. For example, grounding is indicated by ⏚ .

In this Instruction Manual, instructions at a lower level than the above, instructions for other functions, and so on are classified into "POINT".
After reading this Instruction Manual, keep it accessible to the operator.

1. To prevent electric shock, note the following

⚠ WARNING

- Before wiring and inspections, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.
- Ground the servo amplifier and servo motor securely.
- Any person who is involved in wiring and inspection should be fully competent to do the work.
- Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, it may cause an electric shock.
- Do not operate switches with wet hands. Otherwise, it may cause an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
- To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.
- To avoid an electric shock, insulate the connections of the power supply terminals.

2. To prevent fire, note the following

⚠ CAUTION

- Install the servo amplifier, servo motor, and regenerative resistor on incombustible material. Installing them directly or close to combustibles will lead to smoke or a fire.
- Always connect a magnetic contactor between the power supply and the power supply (L1/L2/L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause smoke or a fire when the servo amplifier malfunctions.
- Always connect a molded-case circuit breaker, or a fuse to each servo amplifier between the power supply and the power supply (L1/L2/L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a molded-case circuit breaker or fuse is not connected, continuous flow of a large current may cause smoke or a fire when the servo amplifier malfunctions.
- When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a regenerative transistor malfunction or the like may overheat the regenerative resistor, causing smoke or a fire.
- When you use a regenerative option with an MR-JE-40C to MR-JE-100C, remove the built-in regenerative resistor and wiring from the servo amplifier.
- Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier and servo motor.

3. To prevent injury, note the following

⚠ CAUTION

- Only the power/signal specified in the Instruction Manual must be supplied/applied to each terminal. Otherwise, an electric shock, fire, injury, etc. may occur.
- Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.
- Ensure that polarity (+/-) is correct. Otherwise, a burst, damage, etc. may occur.
- The servo amplifier heat sink, regenerative resistor, servo motor, etc., may be hot while the power is on and for some time after power-off. Take safety measures such as providing covers to avoid accidentally touching them by hands and parts such as cables.

4. Additional instructions

The following instructions should also be fully noted. Incorrect handling may cause a malfunction, injury, electric shock, fire, etc.

(1) Transportation and installation

⚠ CAUTION

- Transport the products correctly according to their mass.
- Stacking in excess of the specified number of product packages is not allowed.
- Do not hold the lead of the built-in regenerative resistor, cables, or connectors when carrying the servo amplifier. Otherwise, it may drop.
- Install the servo amplifier and the servo motor in a load-bearing place in accordance with the Instruction Manual.
- Do not get on or put heavy load on the product. Otherwise, it may cause injury.
- The equipment must be installed in the specified direction.
- Leave specified clearances between the servo amplifier and the cabinet walls or other equipment.
- Do not install or operate the servo amplifier and servo motor which have been damaged or have any parts missing.
- Do not block the intake and exhaust areas of the servo amplifier. Otherwise, it may cause a malfunction.
- Do not drop or apply heavy impact on the servo amplifiers and the servo motors. Otherwise, injury, malfunction, etc. may occur.
- Do not strike the connector. Otherwise, a connection failure, malfunction, etc. may occur.
- When you keep or use the equipment, please fulfill the following environment.

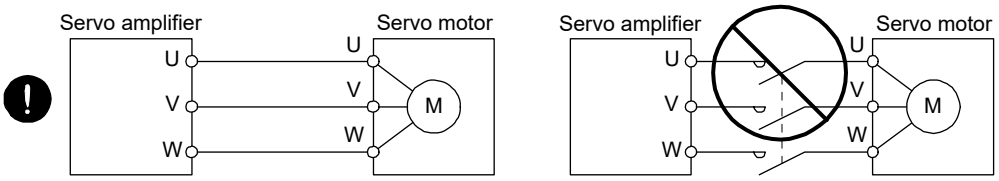
Item		Environment
Ambient temperature	Operation	0 °C to 55 °C (non-freezing)
	Storage	-20 °C to 65 °C (non-freezing)
Ambient humidity	Operation	5 %RH to 90 %RH (non-condensing)
	Storage	
Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt
Altitude		2000 m or less above sea level (Contact your local sales office for the altitude for options.)
Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)

- When the product has been stored for an extended period of time, contact your local sales office.
- When handling the servo amplifier, be careful about the edged parts such as corners of the servo amplifier.
- The servo amplifier must be installed in a metal cabinet.
- When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products. Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing products.
- To prevent a fire or injury from occurring in case of an earthquake or other natural disasters, securely install, mount, and wire the servo motor in accordance with the Instruction Manual.

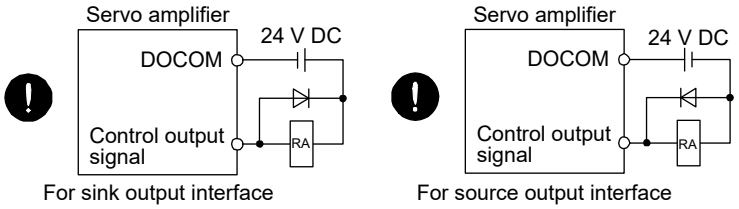
(2) Wiring

⚠ CAUTION

- Before removing the CNP1 connector of MR-JE-40C to MR-JE-100C, disconnect the lead wires of the regenerative resistor from the CNP1 connector.
- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly.
- Make sure to connect the cables and connectors by using the fixing screws and the locking mechanism. Otherwise, the cables and connectors may be disconnected during operation.
- Do not install a power capacitor, surge killer, or radio noise filter (optional FR-BIF) on the servo amplifier output side.
- To avoid a malfunction, connect the wires to the correct phase terminals (U/V/W) of the servo amplifier and servo motor.
- Connect the servo amplifier power output (U/V/W) to the servo motor power input (U/V/W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.



- The connection diagrams in this instruction manual are shown for sink interfaces, unless stated otherwise.
- The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



- When the cable is not tightened enough to the terminal block, the cable or terminal block may generate heat because of the poor contact. Be sure to tighten the cable with specified torque.
- Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- Configure a circuit to turn off EM2 or EM1 when the power supply is turned off to prevent an unexpected restart of the servo amplifier.
- To prevent malfunction, avoid bundling power lines (input/output) and signal cables together or running them in parallel to each other. Separate the power lines from the signal cables.

(3) Test run and adjustment

⚠ CAUTION
●When executing a test run, follow the notice and procedures in this instruction manual. Otherwise, it may cause a malfunction, damage to the machine, or injury. ●Before operation, check the parameter settings. Improper settings may cause some machines to operate unexpectedly. ●Never adjust or change the parameter values extremely as it will make operation unstable. ●Do not get close to moving parts during the servo-on status.

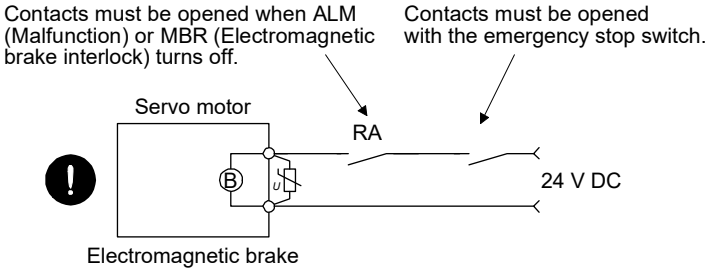
(4) Usage

⚠ CAUTION
●When it is assumed that a hazardous condition may occur due to a power failure or product malfunction, use a servo motor with an external brake to prevent the condition. ●For equipment in which the moving part of the machine may collide against the load side, install a limit switch or stopper to the end of the moving part. The machine may be damaged due to a collision. ●Do not disassemble, repair, or modify the product. Otherwise, an electric shock, fire, injury, etc. may occur. Disassembled, repaired, and/or modified products are not covered under warranty. ●Before resetting an alarm, make sure that the run signal of the servo amplifier is off in order to prevent a sudden restart. Otherwise, it may cause an accident. ●Use a noise filter, etc. to minimize the influence of electromagnetic interference. Electromagnetic interference may be given to the electronic equipment used near the servo amplifier. ●Burning or breaking a servo amplifier may cause a toxic gas. Do not burn or break it. ●Use the servo amplifier with the specified servo motor. ●Correctly wire options and peripheral equipment, etc. in the correct combination. Otherwise, an electric shock, fire, injury, etc. may occur. ●The electromagnetic brake on the servo motor is designed to hold the motor shaft and should not be used for ordinary braking. ●For such reasons as incorrect wiring, service life, and mechanical structure (e.g. where a ball screw and the servo motor are coupled via a timing belt), the electromagnetic brake may not hold the motor shaft. To ensure safety, install a stopper on the machine side. ●If the dynamic brake is activated at power-off, alarm occurrence, etc., do not rotate the servo motor by an external force. Otherwise, it may cause a fire.

(5) Corrective actions

⚠ CAUTION

- Ensure safety by confirming the power off, etc. before performing corrective actions. Otherwise, it may cause an accident.
- If it is assumed that a power failure, machine stoppage, or product malfunction may result in a hazardous situation, use a servo motor with an electromagnetic brake or provide an external brake system for holding purpose to prevent such hazard.
- Configure an electromagnetic brake circuit which is interlocked with an external emergency stop switch.



- Failure of MBR (Electromagnetic brake interlock) or ALM (Malfunction) may cause brake malfunction.
- When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation.
- If the molded-case circuit breaker or fuse is activated, be sure to remove the cause and secure safety before switching the power on. If necessary, replace the servo amplifier and recheck the wiring. Otherwise, it may cause smoke, fire, or an electric shock.
- Provide an adequate protection to prevent unexpected restart after an instantaneous power failure.
- To prevent an electric shock, injury, or fire from occurring after an earthquake or other natural disasters, ensure safety by checking conditions, such as the installation, mounting, wiring, and equipment before switching the power on.

(6) Maintenance, inspection and parts replacement

⚠ CAUTION

- Make sure that the emergency stop circuit operates properly such that an operation can be stopped immediately and a power is shut off by the emergency stop switch.
- It is recommended that the servo amplifier be replaced every 10 years when it is used in general environment.
- When using a servo amplifier whose power has not been turned on for a long time, contact your local sales office.

(7) General instruction

- To illustrate details, the equipment in the diagrams of this Instruction Manual may have been drawn without covers and safety guards. When the equipment is operated, the covers and safety guards must be installed as specified. Operation must be performed in accordance with this Instruction Manual.

● DISPOSAL OF WASTE ●

Please dispose a servo amplifier, battery (primary battery) and other options according to your local laws and regulations.

⚠ EEP-ROM life

The number of write times to the EEP-ROM, which stores parameter settings, etc., is limited to 100,000. If the total number of the following operations exceeds 100,000, the servo amplifier may malfunction when the EEP-ROM reaches the end of its useful life.

- Write to the EEP-ROM due to parameter setting changes
- Write to the EEP-ROM due to device changes

Compliance with global standards

For the compliance with global standards, refer to app. 3.

«About the manual»

You must have this Instruction Manual and the following manuals to use this servo. Ensure to prepare them to use the servo safely.

Relevant manuals

Manual name	Manual No.
MELSERVO-JE Servo Amplifier Instruction Manual (Troubleshooting)	SH(NA)030166ENG
MELSERVO MR-JE-_C Servo Amplifier Instruction Manual (Profile Mode)	SH(NA)030254ENG
MELSERVO MR-JE-_C Servo Amplifier Instruction Manual (Positioning Mode)	SH(NA)030277ENG
MELSERVO MR-JE-_C Servo Amplifier Instruction Manual (Network)	SH(NA)030256ENG
MELSERVO HG-KN/HG-SN Servo Motor Instruction Manual	SH(NA)030135ENG
MELSERVO EMC Installation Guidelines	IB(NA)67310ENG

«Cables used for wiring»

Wires mentioned in this Instruction Manual are selected based on the ambient temperature of 40 °C.

«U.S. customary units»

U.S. customary units are not shown in this manual. Convert the values if necessary according to the following table.

Quantity	SI (metric) unit	U.S. customary unit
Mass	1 [kg]	2.2046 [lb]
Length	1 [mm]	0.03937 [inch]
Torque	1 [N•m]	141.6 [oz•inch]
Moment of inertia	1 [(× 10^{-4} kg•m^2)]	5.4675 [oz•$inch^2$]
Load (thrust load/axial load)	1 [N]	0.2248 [lbf]
Temperature	N [°C] × 9/5 + 32	N [°F]

MEMO

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MEMO

1. FUNCTIONS AND CONFIGURATION

POINT
●To ensure safety of the system against unauthorized access via a network, take security measures such as using a firewall.

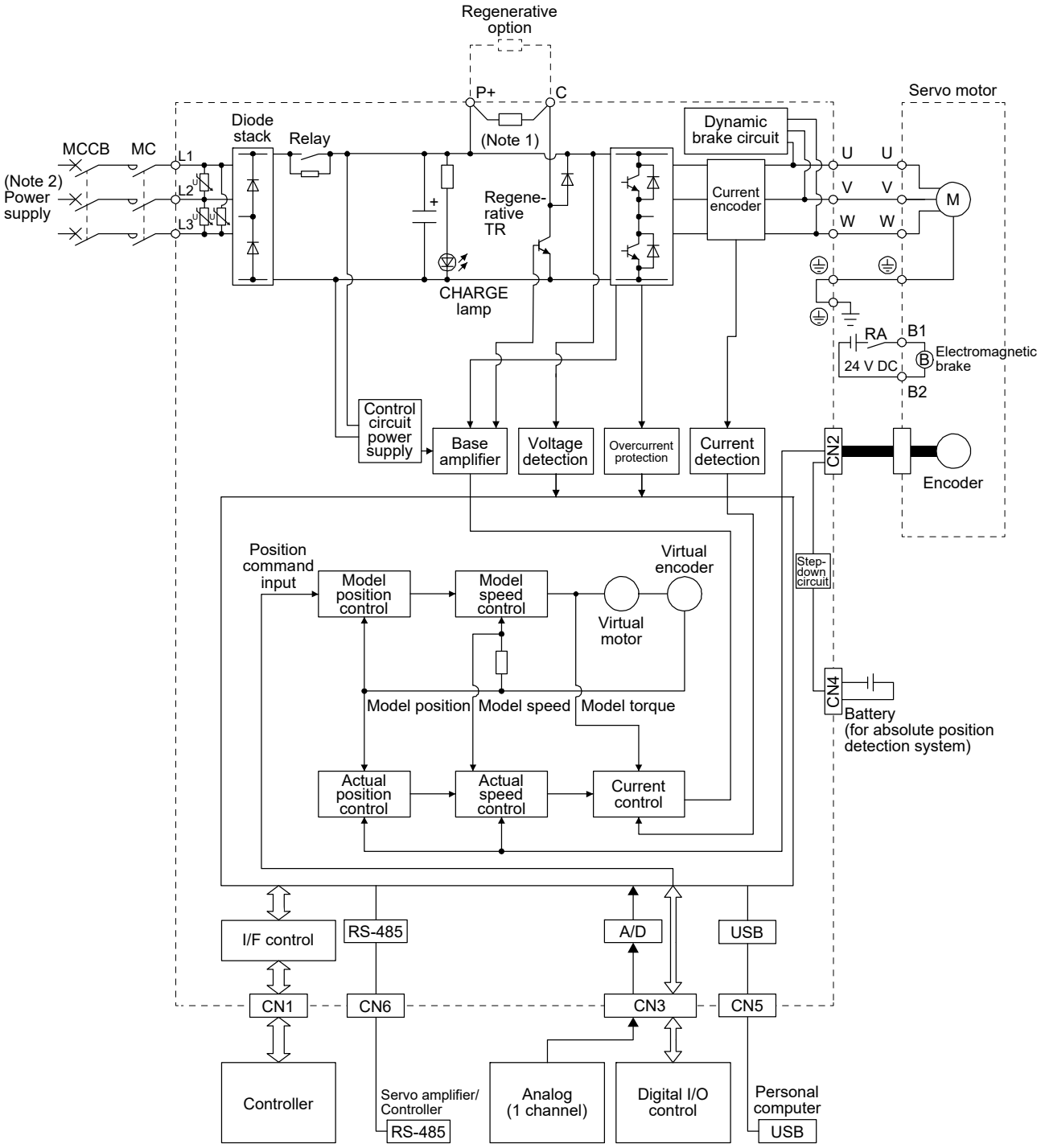
1.1 Summary

The Mitsubishi Electric general-purpose AC servo MELSERVO-JE series have limited functions with keeping high performance based on MELSERVO-J4 series.
The servo amplifier has position, speed, and torque control modes. In the position control mode, the maximum pulse train of 4 Mpulses/s is supported. Further, it can perform operation with the control modes switched, e.g. position/speed control, speed/torque control and torque/position control. Hence, it is applicable to a wide range of fields, not only precision positioning and smooth speed control of machine tools and general industrial machines but also line control and tension control.
The servo amplifier supports profile position/velocity/torque mode that drive motors with communication from the controller. By specifying target position, target speed, acceleration time constant, and deceleration time constant, a position command is created in the servo amplifier and the motor will be driven.
With built-in positioning function, the positioning operation can be performed by using point table method or indexer method. Suitable for assembling a simple positioning system or for simplifying the system.
Drive motor, monitor, and parameter setting can be done with CC-Link IE field network Basic, SLMP, Modbus/TCP and various Modbus RTU open networks by installing the general-purpose Ethernet connector and RS-485 communication connector in each port.
With one-touch tuning and real-time auto tuning, you can automatically adjust the servo gains according to the machine.
The tough drive function, drive recorder function, and preventive maintenance support function strongly support machine maintenance.
The servo amplifier has a USB communication interface. Therefore, you can connect the servo amplifier to the personal computer with MR Configurator2 installed to perform the parameter setting, test operation, gain adjustment, and others.
The MELSERVO-JE series servo motor equipped with an absolute position encoder whose resolution is 131072 pulses/rev will enable a high-accuracy positioning.

1.2 Function block diagram

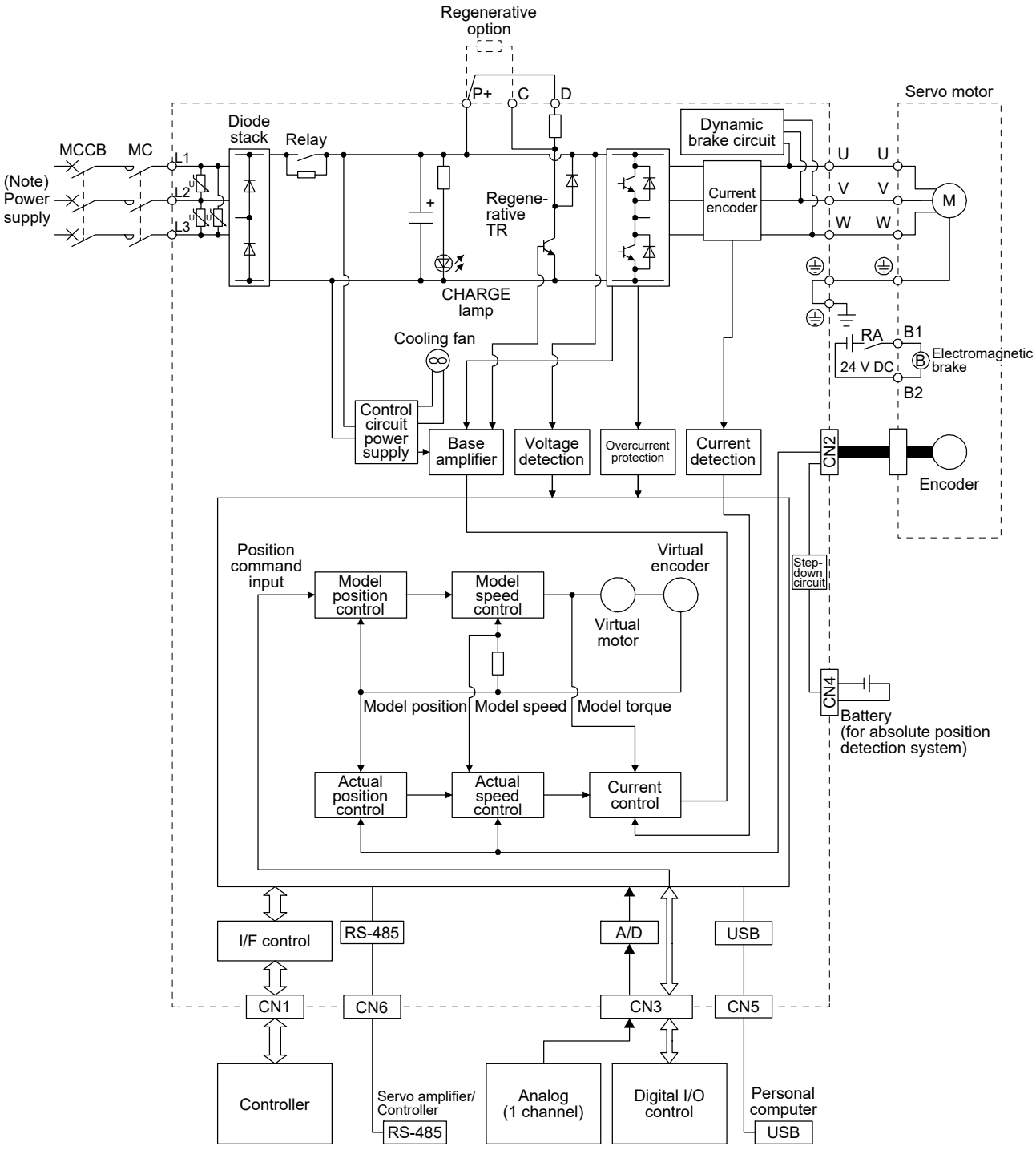
The function block diagram of this servo is shown below.

(1) MR-JE-100C or less



Note 1. The built-in regenerative resistor is not provided for MR-JE-10C and MR-JE-20C.
2. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open.
For the power supply specifications, refer to section 1.3.

(2) MR-JE-200C or more



Note. For the power supply specifications, refer to section 1.3.

1.3 Servo amplifier standard specifications

Model: MR-JE-		10C	20C	40C	70C	100C	200C	300C
Output	Rated voltage	3-phase 170 V AC						
	Rated current [A]	1.1	1.5	2.8	5.8	6.0	11.0	11.0
Power supply input	Voltage/Frequency	3-phase or 1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz				3-phase or 1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz (Note 6)		3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz
	Rated current (Note 4) [A]	0.9	1.5	2.6	3.8	5.0	10.5	14.0
	Permissible voltage fluctuation	3-phase or 1-phase 170 V AC to 264 V AC				3-phase or 1-phase 170 V AC to 264 V AC (Note 6)		3-phase 170 V AC to 264 V AC
	Permissible frequency fluctuation	Within ±5%						
	Power supply capacity [kVA]	Refer to section 10.2.						
	Inrush current [A]	Refer to section 10.5.						
Interface power supply	Voltage	24 V DC ± 10%						
	Current capacity [A]	0.3 (Note 1)						
Control method		Sine-wave PWM control, current control method						
Dynamic brake		Built-in						
Communication function	Ethernet	Connection to master station (controller), etc.						
	USB	Connection to a personal computer or others (MR Configurator2-compatible)						
	RS-485	Connection to master station (controller), etc. (1: n communication (max. 32 axes)) (Note 7)						
Encoder output pulses		Compatible (A/B/Z-phase pulse)						
Position control mode	Max. input pulse frequency	4 Mpulses/s (for differential receiver) (Note 3), 200 kpulses/s (for open collector)						
	Positioning feedback pulse	Encoder resolution (resolution per servo motor revolution): 131072 pulses/rev						
	Command pulse multiplying factor	Electronic gear A/B multiple, A:1 to 16777215, B:1 to 16777215, 1/10 < A/B < 4000						
	In-position range setting	0 pulse to ±65535 pulses (command pulse unit)						
	Error excessive	±3 revolutions						
	Torque limit	Set with parameter or external analog input (0 V DC to +10 V DC/maximum torque)						
Speed control mode	Speed control range	Analog speed command 1: 2000, internal speed command 1: 5000						
	Analog speed command input	0 to ±10 V DC/rated speed (The speed at 10 V is changeable with [Pr. PC12].)						
	Speed fluctuation ratio	±0.01% or less (load fluctuation 0% to 100%), 0% (power fluctuation ±10%), ±0.2% or less (ambient temperature 25 °C ± 10 °C) when using analog speed command						
	Torque limit	Set with parameter or external analog input (0 V DC to +10 V DC/maximum torque)						
Torque control mode	Analog torque command input	0 V DC to ±8 V DC/maximum torque (input impedance 10 kΩ to 12 kΩ)						
	Speed limit	Parameter setting						
Profile mode		Refer to "MR-JE-_C Servo Amplifier Instruction Manual (Profile Mode)"						
Positioning mode		Refer to "MR-JE-_C Servo Amplifier Instruction Manual (Positioning Mode)".						
Protective functions		Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal), servo motor overheat protection, encoder error protection, regenerative error protection, undervoltage protection, instantaneous power failure protection, overspeed protection, and error excessive protection						
Compliance with global standards	CE marking	LVD: EN 61800-5-1 EMC: EN 61800-3						
	UL standard	UL 508C						
Structure (IP rating)		Natural cooling, open (IP20)					Force cooling, open (IP20)	
Close mounting (Note 2)	3-phase power supply input	Possible						
	1-phase power supply input	Possible				Impossible		

Model: MR-JE-			10C	20C	40C	70C	100C	200C	300C
Environment	Ambient temperature	Operation	0 °C to 55 °C (non-freezing)						
		Storage	-20 °C to 65 °C (non-freezing)						
	Ambient humidity	Operation	5 %RH to 90 %RH (non-condensing)						
		Storage							
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt						
	Altitude		2000 m or less above sea level (note 6)						
	Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (X, Y, Z axes)						
Mass [kg]			0.8			1.5		2.1	

Note 1. 0.3 A is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points.
2. When closely mounting the servo amplifier, operate them at the ambient temperature of 0 °C to 45 °C or at 75% or smaller effective load ratio.
3. 1 Mpulse/s or lower commands are supported in the initial setting. When inputting commands over 1 Mpulse/s and 4 Mpulses/s or lower, change the setting in [Pr. PA13].
4. These are current values for 3-phase power supply.
5. When using 1-phase 200 V AC to 240 V AC power supply, operate the servo amplifier at 75% or smaller effective load ratio.
6. Follow the restrictions in section 2.6 when using this product at altitude exceeding 1000 m and up to 2000 m above sea level.
7. RS-485 communication function can be used only on Modbus RTU.

1.4 Combinations of servo amplifiers and servo motors

Servo amplifier (Note)	Servo motor (Note)
MR-JE-10C	HG-KN13_
MR-JE-20C	HG-KN23_
MR-JE-40C	HG-KN43_
MR-JE-70C	HG-KN73_ HG-SN52_
MR-JE-100C	HG-SN102_
MR-JE-200C	HG-SN152_ HG-SN202_
MR-JE-300C	HG-SN302_

Note. By setting [Pr. PA28 HG-KN servo motor series motor maximum speed selection], the motor maximum speed can be changed from 5000 r/min to 6000 r/min for the HG-KN servo motor series.

1.5 Function list

> POINT
>
> ●Ethernet communication (CC-Link IE field network Basic, SLMP and Modbus/TCP) and RS-485 communication (Modbus RTU) are exclusively independent functions.

The following table lists the functions of this servo. For details of the functions, refer to each section indicated in the detailed explanation field.

Function	Description	Detailed explanation
Position control mode (P) (pulse train input)	This servo amplifier is used as a position control servo.	Section 3.2.1 Section 3.6.1 Section 4.2
Speed control mode (S) (Analog input/DI input)	This servo amplifier is used as a speed control servo.	Section 3.2.2 Section 3.6.2 Section 4.3
Torque control mode (T) (Analog input)	This servo amplifier is used as a torque control servo.	Section 3.2.3 Section 3.6.3 Section 4.4
Position/speed control switching mode (P/S)	Using an input device, control can be switched between position control and speed control.	Section 3.6.4
Speed/torque control switch mode (S/T)	Using an input device, control can be switched between speed control and torque control.	Section 3.6.5
Torque/position control switch mode (T/P)	Using an input device, control can be switched between torque control and position control.	Section 3.6.6
Positioning mode (Point table method) (CP)	Select any 1 to 255 point table and perform operation in accordance with the set values. To select point tables, use external input signals or communication function. This function is available with servo amplifiers with software version A4 or later.	"MR-JE-_C Servo Amplifier Instruction Manual (Positioning Mode)"
Positioning mode (Indexer method) (PS)	Perform operation to the station positions divided into 2 to 255. To select station positions, use external input signals or communication function. This function is available with servo amplifiers with software version A4 or later.	
Profile position mode (pp)	The servo amplifier operates in the profile position mode.	"MR-JE-_C Servo Amplifier Instruction Manual (Profile Mode)"
Profile velocity mode (pv)	The servo amplifier operates in the profile velocity mode.	
Profile torque mode (tq)	The servo amplifier operates in the profile torque mode.	
Homing mode (hm)	This servo amplifier operates in the homing mode.	"MR-JE-_C Servo Amplifier Instruction Manual (Profile Mode)" "MR-JE-_C Servo Amplifier Instruction Manual (Positioning Mode)"
Absolute position detection system	To omit home position return at each power-on, set a home position once.	Chapter 12

Function		Description	Detailed explanation
Model adaptive control		This function achieves a high response and stable control following the ideal model. The two-degrees-of-freedom model adaptive control enables the response to be set to the command and to the disturbance separately. This function can also be disabled. Refer to section 7.4 for disabling this function.	
Roll feed display function		Positioning is performed based on the specified travel distance from a status display "0" of current/command positions at start. This function is available with servo amplifiers with software version A4 or later.	"MR-JE-_C Servo Amplifier Instruction Manual (Positioning Mode)"
Touch probe function setting	Current position latch function	The touch probe function is available in the profile mode or the positioning mode. When the touch probe 1 signal turns on, the current position is latched. The latched data can be read with communication commands.	"MR-JE-_C Servo Amplifier Instruction Manual (Positioning Mode)"
	Interrupt positioning function	The touch probe function is available in the profile mode or the positioning mode. When the touch probe 1 signal turns on, this function converts the remaining distance to the travel distance set in [Pr. PT30 Touch probe sensor - Travel distance before stop (lower four digits)] and [Pr. PT31 Touch probe sensor - Travel distance before stop (upper four digits)]. This function is available with servo amplifiers with software version A4 or later.	"MR-JE-_C Servo Amplifier Instruction Manual (Profile Mode)"
Infinite feed function (When degree is set)		When the unit of position data of the profile mode is set to degree, the detection of [AL. E3.1 Multi-revolution counter travel distance excess warning] is disabled and the home position is retained even if the servo motor rotates 32768 revolutions or more in the same direction. Thus, the current position is restored after the power is cycled. This function can be used with the absolute position detection system.	"MR-JE-_C Servo Amplifier Instruction Manual (Profile Mode)"
Command pulse selection		Command pulse train form can be selected from among three different types.	[Pr. PA13]
High-resolution encoder		High-resolution encoder of 131072 pulses/rev is used for the encoder of the servo motor compatible with the MELSERVO-JE series.	
Gain switching function		You can switch gains during rotation and during stop, and can use an input device to switch gains during operation.	Section 7.2
Advanced vibration suppression control II		This function suppresses vibration and residual vibration at an arm end.	Section 7.1.5
Machine resonance suppression filter		This filter function (notch filter) decreases the gain of the specific frequency to suppress the resonance of the mechanical system.	Section 7.1.1
Shaft resonance suppression filter		When a load is mounted to the servo motor shaft, resonance by shaft torsion during driving may generate a mechanical vibration of high frequency. The shaft resonance suppression filter suppresses the vibration.	Section 7.1.3
Adaptive filter II		The servo amplifier detects mechanical resonance and sets filter characteristics automatically to suppress mechanical vibration.	Section 7.1.2
Low-pass filter		Suppresses high-frequency resonance which occurs as the servo system response is increased.	Section 7.1.4
Machine analyzer function		Analyzes the frequency characteristic of the mechanical system just by using MR Configurator2. MR Configurator2 is necessary for this function.	
Robust filter		Improves a disturbance response when a response performance cannot be increased because of a large load to motor inertia ratio, such as a roll feed axis.	[Pr. PE41]
Slight vibration suppression control		Suppresses vibration of ±1 pulse generated at each servo motor stop.	[Pr. PB24]
Electronic gear		Positioning control is performed with the position command from the controller multiplied by a set electronic gear ratio.	[Pr. PA06] [Pr. PA07]
S-pattern acceleration/ deceleration time constant		Enables smooth acceleration and deceleration. Set S-pattern acceleration/deceleration time constants with [Pr. PC03]. Regardless of the command speed, S-pattern acceleration/deceleration time constant will be longer in comparison with the linear acceleration/deceleration time constant.	[Pr. PC03]

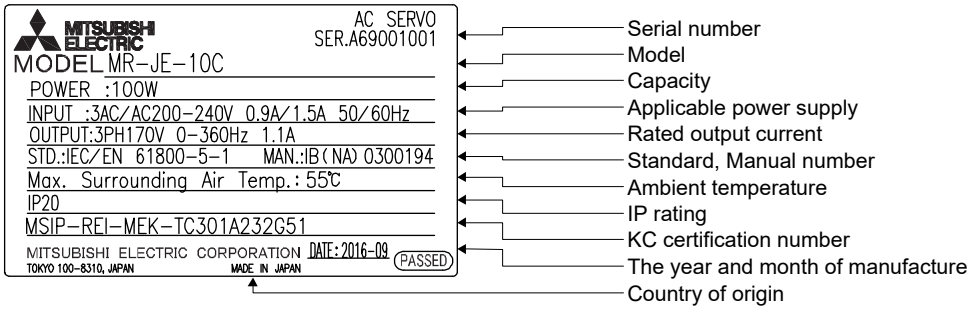
Function	Description	Detailed explanation
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	Section 6.3
Regenerative option	Use a regenerative option when the built-in regenerative resistor of the servo amplifier does not have sufficient capacity for a large regenerative power generated.	Section 11.2
Alarm history clear	Clears alarm histories.	[Pr. PC18]
Input signal selection (device settings)	ST1 (Forward rotation start), ST2 (Reverse rotation start), and SON (Servo-on) and other input device can be assigned to certain pins of the CN3 connector.	Section 3.5
Output signal selection (device settings)	The output devices including MBR (Electromagnetic brake interlock) can be assigned to certain pins of the CN3 connector.	[Pr. PD29] to [Pr. PD32]
Output signal (DO) forced output	Forcibly turns on/off the output signals, independently of the servo status. Use this function for checking output signal wiring, etc.	Section 4.7.1 (1) (d)
Torque limit	Limits the servo motor torque.	[Pr. PA11] [Pr. PA12] [Pr. PC35]
Speed limit	Servo motor speed can be limited to any value.	Section 3.6.3 (3) [Pr. PC05] to [Pr. PC11]
Automatic VC offset	Voltage is automatically offset to stop the servo motor if it does not come to a stop when VC (Analog speed command) is 0 V. MR Configurator2 is necessary for this function.	
Alarm code output	If an alarm has occurred, the corresponding alarm number generates a 3-bit code.	Chapter 8
Test operation mode	Jog operation/positioning operation/motor-less operation/DO forced output/program operation/single-step feed MR Configurator2 is necessary for this function.	Section 4.7
MR Configurator2	Using a personal computer, you can perform the parameter setting, test operation, monitoring, and others.	Section 11.4
One-touch tuning	Gain adjustment is performed just by one click on MR Configurator2. This function is available with MR Configurator2 or via a network.	Section 6.2 "MR-JE-_C Servo Amplifier Instruction Manual (Network)"
Tough drive function	This function makes the equipment continue operating even under the condition that an alarm occurs. The tough drive function includes two types: the vibration tough drive and the instantaneous power failure tough drive.	Section 7.3
Drive recorder function	This function continuously monitors the servo status and records the status transition before and after an alarm for a fixed period of time. You can check the recorded data by clicking the Waveform-Display button on the drive recorder window on MR Configurator2. However, the drive recorder is not available when: 1. The graph function of MR Configurator2 is being used. 2. The machine analyzer function is being used. 3. [Pr. PF21] is set to "-1".	[Pr. PA23]
Servo amplifier life diagnosis function	You can check the cumulative energization time and the number of on/off times of the inrush relay. This function gives an indication of the replacement time for parts of the servo amplifier including a capacitor and a relay before they malfunction. This function is available with MR Configurator2 or via a network.	"MR-JE-_C Servo Amplifier Instruction Manual (Network)"
Power monitoring function	This function calculates the power running energy and the regenerative power from the data in the servo amplifier such as speed and current. Power consumption and others are displayed on MR Configurator2.	

Function	Description	Detailed explanation
Machine diagnosis function	From the data in the servo amplifier, this function estimates the friction and vibrational component of the drive system in the equipment and recognizes an error in the machine parts, including a ball screw and bearing. This function is available with MR Configurator2 or via a network.	"MR-JE-_C Servo Amplifier Instruction Manual (Network)"
Modbus RTU	The Modbus RTU uses dedicated message frames for the Ethernet communication between a master and slaves. The dedicated message frame has a message field called Function which reads and writes data, and parameter setting (reading and writing) of the servo amplifier and monitoring can be done with this message field. In the profile mode or positioning mode, driving the servo motor is also possible. This function is available with servo amplifiers with software version A4 or later.	
Modbus/TCP	The Modbus/TCP uses dedicated message frames for the Ethernet communication between a client (master) and servers (slaves). The dedicated message frame has a message field called Function which reads and writes data, and parameter setting (reading and writing) of the servo amplifier and monitoring can be done with this message field. In the profile mode or positioning mode, driving the servo motor is also possible. This function is available with servo amplifier with software version A3 or later.	
CC-Link IE Field Network Basic	CC-Link IE Field Network Basic enables fixed cycle communication between the master and slave stations using a general-purpose Ethernet connector. Setting parameters (for reading/writing) of servo amplifiers and monitoring can be performed. In the profile mode or positioning mode, driving the servo motor is also possible.	
SLMP	SLMP (SeamLess Message Protocol) is a protocol to access SLMP-compatible devices from external devices (such as a personal computer and an HMI) or CPU module via Ethernet. Setting parameters (for reading/writing) of servo amplifiers and monitoring can be performed. In the profile mode or positioning mode, driving the servo motor is also possible.	
IP address filtering function	You can limit the network devices to be connected to the servo amplifier by registering the range of IP addresses in advance.	
Operation specification IP address function	To limit network devices to which an operation right is given in Ethernet communication (CC-Link IE Field Network Basic, SLMP, or Modbus/TCP), set the range of IP addresses. Monitoring/parameter reading can be performed with the network devices having no operation right.	
Lost motion compensation function	This function improves the response delay generated when the machine moving direction is reversed.	Section 7.5
Limit switch	Travel intervals can be limited with LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end).	
Software limit	Limits travel intervals by address using parameters. Enables the same function with the limit switch by setting parameters.	"MR-JE-_C Servo Amplifier Instruction Manual (Positioning Mode)" "MR-JE-_C Servo Amplifier Instruction Manual (Profile Mode)"
Analog override	Limits a servo motor speed with analog inputs. The value can be changed to 0% to 200% of the set speed. This function is available with servo amplifiers with software version A4 or later.	"MR-JE-_C Servo Amplifier Instruction Manual (Positioning Mode)"
Digital override	A commanded speed multiplied by an override value selected with OVR (Override selection) will be an actual servo motor speed. The value can be changed to 0% to 360% of the set speed. This function is available with servo amplifiers with software version A4 or later.	

1.6 Model designation

(1) Rating plate

The following shows an example of rating plate for explanation of each item.



(2) Model

The following describes what each block of a model name indicates.

MR - J E - 1 0 C

Series

Ethernet Interface

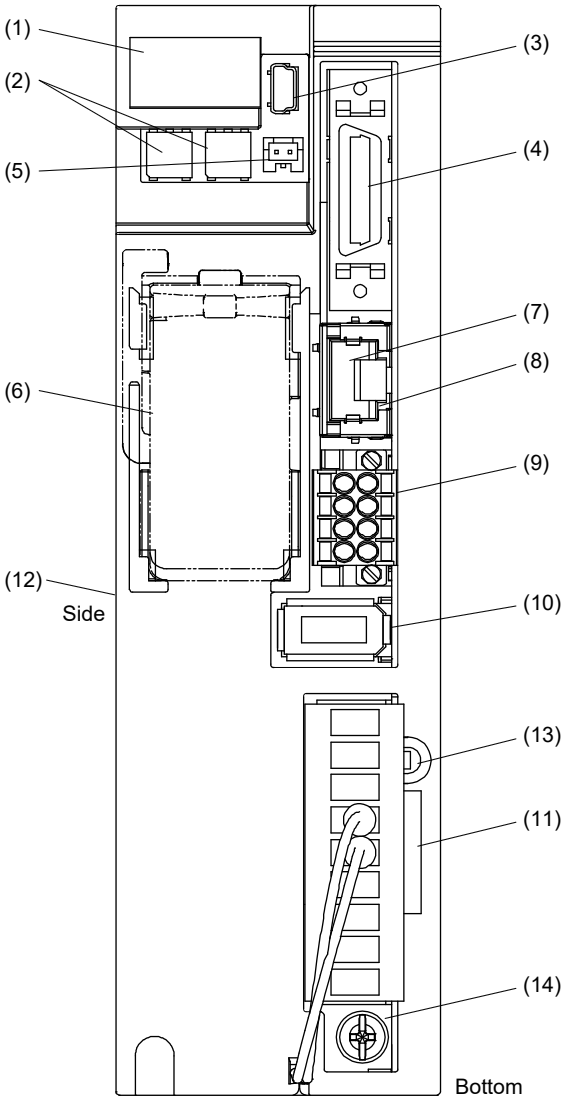
Rated output

Symbol	Rated output [kW]
10	0.1
20	0.2
40	0.4
70	0.75
100	1
200	2
300	3

1.7 Structure

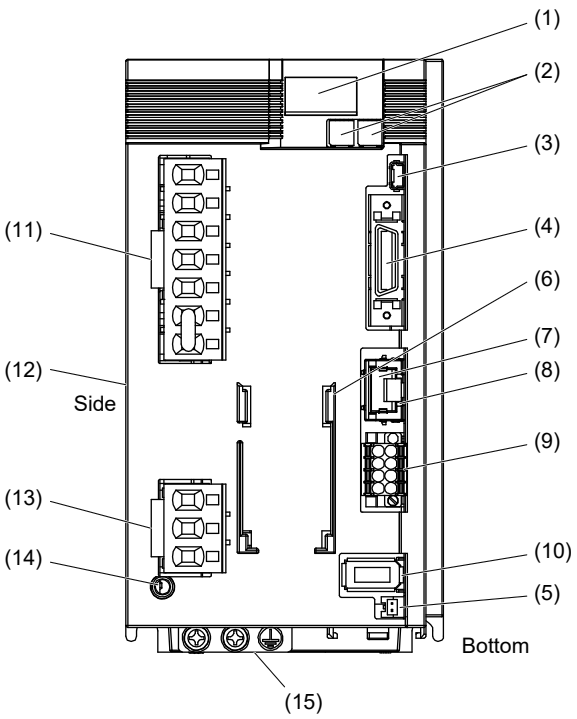
1.7.1 Parts identification

(1) MR-JE-100C or less



No.	Name/Application	Detailed explanation
(1)	Display The 3-digit, 7-segment LED shows the servo status and the alarm number.	Section 4.5
(2)	Identification number setting rotary switch (SW1/SW2) Used to set the identification number of the servo amplifier.	
(3)	USB communication connector (CN5) Connect with the personal computer.	Section 11.4
(4)	I/O signal connector (CN3) Connect digital I/O signal and analog output signal.	Section 3.2 Section 3.4
(5)	Battery connector (CN4) Connect the battery for absolute position data backup.	Section 11.5
(6)	Battery holder Install the battery for absolute position data backup.	
(7)	Ethernet cable connector (CN1) Connect the Ethernet cable.	Section 11.1.3
(8)	Ethernet communication status displaying LED	Section 4.5.4
(9)	RS-485 communication connector (CN6) Connect with the Modbus RTU communication device.	Section 3.4
(10)	Encoder connector (CN2) Connect the servo motor encoder.	Section 3.4
(11)	Power connector (CNP1) Used to connect the input power supply, built-in regenerative resistor, regenerative option, and servo motor.	Section 3.1 Section 3.3
(12)	Rating plate	Section 1.6
(13)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the wires.	
(14)	Protective earth (PE) terminal	Section 3.1 Section 3.3

(2) MR-JE-200C or more



No.	Name/Application	Detailed explanation
(1)	Display The 3-digit, 7-segment LED shows the servo status and the alarm number.	Section 4.5
(2)	Identification number setting rotary switch (SW1/SW2) Used to set the identification number of the servo amplifier.	
(3)	USB communication connector (CN5) Connect with the personal computer.	Section 11.4
(4)	I/O signal connector (CN3) Connect digital I/O signal and analog output signal.	Section 3.2 Section 3.4
(5)	Battery connector (CN4) Connect the battery for absolute position data backup.	Section 11.5
(6)	Battery holder Install the battery for absolute position data backup.	
(7)	Ethernet cable connector (CN1) Connect the Ethernet cable.	Section 11.1.3
(8)	Ethernet communication status displaying LED	Section 4.5.4
(9)	RS-485 communication connector (CN6) Connect with the Modbus RTU communication device.	Section 3.4
(10)	Encoder connector (CN2) Connect the servo motor encoder.	Section 3.4
(11)	Power connector (CNP1)	Section 3.1 Section 3.3
(12)	Rating plate	Section 1.6
(13)	Servo motor power connector (CNP2) Used to connect the servo motor.	Section 3.1 Section 3.3
(14)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the wires.	
(15)	Protective earth (PE) terminal	Section 3.1 Section 3.3

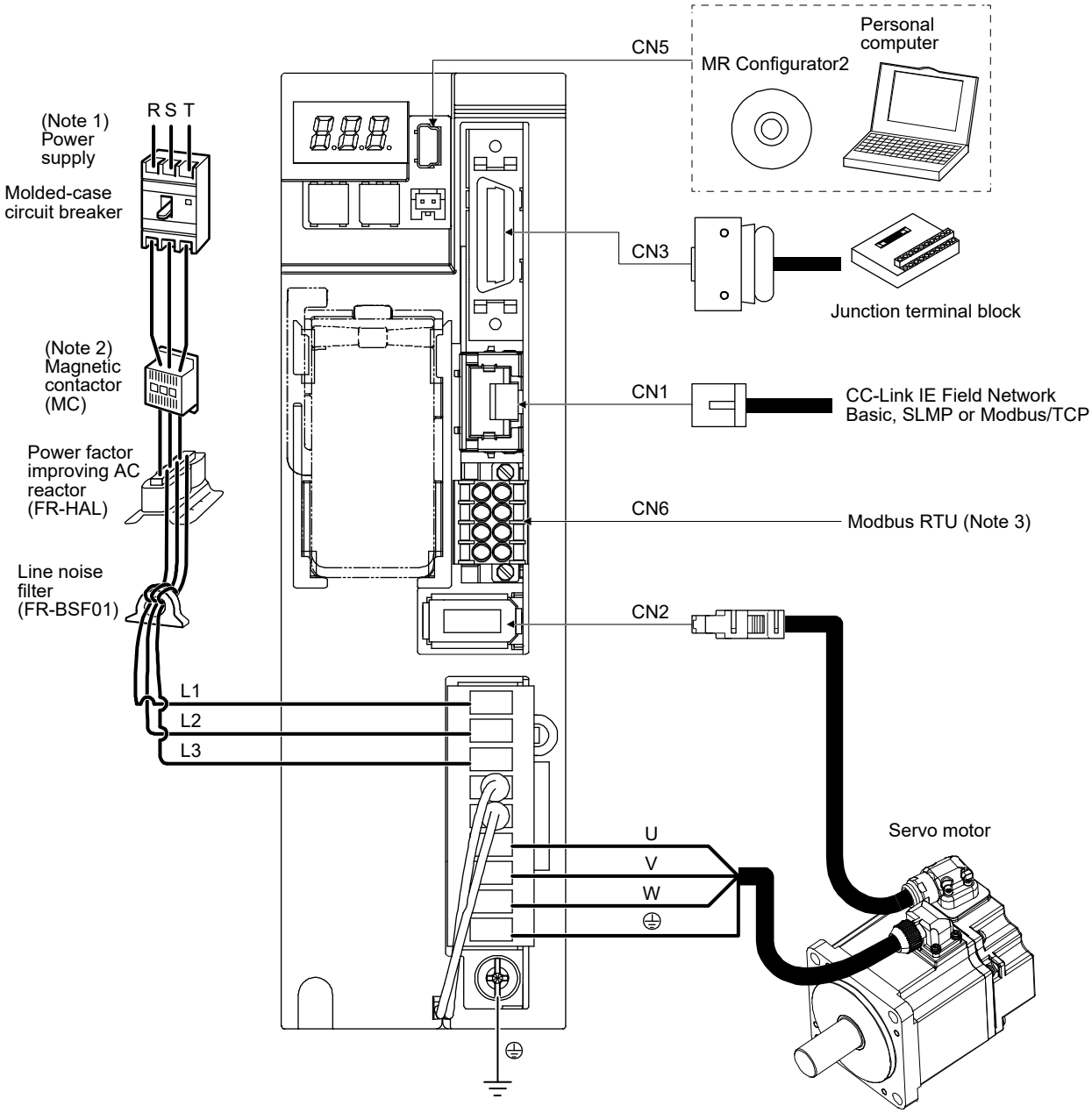
1.8 Configuration including peripheral equipment

⚠CAUTION
- Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

POINT
- Equipment other than the servo amplifier and servo motor are optional or recommended products.

(1) MR-JE-100C or less

The diagram shows MR-JE-10C.



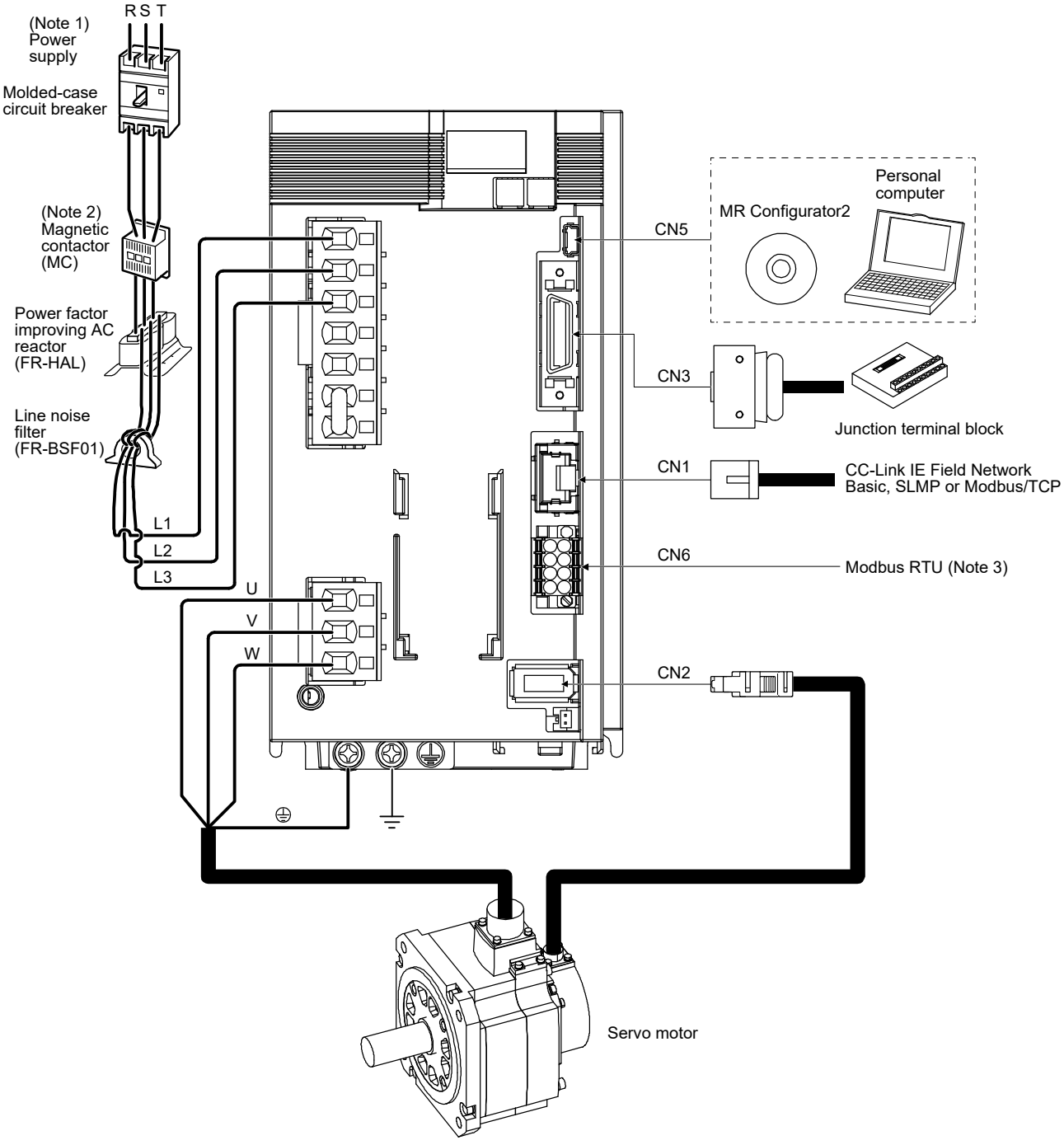
Note 1. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open. For the power supply specifications, refer to section 1.3.

2. Depending on the power supply voltage and operation pattern, bus voltage can decrease. This can shift the mode to the dynamic brake deceleration during forced stop deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.

3. RS-485 communication function can be used only on Modbus RTU.

(2) MR-JE-200C or more

The diagram shows MR-JE-200C.



Note 1. A 1-phase 200 V AC to 240 V AC power supply may be used with the servo amplifier of MR-JE-200C. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L2. Leave L3 open. For the power supply specifications, refer to section 1.3.

2. Depending on the power supply voltage and operation pattern, bus voltage can decrease. This can shift the mode to the dynamic brake deceleration during forced stop deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.

3. RS-485 communication function can be used only on Modbus RTU.

MEMO

2. INSTALLATION

⚠WARNING
- To prevent electric shock, ground each equipment securely.

⚠CAUTION
- Stacking in excess of the specified number of product packages is not allowed.
- Do not hold the lead of the built-in regenerative resistor, cables, or connectors when carrying the servo amplifier. Otherwise, it may drop.
- Install the equipment on incombustible material. Installing them directly or close to combustibles will lead to smoke or a fire.
- Install the servo amplifier and the servo motor in a load-bearing place in accordance with the Instruction Manual.
- Do not get on or put heavy load on the product. Otherwise, it may cause injury.
- Use the equipment within the specified environment. For the environment, refer to section 1.3.
- Provide an adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier.
- Do not block the intake and exhaust areas of the servo amplifier. Otherwise, it may cause a malfunction.
- Do not drop or apply heavy impact on the servo amplifiers and the servo motors. Otherwise, injury, malfunction, etc. may occur.
- Do not install or operate the servo amplifier which has been damaged or has any parts missing.
- When the product has been stored for an extended period of time, contact your local sales office.
- When handling the servo amplifier, be careful about the edged parts such as corners of the servo amplifier.
- The servo amplifier must be installed in a metal cabinet.
- When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products. Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing products.

2. INSTALLATION

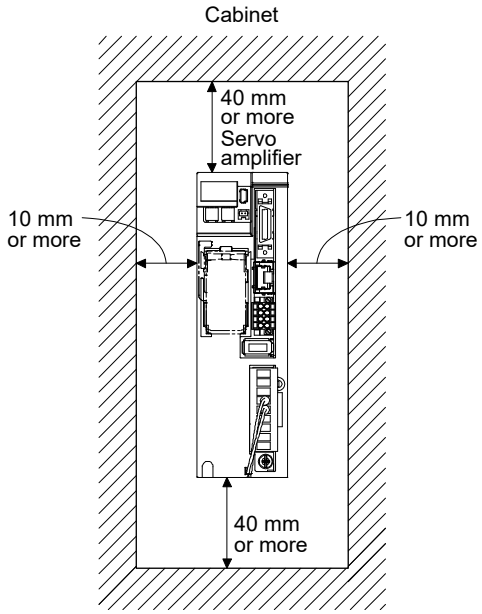
2.1 Installation direction and clearances

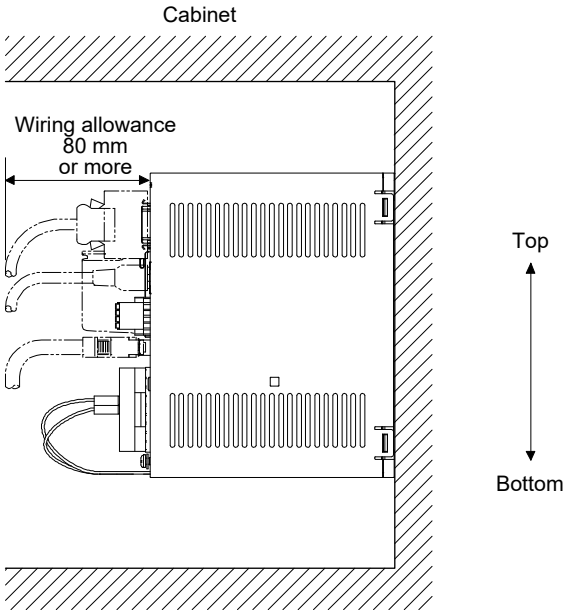
⚠CAUTION	●The equipment must be installed in the specified direction. Otherwise, it may cause a malfunction. ●Leave specified clearances between the servo amplifier and the cabinet walls or other equipment. Otherwise, it may cause a malfunction.

MR-JE-40C to MR-JE-100C have a regenerative resistor on their back face. The regenerative resistor generates heat of 100 °C higher than the ambient temperature. Please fully consider heat dissipation, installation position, etc. when mounting it.

(1) Installation clearances of the servo amplifier

(a) Installation of one servo amplifier

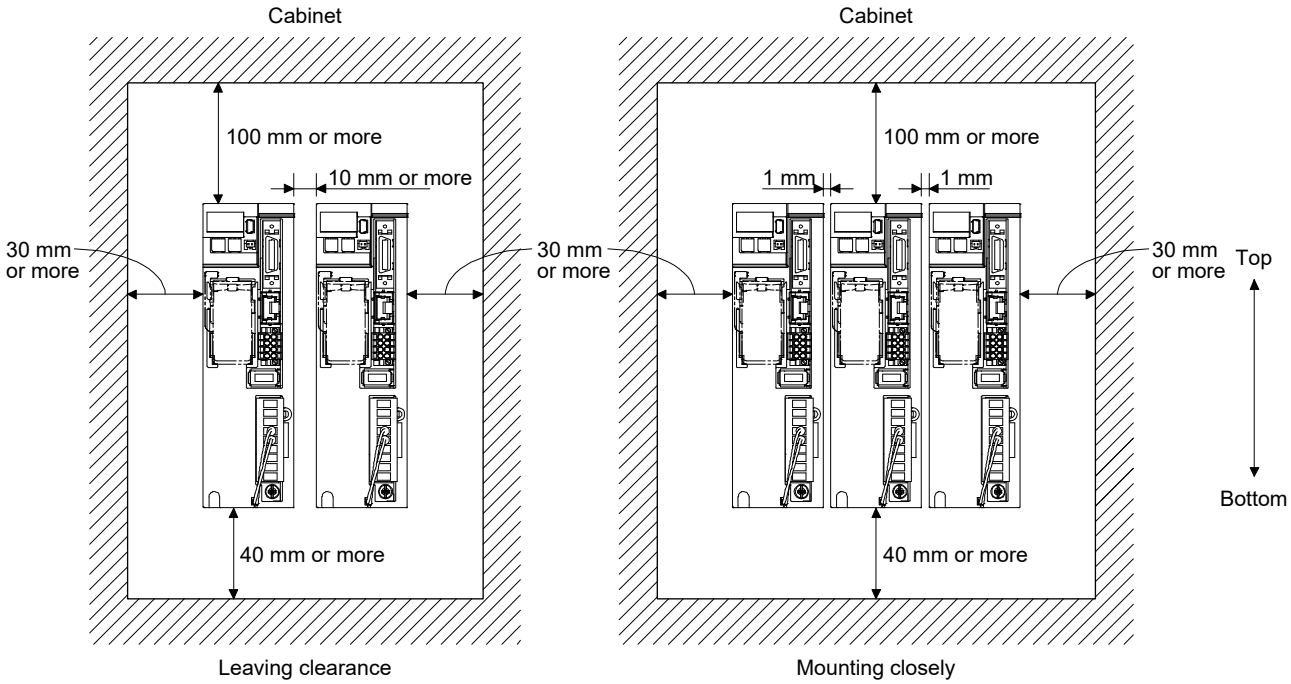




(b) Installation of two or more servo amplifiers

POINT
●Close mounting is possible depending on the capacity of the servo amplifier. Refer to section 1.3 for availability of close mounting.

Leave a large clearance between the top of the servo amplifier and the cabinet walls, and install a cooling fan to prevent the internal temperature of the cabinet from exceeding the environment. When mounting the servo amplifiers closely, leave a clearance of 1 mm between the adjacent servo amplifiers in consideration of mounting tolerances. In this case, keep the ambient temperature within 0 °C to 45 °C or use the servo amplifier with 75% or less of the effective load ratio.



(2) Others

When using heat generating equipment such as the regenerative option, install them with full consideration of heat generation so that the servo amplifier is not affected.
Install the servo amplifier on a perpendicular wall in the correct vertical direction.

2.2 Keep out foreign materials

(1) When drilling in the cabinet, prevent drill chips and wire fragments from entering the servo amplifier.

(2) Prevent oil, water, metallic dust, etc. from entering the servo amplifier through openings in the cabinet or a cooling fan installed on the ceiling.

(3) When installing the cabinet in a place where toxic gas, dirt and dust exist, conduct an air purge (force clean air into the cabinet from outside to make the internal pressure higher than the external pressure) to prevent such materials from entering the cabinet.

2.3 Encoder cable stress

(1) The way of clamping the cable must be fully examined so that bending stress and cable's own weight stress are not applied to the cable connection.

(2) For use in any application where the servo motor moves, fix the cables (encoder, power supply, and brake) with having some slack from the connector connection part of the servo motor to avoid putting stress on the connector connection part. Use the optional encoder cable within the bending life range. Use the power supply and brake wiring cables within the bending life of the cables.

(3) Avoid any probability that the cable insulator might be cut by sharp chips, rubbed by a machine corner or stamped by workers or vehicles.

(4) For installation on a machine where the servo motor moves, the flexing radius should be made as large as possible. Refer to section 10.4 for the bending life.

2.4 Inspection items

⚠WARNING	●Before starting maintenance and/or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier. ●To avoid an electric shock, only qualified personnel should attempt inspections. For repair and parts replacement, contact your local sales office.

⚠CAUTION	●Do not perform insulation resistance test on the servo amplifier. Otherwise, it may cause a malfunction. ●Do not disassemble and/or repair the equipment on customer side.

It is recommended that the following points periodically be checked.

(1) Check for loose terminal block screws. Retighten any loose screws.

(2) Check the cables and the like for scratches or cracks. Inspect them periodically according to operating conditions especially when the servo motor is movable.

(3) Check that the connector is securely connected to the servo amplifier.

(4) Check that the wires are not coming out from the connector.

(5) Check for dust accumulation on the servo amplifier.

(6) Check for unusual noise generated from the servo amplifier.

(7) Make sure that the emergency stop circuit operates properly such that an operation can be stopped immediately and a power is shut off by the emergency stop switch.

2.5 Parts having service life

Service life of the following parts is listed below. However, the service life varies depending on operating methods and environment. If any fault is found in the parts, they must be replaced immediately regardless of their service life. For parts replacement, please contact your local sales office.

Part name	Life guideline
Smoothing capacitor	10 years
Relay	Number of power-on, forced stop by EM1 (Forced stop 1), and sudden stop command from controller: 100,000 times
Cooling fan	50,000 hours to 70,000 hours (7 years to 8 years)
Absolute position battery	Refer to section 12.2.

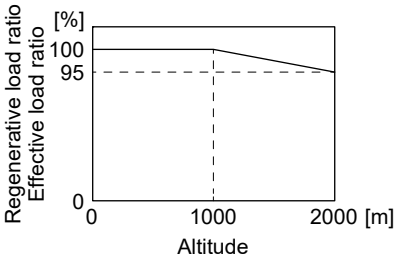
(1) Smoothing capacitor
The characteristic of smoothing capacitor is deteriorated due to ripple currents, etc. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its life in 10 years of continuous operation in normal air-conditioned environment (ambient temperature of 40 °C or less).

(2) Relays
Contact faults will occur due to contact wear arisen from switching currents. Relays will reach the end of their lives depending on their power supply capacity when the number of power-on times, number of forced stop times by EM1 (Forced stop 1), and number of controller forced stop command times are 100,000 times in total.

(3) Servo amplifier cooling fan
The cooling fan bearings reach the end of their life in 50,000 hours to 70,000 hours. Normally, therefore, the cooling fan must be replaced in seven to eight years of continuous operation as a guideline. If unusual noise or vibration is found during inspection, the cooling fan must also be replaced.
The life indicates under the yearly average ambient temperature of 40 °C, free from corrosive gas, flammable gas, oil mist, dust and dirt.

2.6 Restrictions when using this product at altitude exceeding 1000 m and up to 2000 m above sea level

(1) Effective load ratio and regenerative load ratio
As heat dissipation effects decrease in proportion to the decrease in air density, use the product within the effective load ratio and regenerative load ratio shown in the following figure.



When closely mounting the servo amplifiers, operate them at the ambient temperature of 0 °C to 45 °C or at 75% or smaller effective load ratio. (Refer to section 2.1.)

(2) Input voltage
Generally, a withstand voltage decreases as the altitude increases; however, there is no restriction on the withstand voltage. Use in the same manner as in 1000 m or less. (Refer to section 1.3.)

(3) Parts having service life
(a) Smoothing capacitor
The capacitor will reach the end of its life in 10 years of continuous operation in air-conditioned environment (ambient temperature of 30 °C or less).

(b) Relay
There is no restriction. Use in the same manner as in 1000 m or less. (Refer to section 2.4.)

(c) Servo amplifier cooling fan
There is no restriction. Use in the same manner as in 1000 m or less. (Refer to section 2.4.)

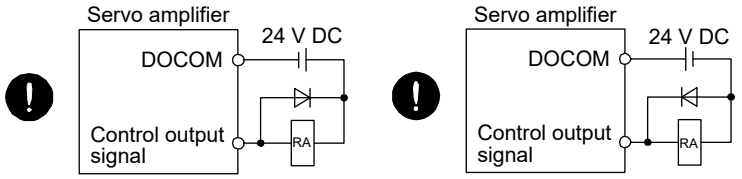
3. SIGNALS AND WIRING

⚠WARNING

- Any person who is involved in wiring should be fully competent to do the work.
- Before wiring, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.
- Ground the servo amplifier and servo motor securely.
- Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, it may cause an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
- To avoid an electric shock, insulate the connections of the power supply terminals.

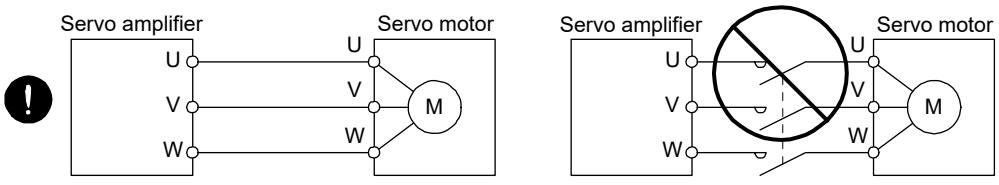
⚠CAUTION

- Before removing the CNP1 connector from MR-JE-40C to MR-JE-100C, disconnect the lead wires of the regenerative resistor from the CNP1 connector.
- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly, resulting in injury.
- Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.
- Ensure that polarity (+/-) is correct. Otherwise, a burst, damage, etc. may occur.
- The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



For sink output interface　　For source output interface

- Use a noise filter, etc. to minimize the influence of electromagnetic interference. Electromagnetic interference may be given to the electronic equipment used near the servo amplifier.
- Do not install a power capacitor, surge killer or radio noise filter (optional FR-BIF) with the power line of the servo motor.
- When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a transistor fault or the like may overheat the regenerative resistor, causing a fire.
- Do not modify the equipment.
- Connect the servo amplifier power output (U/V/W) to the servo motor power input (U/V/W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.



⚠CAUTION

- Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- Before wiring, switch operation, etc., eliminate static electricity. Otherwise, it may cause a malfunction.

3.1 Input power supply circuit

⚠CAUTION

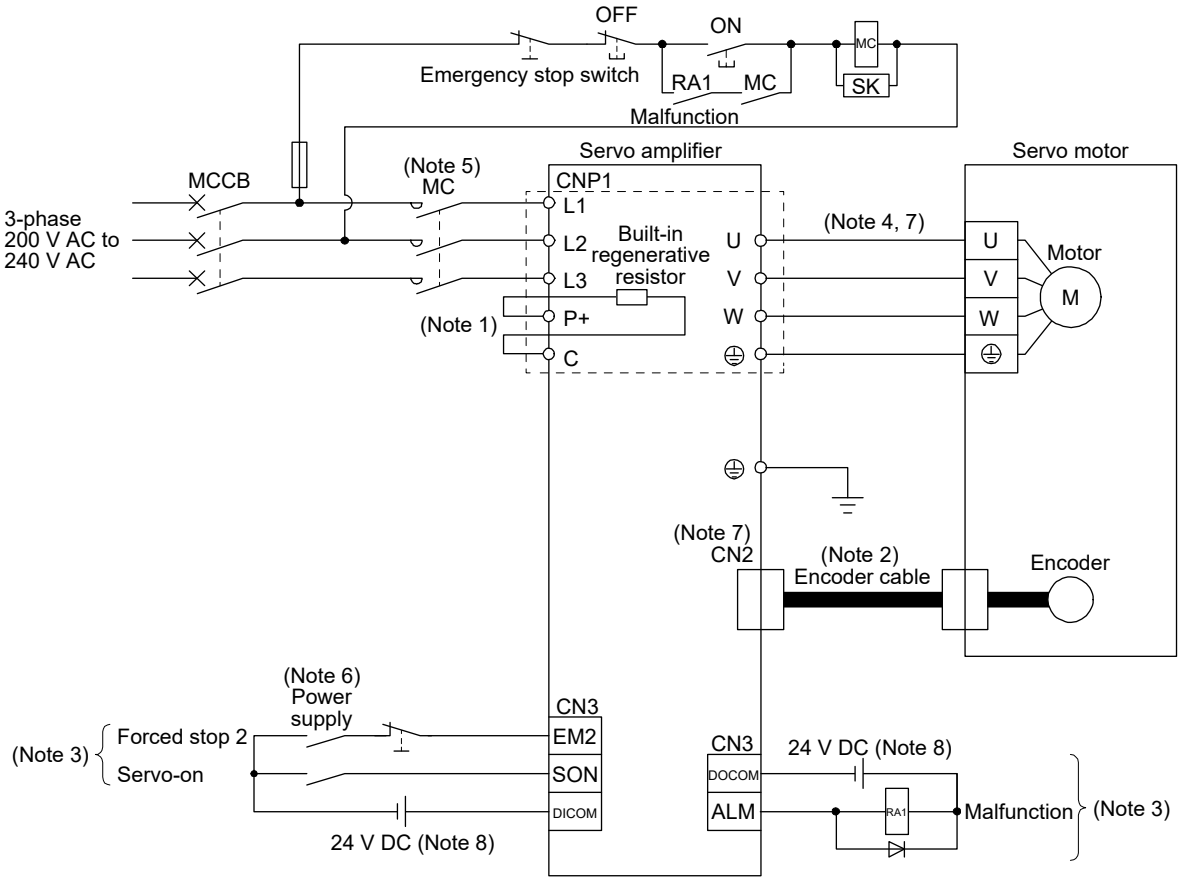
- Always connect a magnetic contactor between the power supply and the power supply (L1/L2/L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.
- Use ALM (Malfunction) to switch power off. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the regenerative resistor.
- Before removing the CNP1 connector from MR-JE-40C to MR-JE-100C, disconnect the lead wires of the regenerative resistor from the CNP1 connector. Not doing so may break the lead wires of the regenerative resistor.
- Check the servo amplifier model, and then input proper voltage to the servo amplifier power supply. If input voltage exceeds the upper limit of the specification, the servo amplifier will break down.
- The servo amplifier has a built-in surge absorber (varistor) to reduce exogenous noise and to suppress lightning surge. Exogenous noise or lightning surge deteriorates the varistor characteristics, and the varistor may be damaged. To prevent a fire, use a molded-case circuit breaker or fuse for input power supply.
- Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

POINT

- EM2 has the same function as EM1 in the torque control mode.
- When a 1-phase 200 V AC to 240 V AC power supply is used, the connection destination differs depending on the servo amplifier. Ensure that the connection destination is correct.

Configure the wirings so that the power supply is shut off and SON (Servo-on) is turned off after deceleration to a stop due to an alarm occurring, enabled servo forced stop, etc. A molded-case circuit breaker (MCCB) must be used with the input cables of the power supply.

(1) Using 3-phase 200 V AC to 240 V AC power supply for MR-JE-10C to MR-JE-100C



Note 1. MR-JE-40C to MR-JE-100C have a built-in regenerative resistor. (factory-wired) When using the regenerative option, refer to section 11.2.

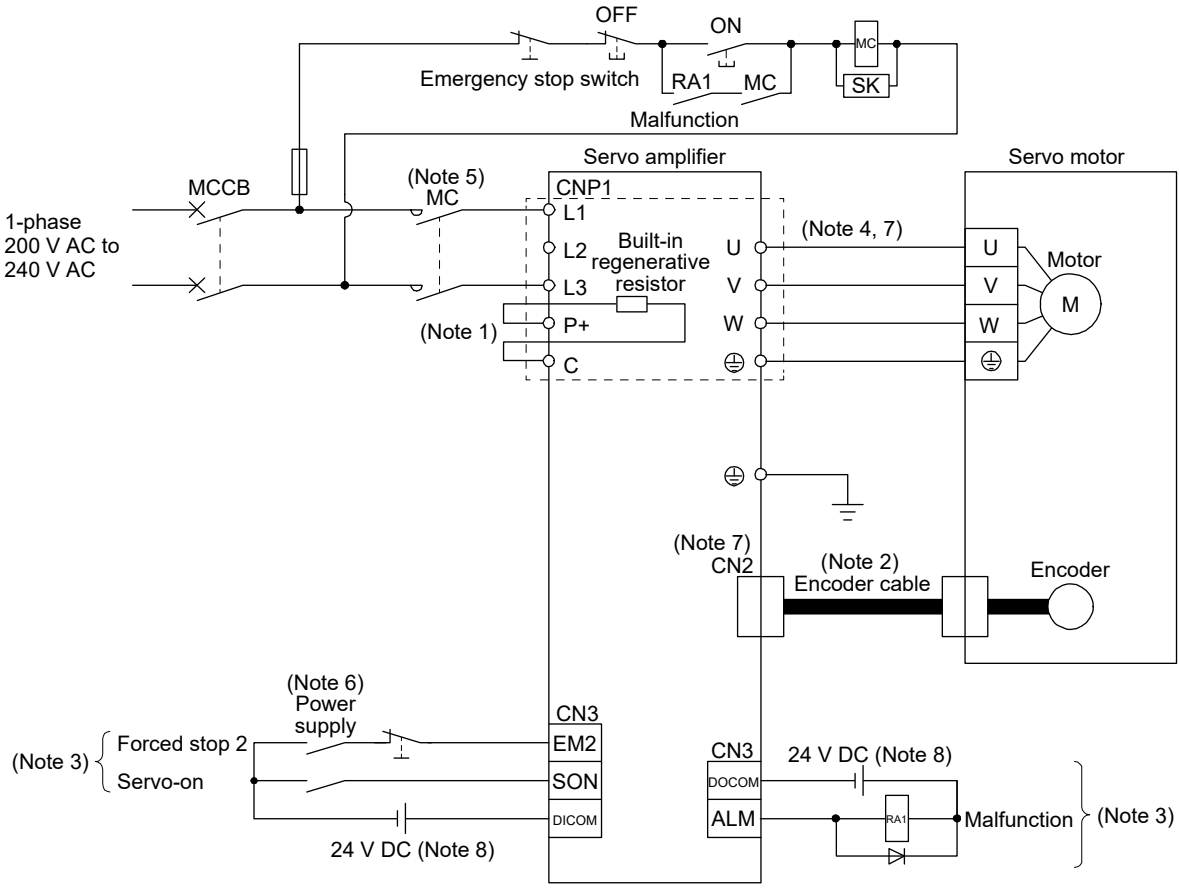
2. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "HG-KN/HG-SN Servo Motor Instruction Manual".
3. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
4. For connecting servo motor power wires, refer to "HG-KN/HG-SN Servo Motor Instruction Manual".
5. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the power supply voltage and operation pattern, bus voltage can decrease. This can shift the mode to the dynamic brake deceleration during forced stop deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
6. Configure a circuit to turn off EM2 when the power is turned off to prevent an unexpected restart of the servo amplifier.
7. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
8. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

(2) Using 1-phase 200 V AC to 240 V AC power supply for MR-JE-10C to MR-JE-100C

POINT

●Connect the 1-phase 200 V AC to 240 V AC power supply to L1 and L3. One of the connecting destinations is different from MR-JE-200C Servo Amplifier's.

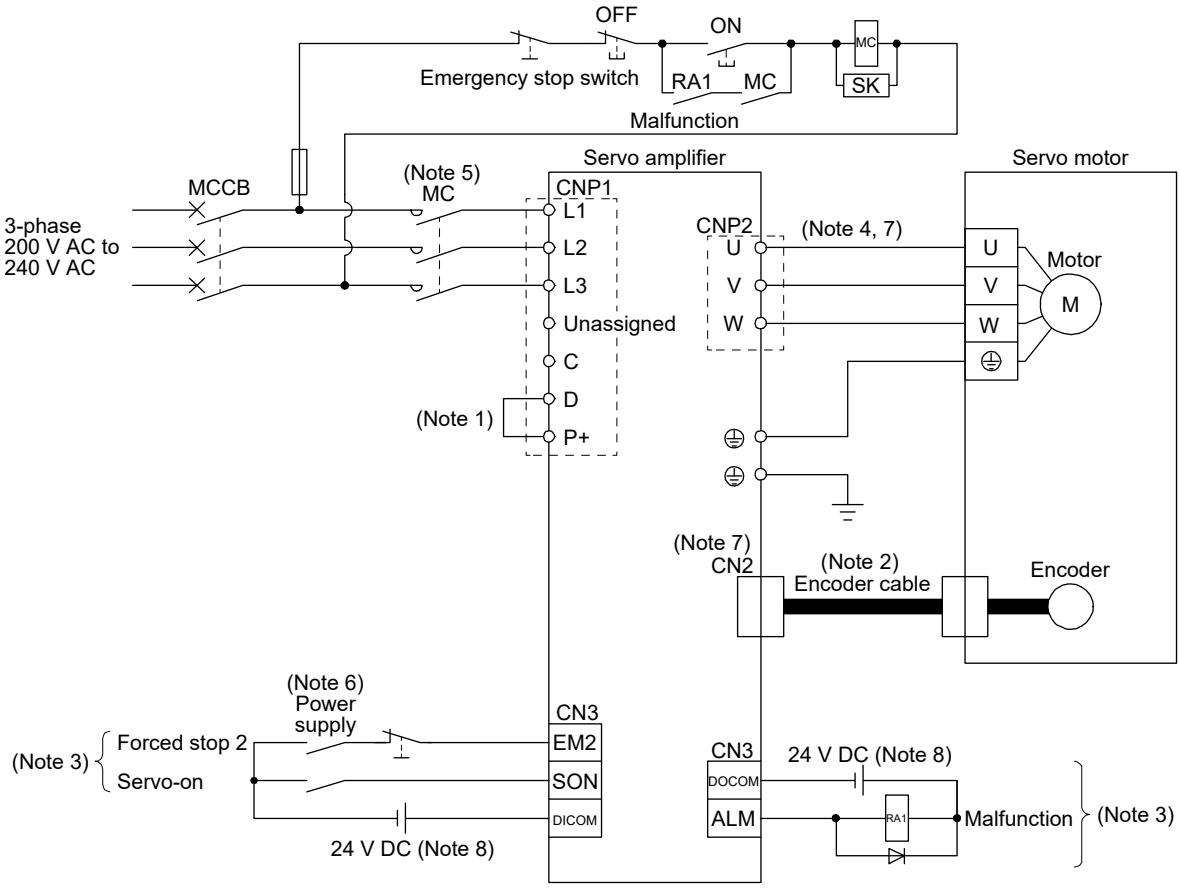
●You can use the neutral point of a 3-phase 400 V AC class power supply to input a 1-phase 200 V AC class power supply to the servo amplifier. Refer to app. 6 for details.



Note 1. MR-JE-40C to MR-JE-100C have a built-in regenerative resistor. (factory-wired) When using the regenerative option, refer to section 11.2.

2. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "HG-KN/HG-SN Servo Motor Instruction Manual".
3. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
4. For connecting servo motor power wires, refer to "HG-KN/HG-SN Servo Motor Instruction Manual".
5. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the power supply voltage and operation pattern, bus voltage can decrease. This can shift the mode to the dynamic brake deceleration during forced stop deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
6. Configure a circuit to turn off EM2 when the power is turned off to prevent an unexpected restart of the servo amplifier.
7. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
8. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

(3) Using 3-phase 200 V AC to 240 V AC power supply for MR-JE-200C or MR-JE-300C



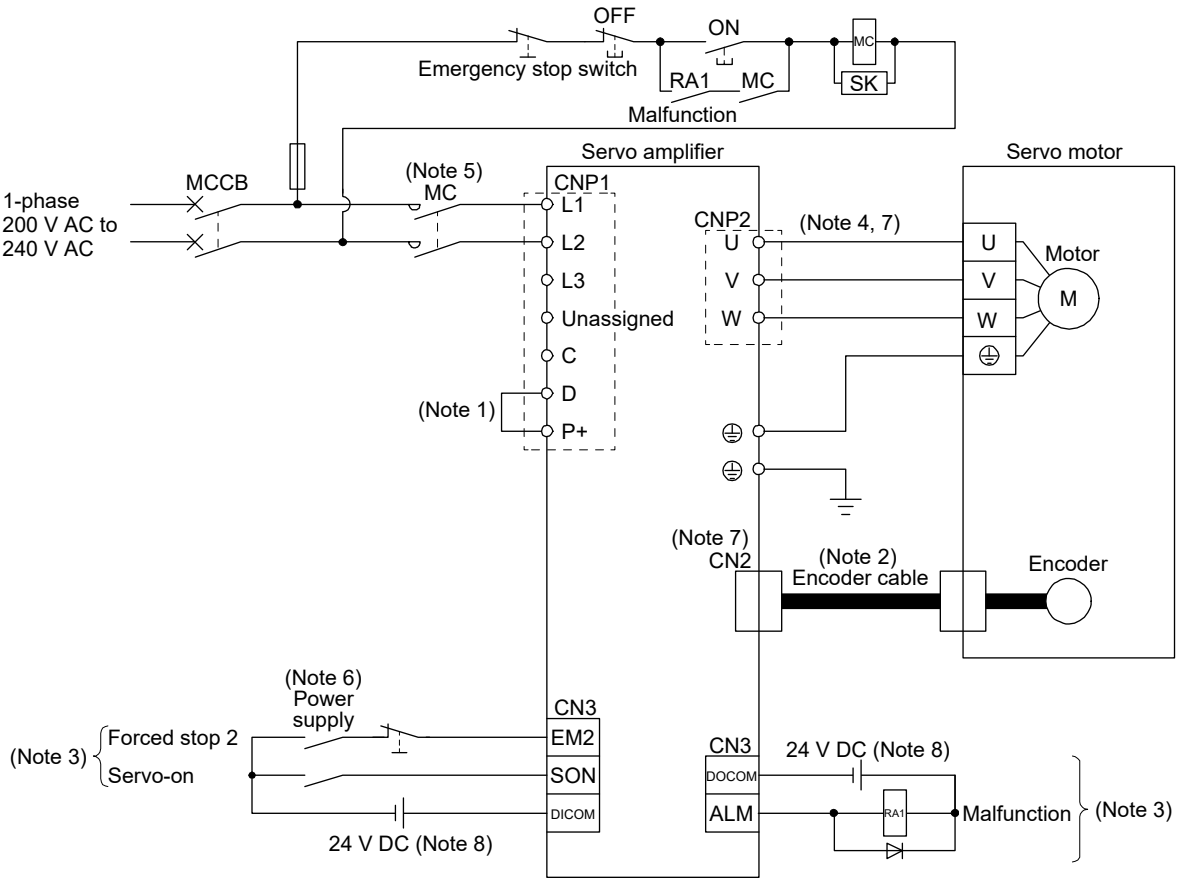
Note 1. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
2. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "HG-KN/HG-SN Servo Motor Instruction Manual".
3. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
4. For connecting servo motor power wires, refer to "HG-KN/HG-SN Servo Motor Instruction Manual".
5. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the power supply voltage and operation pattern, bus voltage can decrease. This can shift the mode to the dynamic brake deceleration during forced stop deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
6. Configure a circuit to turn off EM2 when the power is turned off to prevent an unexpected restart of the servo amplifier.
7. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
8. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

(4) Using 1-phase 200 V AC to 240 V AC power supply for MR-JE-200C

POINT

●Connect the 1-phase 200 V AC to 240 V AC power supply to L1 and L2. One of the connecting destinations is different from MR-JE-100C or less Servo Amplifier's.

●You can use the neutral point of a 3-phase 400 V AC class power supply to input a 1-phase 200 V AC class power supply to the servo amplifier. Refer to app. 7 for details.



Note 1. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.

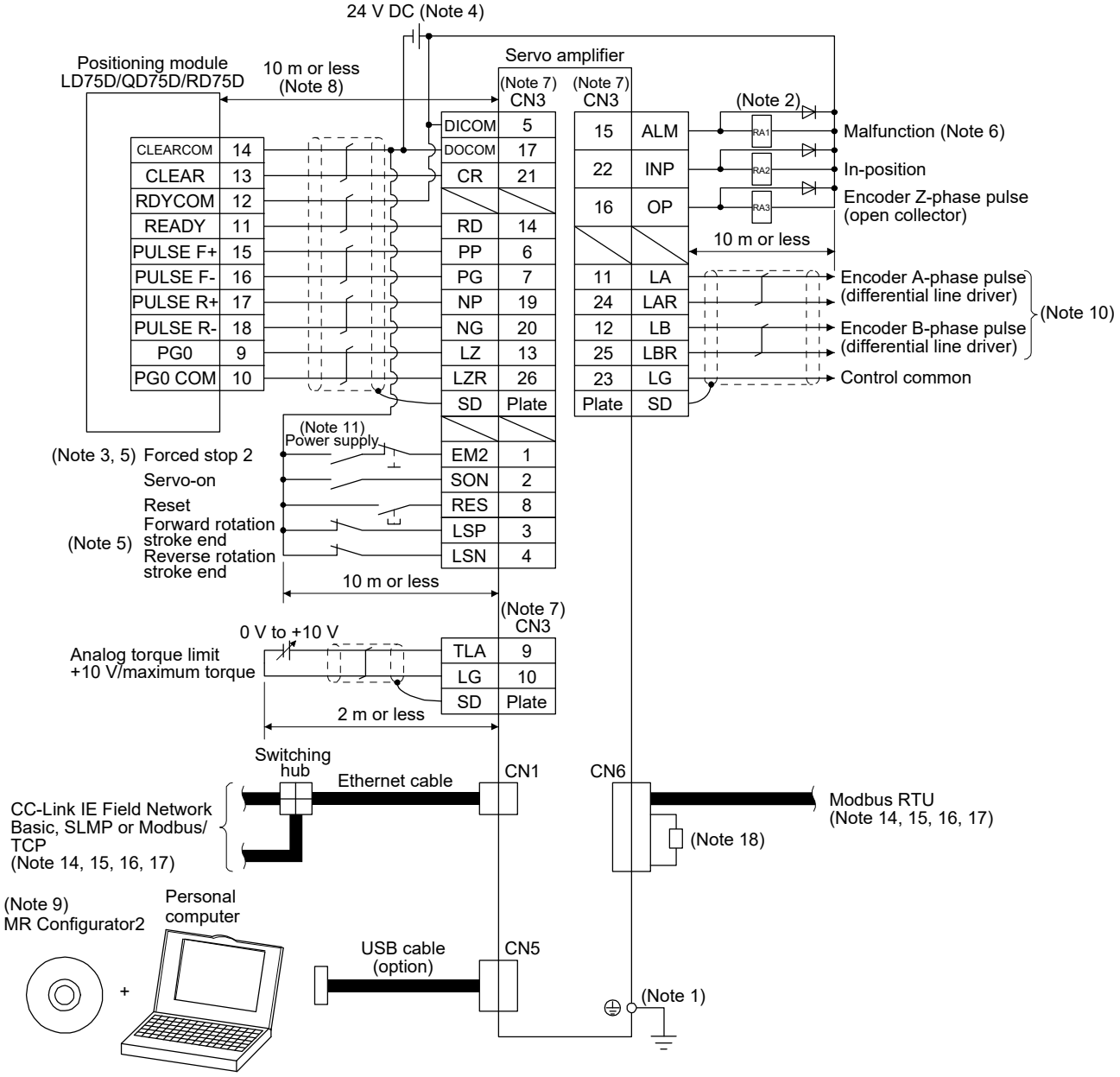
2. For the encoder cable, use of the option cable is recommended. For cable selection, refer to "HG-KN/HG-SN Servo Motor Instruction Manual".
3. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
4. For connection of servo motor power wires, refer to "HG-KN/HG-SN Servo Motor Instruction Manual".
5. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the power supply voltage and operation pattern, bus voltage can decrease. This can shift the mode to the dynamic brake deceleration during forced stop deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
6. Configure a circuit to turn off EM2 when the power is turned off to prevent an unexpected restart of the servo amplifier.
7. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
8. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

3.2 I/O signal connection example

3.2.1 Position control mode

(1) When you use a positioning module LD75D/QD75D/RD75D

(a) For sink I/O interface

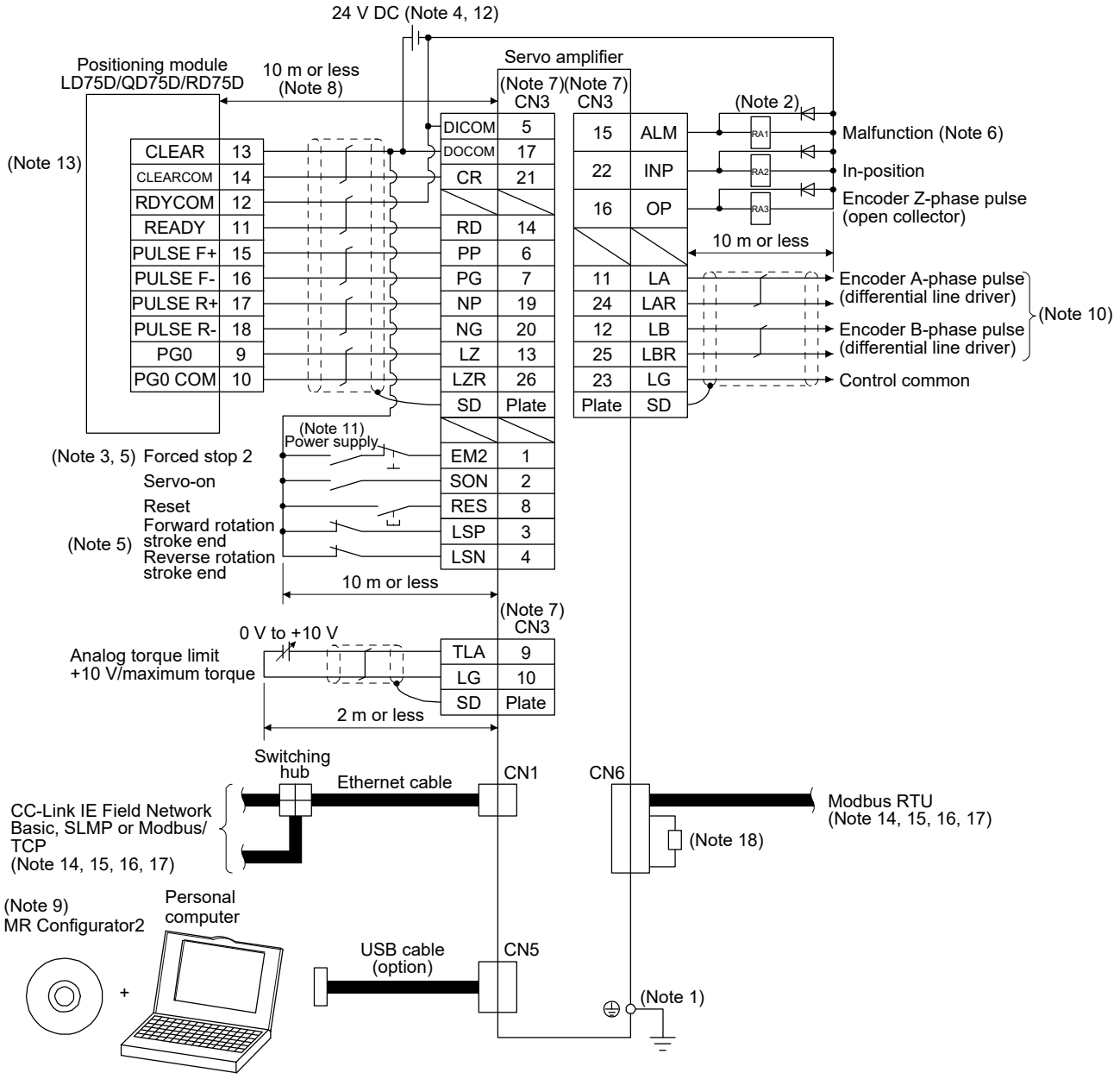


Note
1. To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.
2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will malfunction and will not output signals, disabling EM2 (Forced stop 2) and other protective circuits.
3. The forced stop switch (normally closed contact) must be installed.
4. Supply 24 V DC ± 10% to interfaces from outside. The total current capacity is up to 300 mA. 300 mA is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points. Refer to section 3.9.2 (1) that gives the current value necessary for the interface.
5. When starting operation, always turn on EM2 (Forced stop 2), LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end) (normally closed contact).
6. ALM (Malfunction) turns on in normal alarm-free condition (normally closed contact). When this signal is switched off (at occurrence of an alarm), the output of the programmable controller should be stopped by the sequence program.
7. The pins with the same signal name are connected in the servo amplifier.
8. This length applies to the command pulse train input in the differential line driver type. It is 2 m or less in the open-collector type.
9. Use SW1DNC-MRC2-_. (Refer to section 11.4.)
10. Disconnection of the command cable or noise may cause a position mismatch. To avoid the position mismatch, check the encoder A-phase pulse and encoder B-phase pulse on the controller side.
11. Configure a circuit to turn off EM2 when the power is turned off to prevent an unexpected restart of the servo amplifier.
12. Plus and minus of the power of source interface are the opposite of those of sink interface.
13. CLEAR and CLEARCOM of source interface are interchanged to sink interface.
14. For communication function, refer to the "MR-JE-_C Servo Amplifier Instruction Manual (Network)".
15. When using the absolute position detection system, absolute position data reading can be done by using communication. For absolute position detection system, refer to chapter 12.3.
16. Modbus/TCP can be used with servo amplifiers with software version A3 or later. Modbus RTU can be used with servo amplifiers with software version A4 or later.
17. Ethernet communication (CC-Link IE field network Basic, SLMP and Modbus/TCP) and RS-485 communication (Modbus RTU) are exclusively independent functions. Only the communication function selected in [Pr. PN08] "Select communication function" can be used.
18. If this servo amplifier is the last axis, connect a 150 Ω resistor between DA and DB, and terminate the servo amplifier. For details, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".

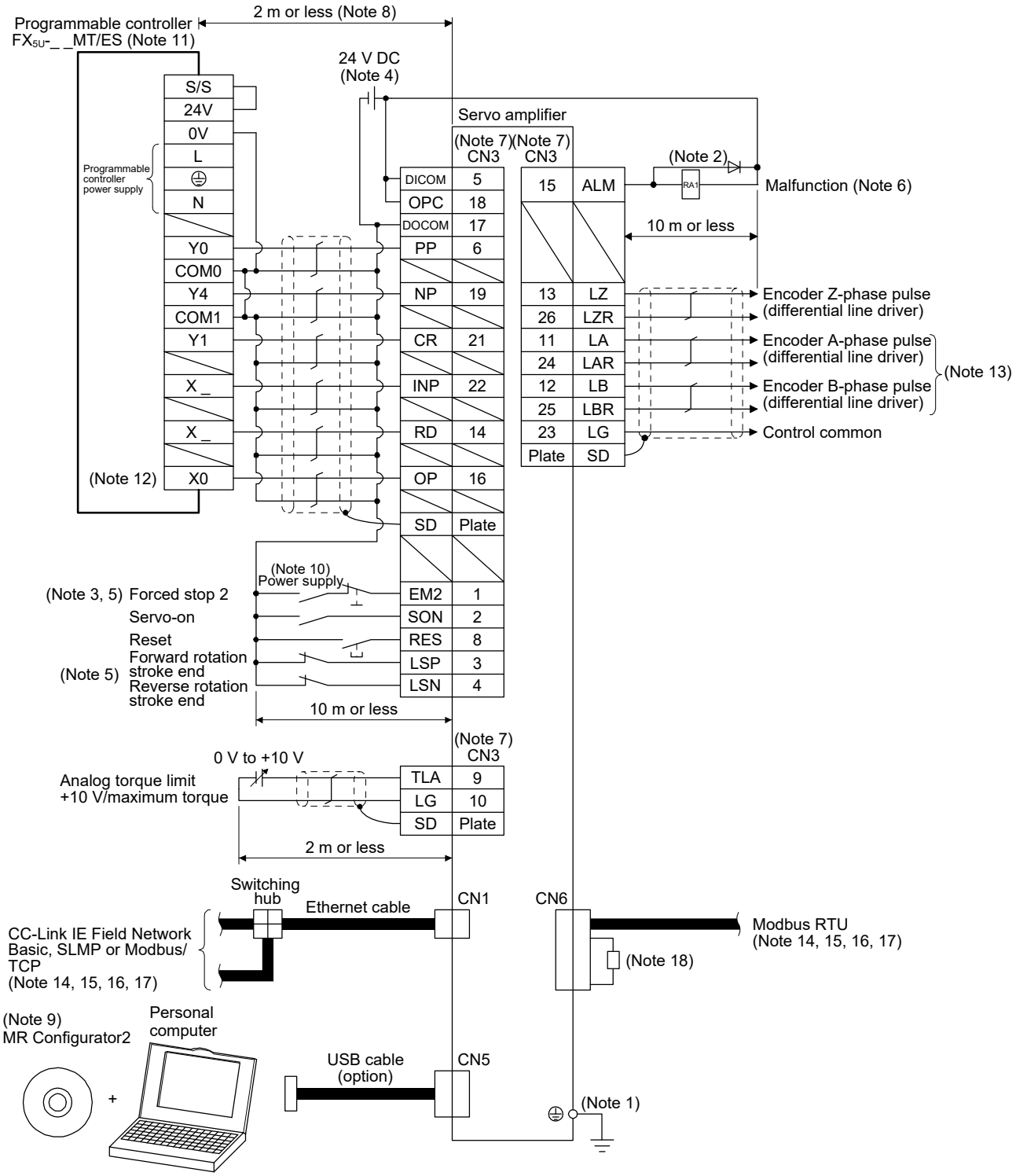
(b) For source I/O interface

POINT

●For notes, refer to (1) (a) in this section.



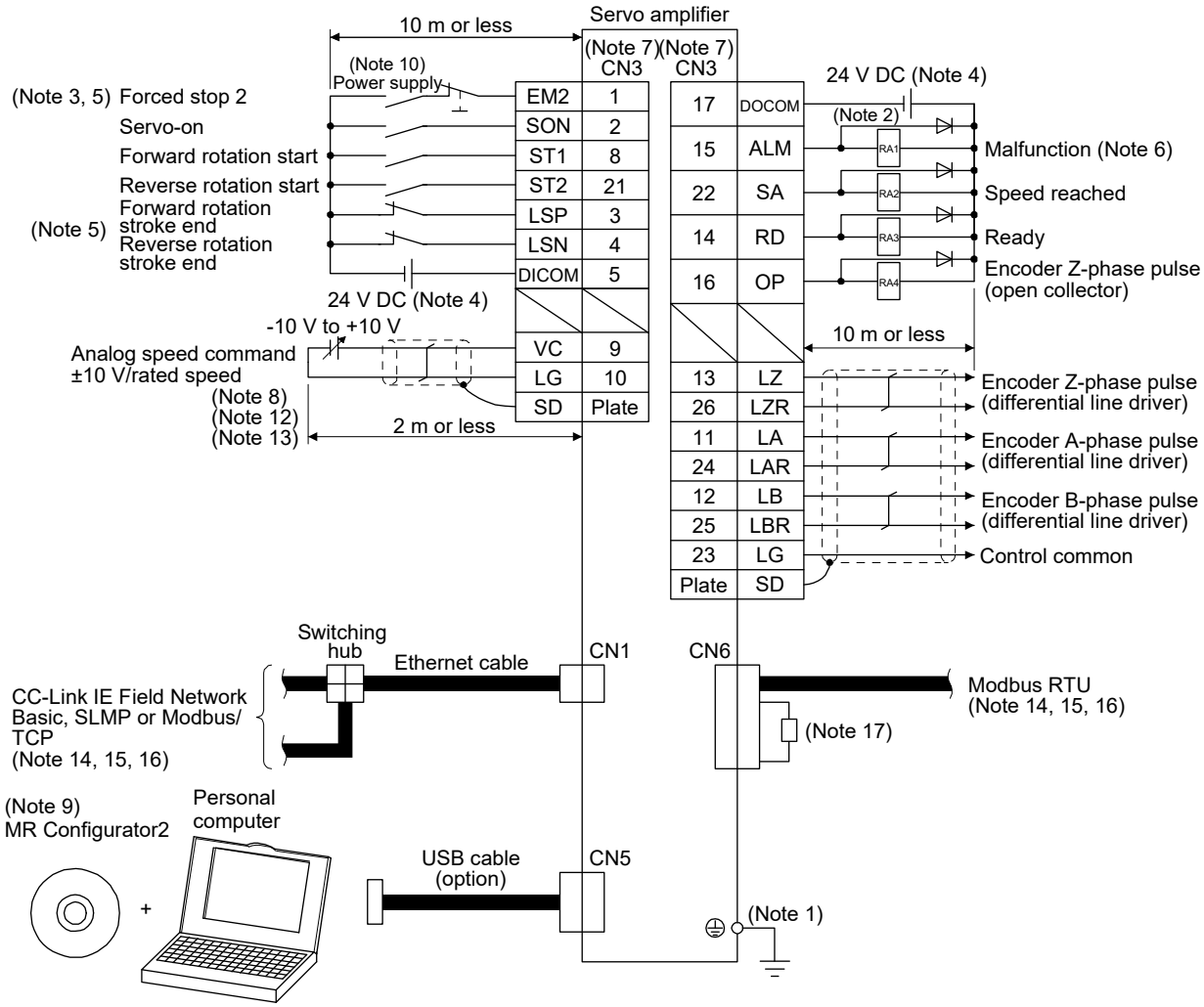
(2) When you use a positioning module FX_{5U}-_ _MT/ES (For sink I/O interface)



Note
1. To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.
2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will malfunction and will not output signals, disabling EM2 (Forced stop 2) and other protective circuits.
3. The forced stop switch (normally closed contact) must be installed.
4. Supply 24 V DC ± 10% to interfaces from outside. The total current capacity is up to 300 mA. 300 mA is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points. Refer to section 3.9.2 (1) that gives the current value necessary for the interface.
5. When starting operation, always turn on EM2 (Forced stop 2), LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end) (normally closed contact).
6. ALM (Malfunction) turns on in normal alarm-free condition (normally closed contact). When this signal is switched off (at occurrence of an alarm), the output of the programmable controller should be stopped by the sequence program.
7. The pins with the same signal name are connected in the servo amplifier.
8. Connect them within 2 m because of open-collector type.
9. Use SW1DNC-MRC2-_. (Refer to section 11.4.)
10. Configure a circuit to turn off EM2 when the power is turned off to prevent an unexpected restart of the servo amplifier.
11. Select the number of I/O points of the programmable controller depending on your system.
12. Select it within X0 to X7.
13. Disconnection of the command cable or noise may cause a position mismatch. To avoid the position mismatch, check the encoder A-phase pulse and encoder B-phase pulse on the controller side.
14. For communication function, refer to the "MR-JE-_C Servo Amplifier Instruction Manual (Network)".
15. When using the absolute position detection system, absolute position data reading can be done by using communication. For absolute position detection system, refer to chapter 12.3.
16. Modbus/TCP can be used with servo amplifiers with software version A3 or later. Modbus RTU can be used with servo amplifiers with software version A4 or later.
17. Ethernet communication (CC-Link IE field network Basic, SLMP and Modbus/TCP) and RS-485 communication (Modbus RTU) are exclusively independent functions. Only the communication function selected in [Pr. PN08] "Select communication function" can be used.
18. If this servo amplifier is the last axis, connect a 150 Ω resistor between DA and DB, and terminate the servo amplifier. For details, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".

3.2.2 Speed control mode

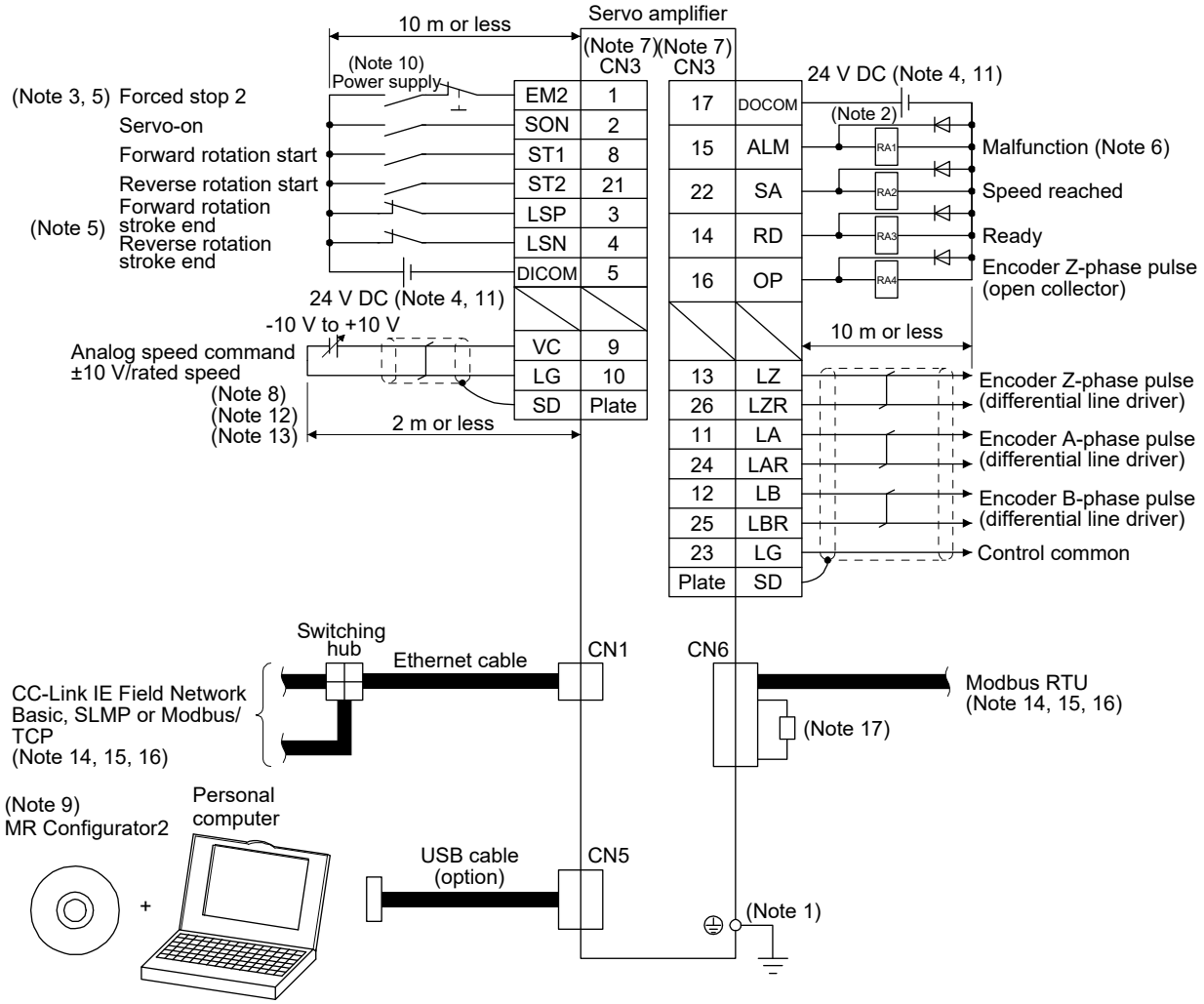
(1) For sink I/O interface



Note
1. To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.
2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will malfunction and will not output signals, disabling EM2 (Forced stop 2) and other protective circuits.
3. The forced stop switch (normally closed contact) must be installed.
4. Supply 24 V DC ± 10% to interfaces from outside. The total current capacity is up to 300 mA. 300 mA is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points. Refer to section 3.9.2 (1) that gives the current value necessary for the interface. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.
5. When starting operation, always turn on EM2 (Forced stop 2), LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end) (normally closed contact).
6. ALM (Malfunction) turns on in normal alarm-free condition (normally closed contact).
7. The pins with the same signal name are connected in the servo amplifier.
8. TLA will be available when TL (External torque limit selection) is enabled with [Pr. PD05], [Pr. PD08], [Pr. PD11], [Pr. PD14], [Pr. PD17], [Pr. PD23] and [Pr. PD26]. (Refer to section 3.6.1 (5).)
9. Use SW1DNC-MRC2-_. (Refer to section 11.4.)
10. Configure a circuit to turn off EM2 when the power is turned off to prevent an unexpected restart of the servo amplifier.
11. Plus and minus of the power of source interface are the opposite of those of sink interface.
12. Analog speed command is available when "VC setting (1 _ _ _)" is selected in [Pr. PC29]. (Refer to [Pr. PC29] in section 5.2)
13. Use [Pr. PA11], [Pr. PA12], and [Pr. PC35] for the torque limit.
14. For communication function, refer to the "MR-JE-_C Servo Amplifier Instruction Manual (Network)".
15. Modbus/TCP can be used with servo amplifiers with software version A3 or later. Modbus RTU can be used with servo amplifiers with software version A4 or later.
16. Ethernet communication (CC-Link IE field network Basic, SLMP and Modbus/TCP) and RS-485 communication (Modbus RTU) are exclusively independent functions. Only the communication function selected in [Pr. PN08] "Select communication function" can be used.
17. If this servo amplifier is the last axis, connect a 150 Ω resistor between DA and DB, and terminate the servo amplifier. For details, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".

(2) For source I/O interface

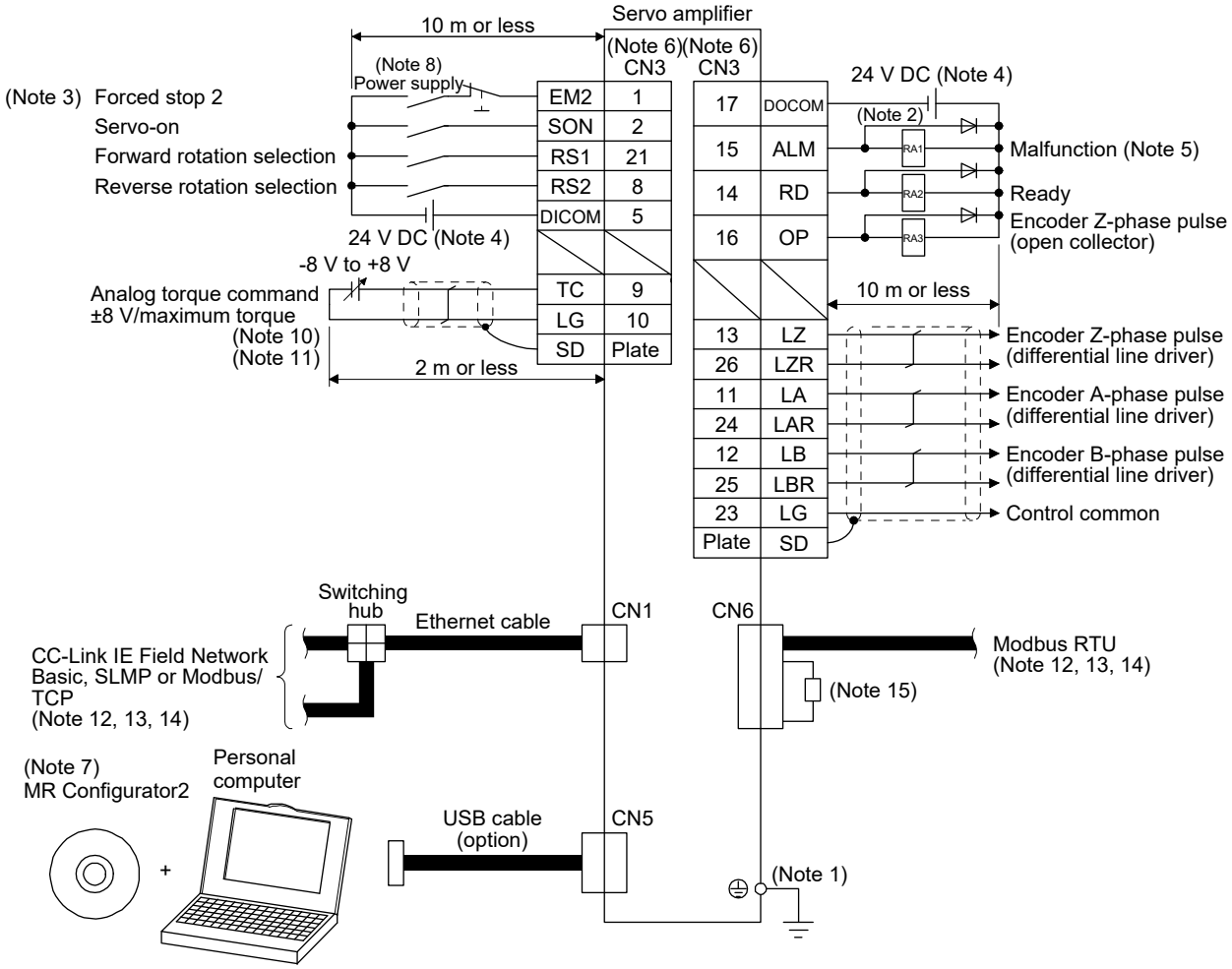
POINT
●For notes, refer to (1) in this section.



3.2.3 Torque control mode

POINT
●EM2 has the same function as EM1 in the torque control mode.

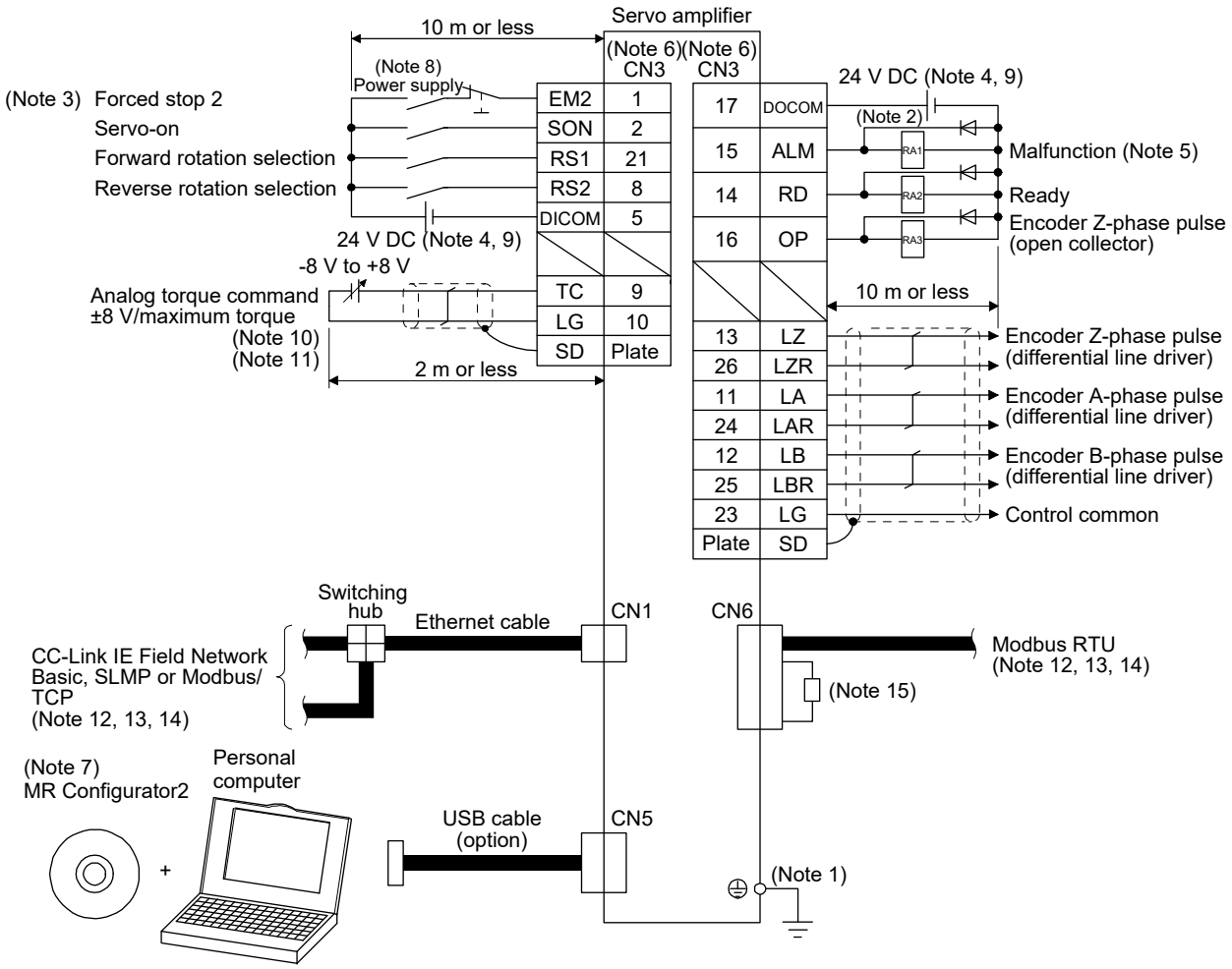
(1) For sink I/O interface



Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.
2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will malfunction and will not output signals, disabling EM2 (Forced stop 2) and other protective circuits.
3. The forced stop switch (normally closed contact) must be installed.
4. Supply 24 V DC ± 10% to interfaces from outside. The total current capacity is up to 300 mA. 300 mA is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points. Refer to section 3.9.2 (1) that gives the current value necessary for the interface. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.
5. ALM (Malfunction) turns on in normal alarm-free condition (normally closed contact).
6. The pins with the same signal name are connected in the servo amplifier.
7. Use SW1DNC-MRC2-_. (Refer to section 11.4.)
8. Configure a circuit to turn off EM2 when the power is turned off to prevent an unexpected restart of the servo amplifier.
9. Plus and minus of the power of source interface are the opposite of those of sink interface.
10. Analog torque command is available when "TC/TLA setting (0 _ _ _)" is selected in [Pr. PC29]. (Refer to [Pr. PC29] in section 5.2)
11. Use [Pr. PC05] to [Pr. PC11] for the speed limit.
12. For communication function, refer to the "MR-JE-_C Servo Amplifier Instruction Manual (Network)".
13. Modbus/TCP can be used with servo amplifiers with software version A3 or later. Modbus RTU can be used with servo amplifiers with software version A4 or later.
14. Ethernet communication (CC-Link IE field network Basic, SLMP and Modbus/TCP) and RS-485 communication (Modbus RTU) are exclusively independent functions. Only the communication function selected in [Pr. PN08] "Select communication function" can be used.
15. If this servo amplifier is the last axis, connect a 150 Ω resistor between DA and DB, and terminate the servo amplifier. For details, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".

(2) For source I/O interface

POINT
●For notes, refer to (1) in this section.



3.3 Explanation of power supply system

3.3.1 Signal explanations

POINT

●For the layout of connector and terminal block, refer to chapter 9 DIMENSIONS.

<table>
<tr><th>Symbol</th><th>Connection target (application)</th><th>Description</th></tr>
<tr><td>L1/L2/L3</td><td>Power supply</td><td>Supply the following power to L1/L2/L3. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open.
For 1-phase 200 V AC to 240 V AC of MR-JE-200C, connect the power supply to L1 and L2. Leave L3 open.
<table>
<tr><th>Servo amplifier
Power supply</th><th>MR-JE-10C to MR-JE-100C</th></tr>
<tr><td>3-phase 200 V AC to 240 V AC,
50 Hz/60 Hz</td><td>L1/L2/L3</td></tr>
<tr><td>1-phase 200 V AC to 240 V AC,
50 Hz/60 Hz</td><td>L1/L3</td></tr>
</table>
</td></tr>
<tr><td>P+/C/D</td><td>Regenerative option</td><td>1) MR-JE-100C or less
MR-JE-10C to MR-JE-100C do not have D.
When using a servo amplifier built-in regenerative resistor, connect P+ and C. (factory-wired)
MR-JE-10C and MR-JE-20C do not have a built-in regenerative resistor.
When using a regenerative option, disconnect wires of P+ and C for the built-in regenerative resistor. And then connect wires of the regenerative option to P+ and C.
2) MR-JE-200C or more
When using a servo amplifier built-in regenerative resistor, connect P+ and D. (factory-wired)
When using a regenerative option, disconnect P+ and D, and connect the regenerative option to P+ and C.
Refer to section 11.2 for details.</td></tr>
<tr><td>U/V/W</td><td>Servo motor power</td><td>Connect them to the servo motor power supply (U/V/W). Connect the servo amplifier power output (U/V/W) to the servo motor power input (U/V/W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.</td></tr>
<tr><td>⏚</td><td>Protective earth (PE)</td><td>Connect it to the grounding terminal of the servo motor and to the protective earth (PE) of the cabinet for grounding.</td></tr>
</table>

3.3.2 Power-on sequence

POINT
● The output signal, etc. may be unstable at power-on.

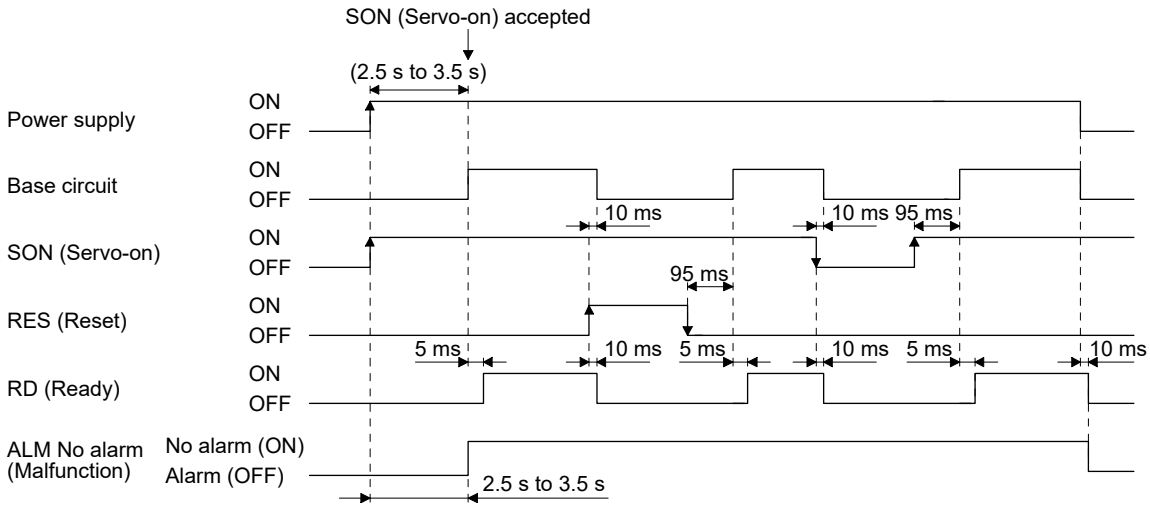
(1) Power-on procedure

1) Always wire the power supply as shown in above section 3.1 using the magnetic contactor with the power supply (L1/L2/L3). Configure an external sequence to switch off the magnetic contactor as soon as an alarm occurs.

2) The servo amplifier receives the SON (Servo-on) 2.5 s to 3.5 s after the power supply is switched on. Therefore, when SON (Servo-on) is switched on simultaneously with the power supply, the base circuit will switch on in about 2.5 s to 3.5 s, and the RD (Ready) will switch on in further about 5 ms, making the servo amplifier ready to operate. (Refer to (2) in this section.)

3) When RES (Reset) is switched on, the base circuit is shut off and the servo motor shaft coasts.

(2) Timing chart



3.3.3 Wiring CNP1

POINT
●For the wire sizes used for wiring, refer to section 11.6. ●When wiring, remove the power connectors from the servo amplifier. ●Insert only one wire or ferrule to each wire insertion hole.

To wire to CNP1, use servo amplifier power connectors packed with the amplifier or optional connectors (refer to section 11.1.1).

(1) Connector

(a) MR-JE-10C to MR-JE-100C

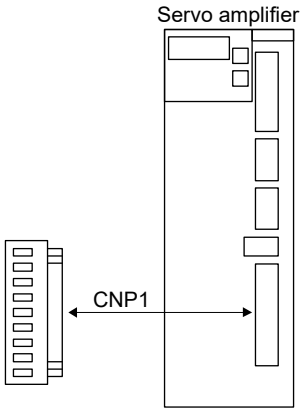


Table 3.1 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire		Stripped length [mm]	Open tool	Manufacturer
		Size	Insulator OD			
CNP1	09JFAT-SAXGDK-H5.0	AWG 18 to 14	3.9 mm or shorter	9	J-FAT-OT (N) or J-FAT-OT	JST

(b) MR-JE-200C/MR-JE-300C

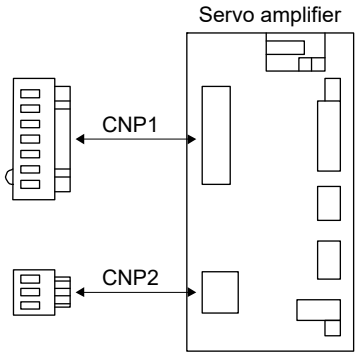


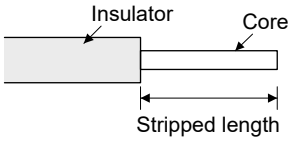
Table 3.2 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire		Stripped length [mm]	Open tool	Manufacturer
		Size	Insulator OD			
CNP1	06(7-4)JFAT-SAXGFK-XL	AWG 16 to 10	4.7 mm or shorter	11.5	J-FAT-OT-EXL	JST
CNP2	03JFAT-SAXGFK-XL					

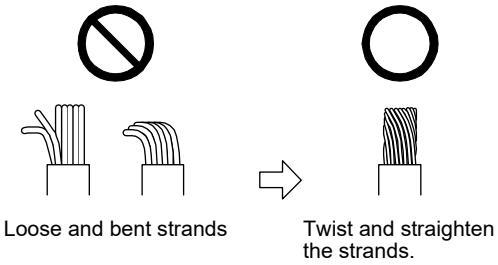
(2) Cable connection procedure

(a) Fabrication on cable insulator

Refer to table 3.1 for stripped length of cable insulator. The appropriate stripped length of cables depends on their type, etc. Set the length considering their status.



Twist strands lightly and straighten them as follows.



You can also use a ferrule to connect with the connectors. When you use a ferrule, use the following ferrules and crimp terminal.

Servo amplifier	Wire size	Ferrule model (Phoenix Contact)		Crimp terminal (Phoenix Contact)
		For one	For two	
MR-JE-10C to MR-JE-100C	AWG 16	AI1.5-10BK	AI-TWIN2×1.5-10BK	CRIMPFOX-ZA3
	AWG 14	AI2.5-10BU		
MR-JE-200C to MR-JE-300C	AWG 16	AI1.5-10BK	AI-TWIN2×1.5-10BK	
	AWG 14	AI2.5-10BU	AI-TWIN2×2.5-10BU	
	AWG 12	AI4-10GY		

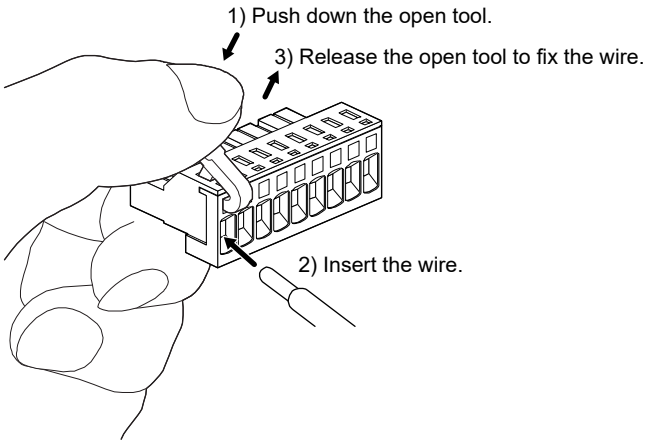
(b) Inserting wire

Insert only one wire or ferrule to each wire insertion hole.

Insert the open tool as follows and push down it to open the spring. While the open tool is pushed down, insert the stripped wire into the wire insertion hole. Check the wire insertion depth, and make sure that the cable insulator will not be caught by the spring and that the conductive part of the stripped wire will not be exposed.

Release the open tool to fix the wire. Pull the wire lightly to confirm that the wire is surely connected. In addition, make sure that no conductor wire sticks out of the connector.

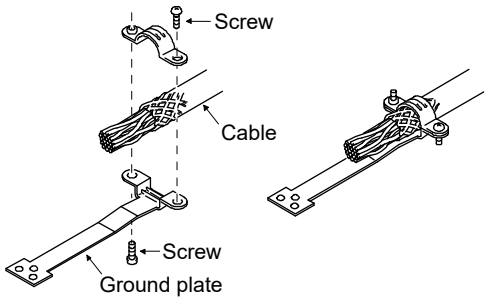
The following shows a connection example of the CNP1 connector.



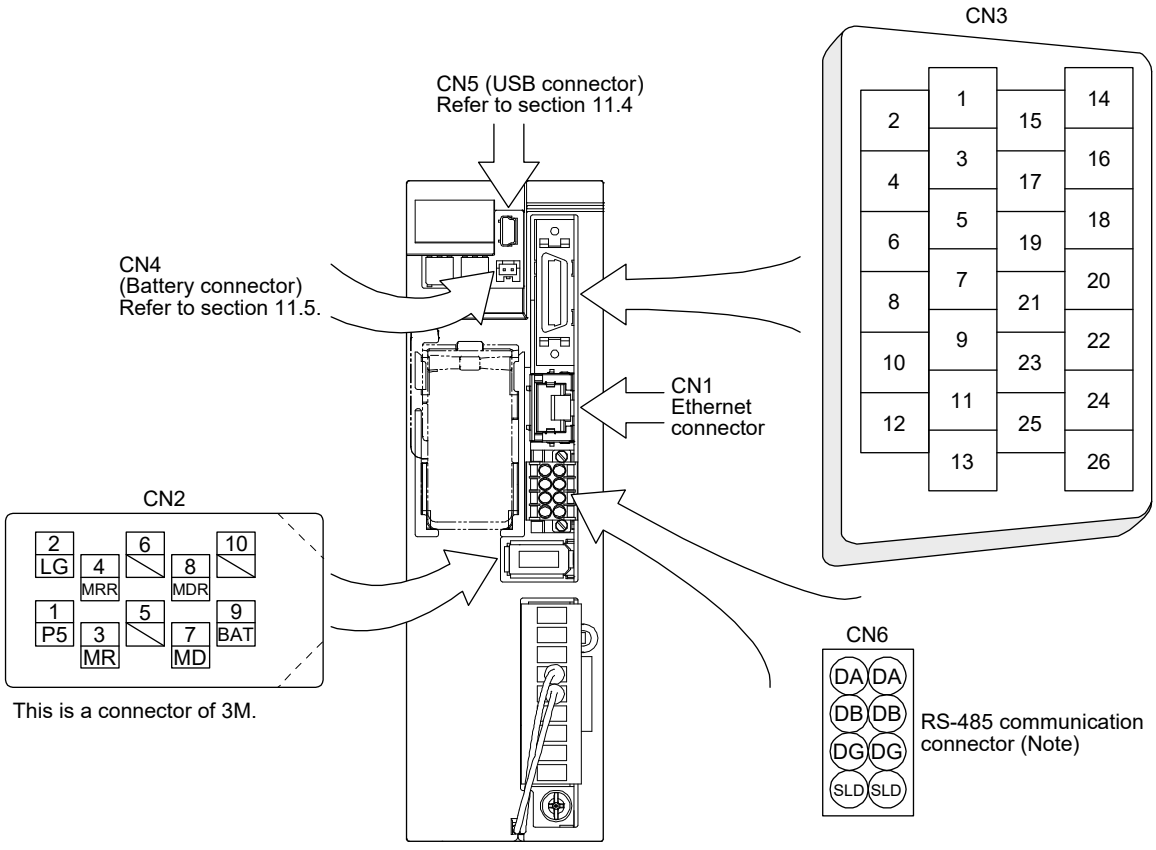
3.4 Connectors and pin assignment

POINT

- The pin assignment of the connectors is as viewed from the cable connector wiring section.
- For the CN3 connector, securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.



The servo amplifier front view shown is that of the MR-JE-40C or less. Refer to chapter 9 DIMENSIONS for the appearances and connector layouts of the other servo amplifiers.



The frames of the CN2 and CN3 connectors are connected to the protective earth terminal in the servo amplifier.

Note. RS-485 communication function can be used only on Modbus RTU.

The device assignment of the CN3 connector pins changes depending on the control mode. For the pins which are given parameters in the related parameter column, their devices can be changed using those parameters.

Pin No.	I/O (Note 1)	I/O signals in control modes (Note 2)						Related parameter
		P	P/S	S	S/T	T	T/P	
1	I	EM2	EM2	EM2	EM2	EM2	EM2	
2	I	SON	SON	SON	SON	SON	SON	PD05/PD06
3	I	LSP	LSP	LSP	LSP	LSP	LSP	PD08/PD09
4	I	LSN	LSN	LSN	LSN	LSN	LSN	PD11/PD12
5		DICOM	DICOM	DICOM	DICOM	DICOM	DICOM	
6	I	PP	PP/-	(Note 5)	(Note 5)	(Note 5)	-/PP	PD23/PD24
7	I	PG	PG/-				-/PG	
8	I	RES	RES/ST1	ST1	ST1/RS2	RS2	RS2/RES	PD14/PD15
9	I	TLA	TLA/TLA (Note 3)	TLA (Note 3)	TLA/TC (Note 3, 4)	TC (Note 4)	TC/TLA (Note 4)	PC29
		-	-/VC (Note 6)	VC (Note 6)				
10		LG	LG	LG	LG	LG	LG	
11	O	LA	LA	LA	LA	LA	LA	
12	O	LB	LB	LB	LB	LB	LB	
13	O	LZ	LZ	LZ	LZ	LZ	LZ	
14	O	RD	RD	RD	RD	RD	RD	PD29
15	O	ALM	ALM	ALM	ALM	ALM	ALM	PD30
16	O	OP	OP	OP	OP	OP	OP	PD31/PD38
17		DOCOM	DOCOM	DOCOM	DOCOM	DOCOM	DOCOM	
18		OPC	OPC/-				-/OPC	
19	I	NP	NP/-	(Note 5)	(Note 5)	(Note 5)	-/NP	PD26/PD27
20	I	NG	NG/-				-/NG	
21	I	CR	CR/ST2	ST2	ST2/RS1	RS1	RS1/CR	PD17/PD18
22	O	INP	INP/SA	SA	SA/-		-/INP	PD32
23		LG	LG	LG	LG	LG	LG	
24	O	LAR	LAR	LAR	LAR	LAR	LAR	
25	O	LBR	LBR	LBR	LBR	LBR	LBR	
26	O	LZR	LZR	LZR	LZR	LZR	LZR	

Note 1. I: input signal, O: output signal

2. P: position control mode, S: speed control mode, T: torque control mode, P/S: position/speed control switching mode, S/T: speed/torque control switching mode, T/P: torque/position control switching mode
3. Set the speed command in speed control mode with [Pr. PC05] to [Pr. PC11]
4. Set the speed limit value in torque control mode with [Pr. PC05] to [Pr. PC11]
5. Input devices are not assigned by default. When using CN3-19 pin as the input device of sink interface, assign the device with [Pr. PD23], [Pr. PD24], [Pr. PD26], and [Pr. PD27] as necessary. In addition, supply + of 24 V DC to CN3-18 pin (OPC: power input for open-collector sink interface).
6. Set [Pr. PC29] to "VC setting (1 _ _ _)". (Refer to [Pr. PC29] in section 5.2)

3.5 Signal (device) explanations

For the I/O interfaces (symbols in I/O division column in the table), refer to section 3.9.2. In the control mode field of the table

P: position control mode, S: speed control mode, T: torque control mode Torque control mode

○: devices used with initial setting status, △: devices used by setting [Pr. PA04], [Pr. PD05], [Pr. PD06], [Pr. PD08], [Pr. PD09], [Pr. PD11], [Pr. PD12], [Pr. PD14], [Pr. PD15], [Pr. PD17], [Pr. PD18], [Pr. PD23], [Pr. PD24], [Pr. PD26] and [Pr. PD27]

The pin numbers in the connector pin No. column are those in the initial status.

(1) I/O device

(a) Input device

<table>
<tr><th rowspan="2">Device</th><th rowspan="2">Symbol</th><th rowspan="2">Connector pin No.</th><th rowspan="2">Function and application</th><th rowspan="2">I/O division</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>Forced stop 2</td><td>EM2</td><td>CN3-1</td><td>Turn off EM2 (open between commons) to decelerate the servo motor to a stop with commands.
Turn EM2 on (short between commons) in the forced stop state to reset that state.
The following shows the setting of [Pr. PA04].
<table><tr><th rowspan="2">[Pr. PA04] setting</th><th rowspan="2">EM2/EM1</th><th colspan="2">Deceleration method</th></tr><tr><th>EM2 or EM1 is off</th><th>Alarm occurred</th></tr><tr><td>0 _ _ _</td><td>EM1</td><td>MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.</td><td>MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.</td></tr><tr><td>2 _ _ _</td><td>EM2</td><td>MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.</td><td>MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.</td></tr></table>EM2 and EM1 are mutually exclusive.
EM2 has the same function as EM1 in the torque control mode.</td><td>DI-1</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>Forced stop 1</td><td>EM1</td><td>(CN3-1)</td><td>When using EM1, set [Pr. PA04] to "0 _ _ _" to enable EM1.
When EM1 is turned off (open between commons), the base circuit shuts off, and the dynamic brake operates to decelerate the servo motor to a stop.
The forced stop will be reset when EM1 is turned on (short between commons).</td><td>DI-1</td><td>△</td><td>△</td><td>△</td></tr>
<tr><td>Servo-on</td><td>SON</td><td>CN3-2</td><td>Turn SON on to power on the base circuit and make the servo amplifier ready to operate. (servo-on status)
Turn it off to shut off the base circuit and coast the servo motor.
Set "_ _ _ 4" in [Pr. PD01] to switch this signal on (keep terminals connected) automatically in the servo amplifier.</td><td>DI-1</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>Reset</td><td>RES</td><td>CN3-8</td><td>Turn on RES for more than 50 ms to reset the alarm.
Some alarms cannot be deactivated by RES (Reset). Refer to chapter 8.
Turning RES on in an alarm-free status shuts off the base circuit. The base circuit is not shut off when "_ _ 1 _" is set in [Pr. PD35].
This device is not designed to make a stop. Do not turn it on during operation.</td><td>DI-1</td><td>○</td><td>○</td><td>○</td></tr>
</table>

<table>
<tr><th rowspan="2">Device</th><th rowspan="2">Symbol</th><th rowspan="2">Connector pin No.</th><th rowspan="2">Function and application</th><th rowspan="2">I/O division</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>Forward rotation stroke end</td><td>LSP</td><td>CN3-3</td><td rowspan="2">To start operation, turn on LSP and LSN. Turn it off to bring the motor to a sudden stop and make it servo-locked.
Setting [Pr. PD35] to "_ _ _ 1" will enable a slow stop.

<table><tr><th colspan="2">(Note) Input device</th><th colspan="2">Operation</th></tr><tr><th>LSP</th><th>LSN</th><th>CCW direction</th><th>CW direction</th></tr><tr><td>1</td><td>1</td><td>○</td><td>○</td></tr><tr><td>0</td><td>1</td><td></td><td>○</td></tr><tr><td>1</td><td>0</td><td>○</td><td></td></tr><tr><td>0</td><td>0</td><td></td><td></td></tr></table>Note. 0: Off
1: On

Set [Pr. PD01] as indicated below to switch on the signals (keep terminals connected) automatically in the servo amplifier.

<table><tr><th rowspan="2">[Pr. PD01]</th><th colspan="2">Status</th></tr><tr><th>LSP</th><th>LSN</th></tr><tr><td>_ 4 _ _</td><td>Automatic on</td><td></td></tr><tr><td>_ 8 _ _</td><td></td><td>Automatic on</td></tr><tr><td>_ C _ _</td><td>Automatic on</td><td>Automatic on</td></tr></table>When LSP or LSN is turned off, [AL. 99 Stroke limit warning] occurs, and WNG (Warning) turns on. When using WNG, enable it by setting [Pr. PD29] to [Pr. PD32].</td><td>DI-1</td><td>○</td><td>○</td><td></td></tr>
<tr><td>Reverse rotation stroke end</td><td>LSN</td><td>CN3-4</td></tr>
<tr><td>External torque limit selection</td><td>TL</td><td></td><td>Turning off TL will enable [Pr. PA11 Forward torque limit] and [Pr. PA12 Reverse torque limit], and turning on it will enable TLA (Analog torque limit). For details, refer to section 3.6.1 (5).</td><td>DI-1</td><td>△</td><td>△</td><td></td></tr>
<tr><td>Internal torque limit selection</td><td>TL1</td><td></td><td>To select [Pr. PC35 Internal torque limit 2], enable TL1 with [Pr. PD05], [Pr. PD08], [Pr. PD11], [Pr. PD14], [Pr. PD17], [Pr. PD23] and [Pr. PD26]. For details, refer to section 3.6.1 (5).</td><td>DI-1</td><td>△</td><td>△</td><td></td></tr>
<tr><td>Forward rotation start</td><td>ST1</td><td rowspan="2"></td><td rowspan="2">This is used to start the servo motor.
The following shows the directions.

<table><tr><th colspan="2">(Note) Input device</th><th rowspan="2">Servo motor starting direction</th></tr><tr><th>ST2</th><th>ST1</th></tr><tr><td>0</td><td>0</td><td>Stop (servo-lock)</td></tr><tr><td>0</td><td>1</td><td>CCW</td></tr><tr><td>1</td><td>0</td><td>CW</td></tr><tr><td>1</td><td>1</td><td>Stop (servo-lock)</td></tr></table>Note. 0: Off
1: On

If both ST1 and ST2 are switched on or off during operation, the servo motor will be decelerated to a stop according to the [Pr. PC02] setting and servo-locked.
When "_ _ _ 1" is set in [Pr. PC23], the servo motor is not servo-locked after deceleration to a stop.</td><td>DI-1</td><td></td><td>△</td><td></td></tr>
<tr><td>Reverse rotation start</td><td>ST2</td></tr>
</table>

<table>
<tr><th rowspan="2">Device</th><th rowspan="2">Symbol</th><th rowspan="2">Connector pin No.</th><th rowspan="2">Function and application</th><th rowspan="2">I/O division</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>Forward rotation selection</td><td>RS1</td><td></td><td rowspan="3">Select a servo motor torque generation directions.
The following shows the torque generation directions.

<table><tr><th colspan="2">(Note) Input device</th><th rowspan="2">Torque generation direction</th></tr><tr><th>RS2</th><th>RS1</th></tr><tr><td>0</td><td>0</td><td>Torque is not generated.</td></tr><tr><td>0</td><td>1</td><td>Forward rotation in power running mode/reverse rotation in regenerative mode</td></tr><tr><td>1</td><td>0</td><td>Reverse rotation in power running mode/forward rotation in regenerative mode</td></tr><tr><td>1</td><td>1</td><td>Torque is not generated.</td></tr></table>Note. 0: Off
1: On</td><td rowspan="3">DI-1</td><td></td><td></td><td>△</td></tr>
<tr><td>Reverse rotation selection</td><td>RS2</td><td></td><td></td><td></td></tr>
<tr><td>Speed selection 1</td><td>SP1</td><td></td><td></td><td>△</td><td>△</td></tr>
<tr><td>Speed selection 2</td><td>SP2</td><td></td><td>1. For speed control mode
Select the command speed for operation.

<table><tr><th colspan="3">Input device (Note 1)</th><th rowspan="2">Speed command</th></tr><tr><th>SP3</th><th>SP2</th><th>SP1</th></tr><tr><td>0</td><td>0</td><td>0</td><td>Pr. PC05 Internal speed command 1/
VC (Analog speed command) (Note 2)</td></tr><tr><td>0</td><td>0</td><td>1</td><td>Pr. PC05 Internal speed command 1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>Pr. PC06 Internal speed command 2</td></tr><tr><td>0</td><td>1</td><td>1</td><td>Pr. PC07 Internal speed command 3</td></tr><tr><td>1</td><td>0</td><td>0</td><td>Pr. PC08 Internal speed command 4</td></tr><tr><td>1</td><td>0</td><td>1</td><td>Pr. PC09 Internal speed command 5</td></tr><tr><td>1</td><td>1</td><td>0</td><td>Pr. PC10 Internal speed command 6</td></tr><tr><td>1</td><td>1</td><td>1</td><td>Pr. PC11 Internal speed command 7</td></tr></table>Note 1. 0: Off
1: On
2. When [Pr. PC29] is set to "TC/TLA setting (0 _ _ _)", the value in [Pr. PC05 Internal speed command 1] is applied.
2. For the torque control mode
Select the limited speed for operation.

<table><tr><th colspan="3">(Note) Input device</th><th rowspan="2">Speed limit</th></tr><tr><th>SP3</th><th>SP2</th><th>SP1</th></tr><tr><td>0</td><td>0</td><td>0</td><td>Pr. PC05 Internal speed limit 1</td></tr><tr><td>0</td><td>0</td><td>1</td><td>Pr. PC05 Internal speed limit 1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>Pr. PC06 Internal speed limit 2</td></tr><tr><td>0</td><td>1</td><td>1</td><td>Pr. PC07 Internal speed limit 3</td></tr><tr><td>1</td><td>0</td><td>0</td><td>Pr. PC08 Internal speed limit 4</td></tr><tr><td>1</td><td>0</td><td>1</td><td>Pr. PC09 Internal speed limit 5</td></tr><tr><td>1</td><td>1</td><td>0</td><td>Pr. PC10 Internal speed limit 6</td></tr><tr><td>1</td><td>1</td><td>1</td><td>Pr. PC11 Internal speed limit 7</td></tr></table>Note. 0: Off
1: On</td><td>DI-1</td><td></td><td>△</td><td>△</td></tr>
<tr><td>Speed selection 3</td><td>SP3</td><td></td><td>DI-1</td><td></td><td>△</td><td>△</td></tr>
</table>

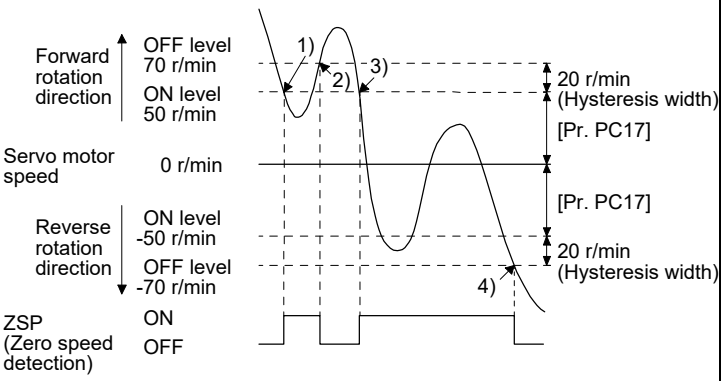
<table>
<tr><th rowspan="2">Device</th><th rowspan="2">Symbol</th><th rowspan="2">Connector pin No.</th><th rowspan="2">Function and application</th><th rowspan="2">I/O division</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>Proportion control</td><td>PC</td><td></td><td>Turn PC on to switch the speed amplifier from the proportional integral type to the proportional type.
If the servo motor at a stop is rotated even one pulse due to any external factor, it generates torque to compensate for a position shift. When the servo motor shaft is to be locked mechanically after positioning completion (stop), switching on the PC (Proportion control) upon positioning completion will suppress the unnecessary torque generated to compensate for a position shift.
When the shaft is to be locked for a long time, switch on the PC (Proportion control) and TL (External torque limit selection) at the same time to make the torque less than the rated by TLA (Analog torque limit).
Do not use PC (Proportional control) in the torque control. When PC (Proportional control) is used in the torque control, operation may be performed at a speed exceeding the speed limit value.</td><td>DI-1</td><td>△</td><td>△</td><td></td></tr>
<tr><td>Clear</td><td>CR</td><td>CN3-21</td><td>Turn CR on to clear the position control counter droop pulses on its leading edge. The pulse width should be 10 ms or longer.
The delay amount set in [Pr. PB03 Position command acceleration/deceleration time constant] is also cleared. When "_ _ _ 1" is set to [Pr. PD37], the pulses are always cleared while CR is on.</td><td>DI-1</td><td>○</td><td></td><td></td></tr>
<tr><td>Electronic gear selection 1</td><td>CM1</td><td></td><td rowspan="2">The combination of CM1 and CM2 enables you to select four different electronic gear numerators set in the parameters.
<table><tr><th colspan="2">(Note) Input device</th><th rowspan="2">Electronic gear numerator</th></tr><tr><th>CM2</th><th>CM1</th></tr><tr><td>0</td><td>0</td><td>Pr. PA06</td></tr><tr><td>0</td><td>1</td><td>Pr. PC32</td></tr><tr><td>1</td><td>0</td><td>Pr. PC33</td></tr><tr><td>1</td><td>1</td><td>Pr. PC34</td></tr></table>Note. 0: Off
1: On</td><td>DI-1</td><td>△</td><td></td><td></td></tr>
<tr><td>Electronic gear selection 2</td><td>CM2</td><td></td><td>DI-1</td><td>△</td><td></td><td></td></tr>
<tr><td>Gain switching</td><td>CDP</td><td></td><td>Turn on CDP to use the values of [Pr. PB29] to [Pr. PB36] and [Pr. PB56] to [Pr. PB60] as the load to motor inertia ratio and gain values.</td><td>DI-1</td><td>△</td><td>△</td><td>△</td></tr>
</table>

<table>
<tr><th rowspan="2">Device</th><th rowspan="2">Symbol</th><th rowspan="2">Connector pin No.</th><th rowspan="2">Function and application</th><th rowspan="2">I/O division</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>Control switching</td><td>LOP</td><td></td><td>«Position/speed control switching mode»
This is used to select the control mode in the position/speed control switching mode.
<table><tr><th>(Note) LOP</th><th>Control mode</th></tr><tr><td>0</td><td>Position</td></tr><tr><td>1</td><td>Speed</td></tr></table>Note. 0: Off
1: On

«Speed/torque control switch mode»
This is used to select the control mode in the speed/torque control switching mode.
<table><tr><th>(Note) LOP</th><th>Control mode</th></tr><tr><td>0</td><td>Speed</td></tr><tr><td>1</td><td>Torque</td></tr></table>Note. 0: Off
1: On

«Torque/position control switch mode»
This is used to select the control mode in the torque/position control switching mode.
<table><tr><th>(Note) LOP</th><th>Control mode</th></tr><tr><td>0</td><td>Torque</td></tr><tr><td>1</td><td>Position</td></tr></table>Note. 0: Off
1: On</td><td>DI-1</td><td colspan="3">Refer to Function and application.</td></tr>
<tr><td>Second acceleration/ deceleration selection</td><td>STAB2</td><td></td><td>The device allows selection of the acceleration/deceleration time constants at servo motor rotation in the speed control mode or torque control mode. The s-pattern acceleration/deceleration time constant is always uniform.
<table><tr><th>(Note) STAB2</th><th>Acceleration/deceleration time constant</th></tr><tr><td>0</td><td>Pr. PC01 Acceleration time constant
Pr. PC02 Deceleration time constant</td></tr><tr><td>1</td><td>Pr. PC30 Acceleration time constant 2
Pr. PC31 Deceleration time constant 2</td></tr></table>Note. 0: Off
1: On</td><td>DI-1</td><td></td><td>△</td><td>△</td></tr>
</table>

(b) Output device

Device	Symbol	Connector pin No.	Function and application	I/O division	Control mode		
					P	S	T
Malfunction	ALM	CN3-15	When an alarm occurs, ALM will turn off. When an alarm does not occur, ALM will turn on after 2.5 s to 3.5 s after power-on. When [Pr. PD39] is "_ _ 1 _", an alarming or warning will turn off ALM.	DO-1	○	○	○
Ready	RD	CN3-14	Enabling servo-on to make the servo amplifier ready to operate will turn on RD.	DO-1	○	○	○
In-position	INP	CN3-22	When the number of droop pulses is in the preset in-position range, INP will turn on. The in-position range can be changed using [Pr. PA10]. When the in-position range is increased, INP may be on during low-speed rotation. INP turns on when servo-on turns on.	DO-1	○		
Speed reached	SA		When the servo motor speed reaches the following range, SA will turn on. Set speed ± ((Set speed × 0.05) + 20) r/min When the preset speed is 20 r/min or less, SA always turns on. SA does not turn on even when the SON (Servo-on) is turned off or the servo motor speed by the external force reaches the preset speed while both ST1 (Forward rotation start) and ST2 (reverse rotation start) are off.	DO-1		○	
Limiting speed	VLC		VLC turns on when speed reaches a value limited with any of [Pr. PC05 Internal speed limit 1] to [Pr. PC11 Internal speed limit 7]. This turns off when SON (Servo-on) turns off.	DO-1			△
Limiting torque	TLC		TLC turns on when a generated torque reaches a value set with any of [Pr. PA11 Forward torque limit], [Pr. PA12 Reverse torque limit], or TLA (Analog torque limit).	DO-1	△	△	
Zero speed detection	ZSP	CN3-16	ZSP turns on when the servo motor speed is zero speed (50 r/min) or less. Zero speed can be changed with [Pr. PC17].  ZSP will turn on when the servo motor is decelerated to 50 r/min (at 1)), and will turn off when the servo motor is accelerated to 70 r/min again (at 2)). ZSP will turn on when the servo motor is decelerated again to 50 r/min (at 3)), and will turn off when the servo motor speed has reached -70 r/min (at 4)). The range from the point when the servo motor speed has reached on level, and ZSP turns on, to the point when it is accelerated again and has reached off level is called hysteresis width. Hysteresis width is 20 r/min for this servo amplifier.	DO-1	○	○	○
Electromagnetic brake interlock	MBR		When using the device, set operation delay time of the electromagnetic brake in [Pr. PC16]. When a servo-off status or alarm occurs, MBR will turn off.	DO-1	△	△	△
Warning	WNG		When warning has occurred, WNG turns on. When a warning is not occurring, WNG will turn off in 2.5 s to 3.5 s after power-on.	DO-1	△	△	△
Battery warning	BWNG		BWNG turns on when [AL. 92 Battery cable disconnection warning] or [AL. 9F Battery warning] has occurred. When the battery warning is not occurring, BWNG will turn off in 2.5 s to 3.5 s after power-on.	DO-1	△		

Device	Symbol	Connector pin No.	Function and application	I/O division	Control mode		
					P	S	T
Alarm code	ACD0	(CN3-14)	To use these signals, set " _ _ _ 1" in [Pr. PD39]. This signal is outputted when an alarm occurs. When an alarm is not occurring, respective ordinary signals are outputted. For details of the alarm codes, refer to chapter 8. When you select alarm code output while MBR or ALM is selected for CN3-14, CN3-16, or CN3-22 pin, [AL. 37 Parameter error] will occur.	DO-1	△	△	△
	ACD1	(CN3-16)					
	ACD2	(CN3-22)					
Variable gain selection	CDPS		CDPS turns on during gain switching.	DO-1	△	△	△
Absolute position undetermined	ABSV		ABSV turns on when the absolute position is undetermined. The device cannot be used in the speed control mode and torque control mode.	DO-1	△		
During tough drive	MTTR		When a tough drive is enabled in [Pr. PA20], activating the instantaneous power failure tough drive will turn on MTTR.	DO-1	△	△	△

(2) Input signal

Device	Symbol	Connector pin No.	Function and application	I/O division	Control mode		
					P	S	T
Analog torque limit	TLA	CN3-9	To use these signals, set TLA to enabled (0 _ _ _) in [Pr. PC29]. To use the signal, enable TL (External torque limit selection) with [Pr. PD05], [Pr. PD08], [Pr. PD11], [Pr. PD14], [Pr. PD17], [Pr. PD23] and [Pr. PD26]. When TLA is enabled, torque is limited in the full servo motor output torque range. Apply 0 V to +10 V DC between TLA and LG. Connect the positive terminal of the power supply to TLA. The maximum torque is generated at +10 V. (Refer to section 3.6.1 (5).) If a value equal to or larger than the maximum torque is inputted to TLA, the value is clamped at the maximum torque. Resolution: 10 bits	Analog input	△	△	
Analog torque command	TC		To use these signals, set TC to enabled (0 _ _ _) in [Pr. PC29]. This is used to control torque in the full servo motor output torque range. Apply 0 V to ±8 V DC between TC and LG. The maximum torque is generated at ±8 V. (Refer to section 3.6.3 (1).) The speed at ±8 V can be changed with [Pr. PC13]. If a value equal to or larger than the maximum torque is inputted to TC, the value is clamped at the maximum torque.	Analog input			○
Analog speed command	VC		To use these signals, set VC to enabled (1 _ _ _) in [Pr. PC29]. Apply 0 V to ±10 V DC between VC and LG. Speed set in [Pr. PC12] is provided at ±10 V. (Refer to section 3.6.2 (1).) If a value equal to or larger than the permissible speed is inputted to VC, the value is clamped at the permissible speed. Resolution: 14 bits or equivalent	Analog input		○	

Device	Symbol	Connector pin No.	Function and application	I/O division	Control mode		
					P	S	T
Forward rotation pulse train Reverse rotation pulse train	PP NP PG NG	CN3-6 CN3-19 CN3-7 CN3-20	This is used to enter a command pulse train. The command input pulse train form, pulse train logic, and command input pulse train filter are changed in [Pr. PA13]. For open-collector type, set [Pr. PA13] to "_ 3 _ _". For differential receiver type, set [Pr. PA13] depending on the maximum input frequency. 1) For open-collector type The maximum input frequency is 200 kpulses/s. For A-phase/B-phase pulse train, 200 kpulses/s will be the frequency after multiplication by four. Input the forward rotation pulse train between PP and DOCOM. Input the reverse rotation pulse train between NP and DOCOM. 2) For differential receiver type The maximum input frequency is 4 Mpulses/s. For A-phase/B-phase pulse train, 4 Mpulses/s will be the frequency after multiplication by four. Input the forward rotation pulse train between PG and PP. Input the reverse rotation pulse train between NG and NP.	DI-2	○		

(3) Output signal

Device	Symbol	Connector pin No.	Function and application	I/O division	Control mode		
					P	S	T
Encoder A-phase pulse (differential line driver)	LA LAR	CN3-11 CN3-24	These devices output pulses of encoder output pulse set in [Pr. PA15] in the differential line driver type. In CCW rotation of the servo motor, the encoder B-phase pulse lags the encoder A-phase pulse by a phase angle of π/2. The relation between rotation direction and phase difference of the A-phase and B-phase pulses can be changed with [Pr. PC19].	DO-2	○	○	○
Encoder B-phase pulse (differential line driver)	LB LBR	CN3-12 CN3-25					
Encoder Z-phase pulse (differential line driver)	LZ LZR	CN3-13 CN3-26	The encoder zero-point signal is outputted in the differential line driver type. One pulse is outputted per servo motor revolution. This turns on when the zero-point position is reached. (negative logic) The minimum pulse width is about 400 μs. For home position return using this pulse, set the creep speed to 100 r/min or less.	DO-2	○	○	○
Encoder Z-phase pulse (open-collector)	OP	CN3-16	To use these signals, assign OP to output devices with [Pr. PD38]. The encoder zero-point signal is outputted in the open-collector type.	DO-1	○	○	○

(4) Power supply

Device	Symbol	Connector pin No.	Function and application	I/O division	Control mode		
					P	S	T
Digital I/F power supply input	DICOM	CN3-5	Input 24 V DC (24 V DC ± 10% 300 mA) for I/O interface. The power supply capacity changes depending on the number of I/O interface points to be used. For sink interface, connect + of 24 V DC external power supply. For source interface, connect - of 24 V DC external power supply.		○	○	○
Open-collector sink interface power supply input	OPC	CN3-18	When inputting a pulse train in the open-collector type with sink interface, supply this terminal with the positive (+) power of 24 V DC.		○		
Digital I/F common	DOCOM	CN3-17	Common terminal of input signal such as EM2 of the servo amplifier. This is separated from LG. For sink interface, connect - of 24 V DC external power supply. For source interface, connect + of 24 V DC external power supply.		○	○	○
Control common	LG	CN3-10 CN3-23	This is a common terminal for TLA/TC/VC/OP. Pins are connected internally.		○	○	○
Shield	SD	Plate	Connect the external conductor of the shielded wire.		○	○	○

3.6 Detailed explanation of signals

3.6.1 Position control mode

POINT

●Adjust the logic of a positioning module and command pulse as follows.

・MELSEC iQ-R series/MELSEC-Q series/MELSEC-L series positioning module

Signal type	Command pulse logic setting	
	Positioning module Pr. 23 setting	MR-JE-_C servo amplifier [Pr. PA13] setting
Open-collector type	Positive logic	Positive logic (_ _ 0 _)
	Negative logic	Negative logic (_ _ 1 _)
Differential line driver type	Positive logic (Note)	Negative logic (_ _ 1 _)
	Negative logic (Note)	Positive logic (_ _ 0 _)

Note. For MELSEC iQ-R series/MELSEC-Q series/MELSEC-L series, the logic means N-side waveform. Therefore, reverse the input pulse logic of the servo amplifier.

・MELSEC-F series positioning module

Signal type	Command pulse logic setting	
	Positioning module (fixed)	MR-JE-_C servo amplifier [Pr. PA13] setting
Open-collector type Differential line driver type	Negative logic	Negative logic (_ _ 1 _)

(1) Pulse train input

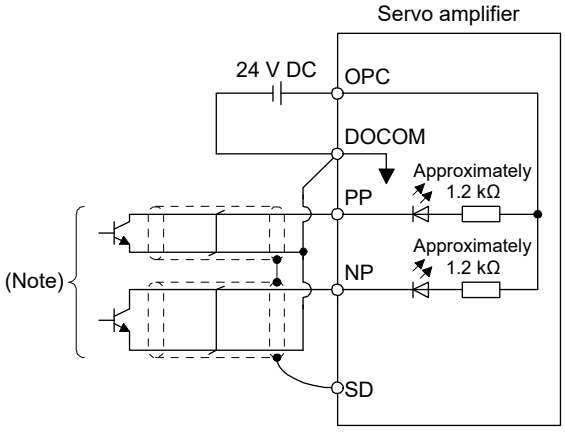
(a) Input pulse waveform selection

You can input command pulses in any of three different forms, and can choose positive or negative logic. Set the command pulse train form in [Pr. PA13]. Refer to section 5.2.1 for details.

(b) Connection and waveform

1) Open-collector type

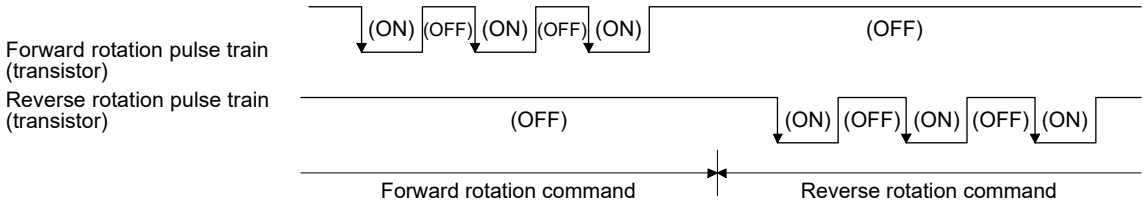
Connect as follows.



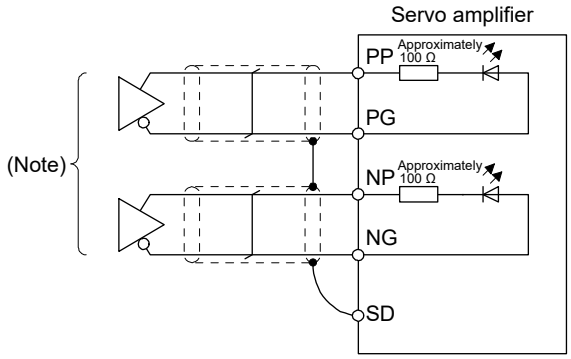
Note. Pulse train input interface is comprised of a photocoupler.

If a resistor is connected to the pulse train signal line, it may malfunction due to reduction in current.

The following section explains about the case where the negative logic and the forward/reverse rotation pulse trains are set to "_ _ 1 0" in [Pr. PA13].

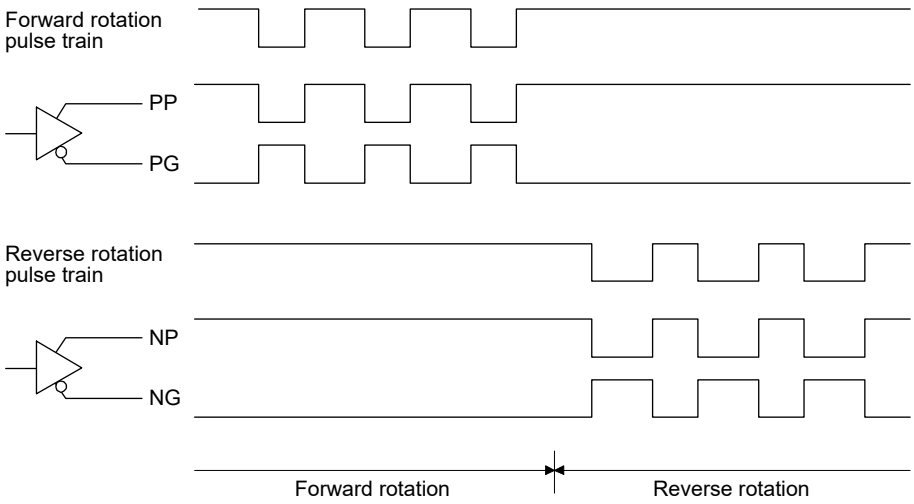


2) Differential line driver type
Connect as follows.



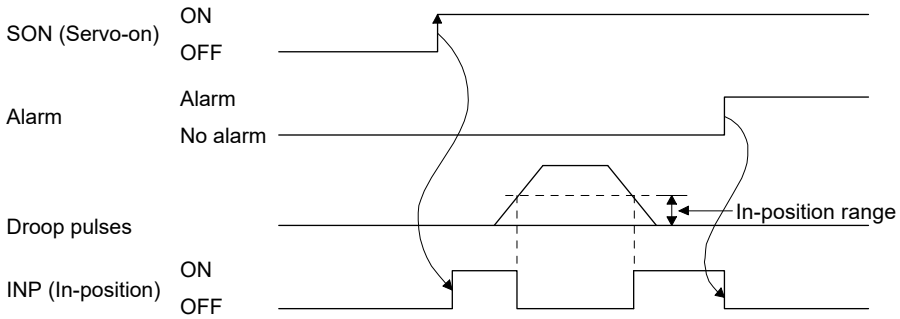
Note. Pulse train input interface is comprised of a photocoupler.
If a resistor is connected to the pulse train signal line, it may malfunction due to reduction in current.

The following example shows that an input waveform has been set to the negative logic and forward/reverse rotation pulse trains by setting "_ _ 1 0" in [Pr. PA13]. The waveforms of PP, PG, NP, and NG are based on LG.

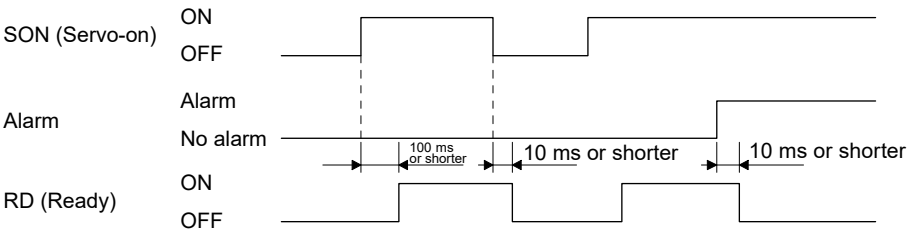


(2) INP (In-position)

INP turns on when the number of droop pulses in the deviation counter falls within the preset in-position range ([Pr. PA10]). INP may turn on continuously during a low-speed operation with a large value set as the in-position range.



(3) RD (Ready)



(4) Electronic gear switching

The combination of CM1 and CM2 enables you to select four different electronic gear numerators set in the parameters.

As soon as CM1/CM2 is turned on or off, the numerator of the electronic gear changes. Therefore, if a shock occurs at switching, use the position smoothing ([Pr. PB03]) to relieve the shock.

(Note) Input device		Electronic gear numerator
CM2	CM1	
0	0	Pr. PA06
0	1	Pr. PC32
1	0	Pr. PC33
1	1	Pr. PC34

Note. 0: Off
1: On

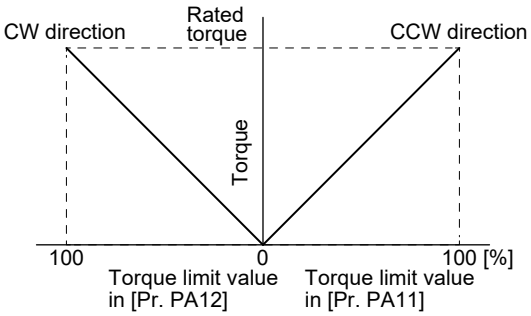
(5) Torque limit

⚠CAUTION	●If the torque limit is canceled during servo-lock, the servo motor may suddenly rotate according to position deviation in respect to the command position. ●When using the torque limit, check that [Pr. PB06 Load to motor inertia ratio] is set properly. Improper settings may cause an unexpected operation such as an overshoot.

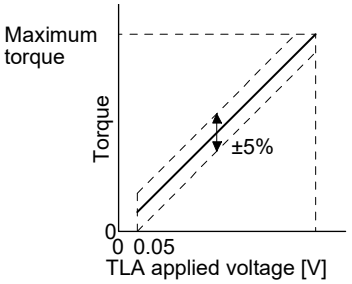
POINT
●Setting "TC/TLA setting (0 _ _ _)" (initial value) in [Pr. PC29] will enable the analog torque limit. ●Setting "VC setting (1 _ _ _)" in [Pr. PC29] will disable the analog torque limit.

(a) Torque limit and torque

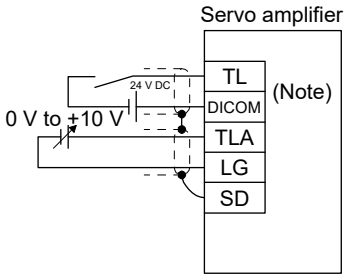
By setting [Pr. PA11 Forward rotation torque limit] or [Pr. PA12 Reverse rotation torque limit], torque is always limited to the maximum value during operation. A relation between the limit value and servo motor torque is as follows.



A relation between the applied voltage of TLA (Analog torque limit) and the torque limit value of the servo motor is as follows. Torque limit values will vary about 5% relative to the voltage depending on products. At the voltage of less than 0.05 V, torque may vary as it may not be limited sufficiently. Therefore, use this function at the voltage of 0.05 V or more.



TLA applied voltage vs. torque limit value



Connection example

Note. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.

(b) Torque limit value selection

The following shows how to select a torque limit using TL (External torque limit selection) from [Pr. PA11 Forward torque limit] or [Pr. PA12 Reverse torque limit] and TLA (Analog torque limit).

When TL1 (Internal torque limit selection) is enabled with [Pr. PD05] to [Pr. PD27], select [Pr. PC35 Internal torque limit 2].

However, if [Pr. PA11] and [Pr. PA12] value is less than the limit value selected by TL/TL1, [Pr. PA11] and [Pr. PA12] value will be enabled.

Input device (Note 1)		Limit value status			Enabled torque limit value	
TL1	TL				CCW power running/CW regeneration	CW power running/CCW regeneration
0	0				Pr. PA11	Pr .PA12
0	1	TLA	>	Pr. PA11 Pr. PA12	Pr. PA11	Pr. PA12
		TLA	<	Pr. PA11 Pr. PA12	TLA (Note 2)	TLA (Note 3)
1	0	Pr. PC35	>	Pr. PA11 Pr. PA12	Pr. PA11	Pr. PA12
		Pr. PC35	<	Pr. PA11 Pr. PA12	Pr. PC35 (Note 2)	Pr. PC35 (Note 3)
1	1	TLA	>	Pr. PC35	Pr. PC35 (Note 2)	Pr. PC35 (Note 3)
		TLA	<	Pr. PC35	TLA (Note 2)	TLA (Note 3)

Note 1. 0: Off
1: On
2. When [Pr. PD38] is set to "_ 2 _ _", the value in [Pr. PA11] is applied.
3. When [Pr. PD38] is set to "_ 1 _ _", the value in [Pr. PA12] is applied.

(c) TLC (Limiting torque)

TLC turns on when the servo motor torque reaches the torque limited using the forward rotation torque limit, reverse rotation torque limit or analog torque limit.

3.6.2 Speed control mode

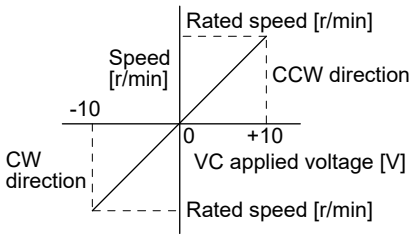
POINT
●Setting "TC/TLA setting (0 _ _ _)" (initial value) in [Pr. PC29] will enable driving the motor by the internal speed command. Note that analog torque limit is available. ●Setting "VC setting (1 _ _ _)" in [Pr. PC29] will enable driving the motor by the analog speed command. Note that analog torque limit is unavailable.

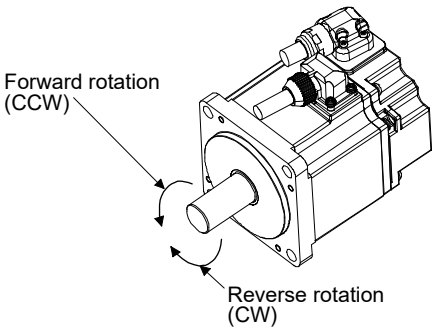
(1) Speed setting

(a) Speed command and speed

The servo motor is run at the speeds set in the parameters or at the speed set in the applied voltage of VC (Analog speed command). A relation between VC (Analog speed command) applied voltage and the servo motor speed is as follows.

Rated speed is achieved at ±10 V with initial setting. The speed at ±10 V can be changed with [Pr. PC12].





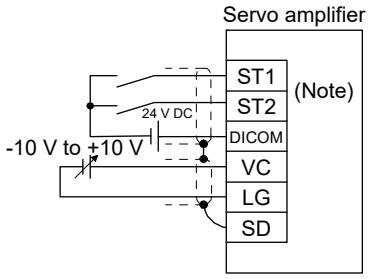
The following table indicates the rotation direction according to ST1 (Forward rotation start) and ST2 (Reverse rotation start) combination.

(Note 1) Input device		Rotation direction (Note 2)			
ST2	ST1	VC (Analog speed command) (Note 3)			Internal speed command
		Polarity: +	0 V	Polarity: -	
0	0	Stop (servo-lock)	Stop (servo-lock)	Stop (servo-lock)	Stop (servo-lock)
0	1	CCW	Stop (no servo-lock)	CW	CCW
1	0	CW		CCW	CW
1	1	Stop (servo-lock)	Stop (servo-lock)	Stop (servo-lock)	Stop (servo-lock)

Note 1. 0: Off
1: On

2. If the torque limit is canceled during servo-lock, the servo motor may suddenly rotate according to position deviation in respect to the command position.
3. Available when "VC command (1 _ _ _)" is selected in [Pr. PC29]. (Refer to [Pr. PC29] in section 5.2)

Normally, connect as follows.



Note. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.

(b) Speed command value selection

To select VC (Analog speed command) and a speed command value of internal speed commands 1 to 7, enable SP1 (Speed selection 1), SP2 (Speed selection 2), and SP3 (Speed selection 3) with [Pr. PD05] to [Pr. PD27].

Input device (Note 1)			Speed command value
SP3	SP2	SP1	
0	0	0	Pr. PC05 Internal speed command 1/ VC (Analog speed command) (Note 2, 3)
0	0	1	Pr. PC05 Internal speed command 1
0	1	0	Pr. PC06 Internal speed command 2
0	1	1	Pr. PC07 Internal speed command 3
1	0	0	Pr. PC08 Internal speed command 4
1	0	1	Pr. PC09 Internal speed command 5
1	1	0	Pr. PC10 Internal speed command 6
1	1	1	Pr. PC11 Internal speed command 7

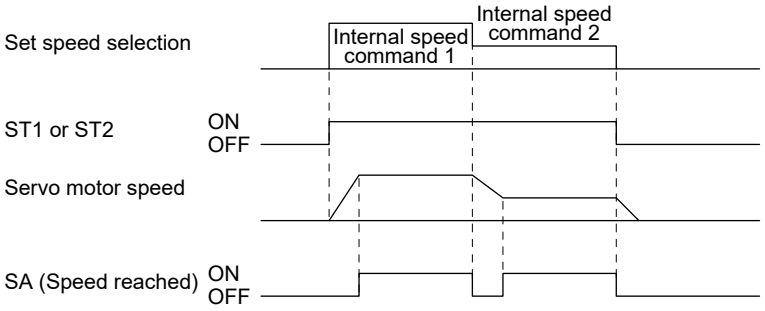
Note 1. 0: Off
1: On
2. Available when "VC command (1 _ _ _)" is selected in [Pr. PC29]. (Refer to [Pr. PC29] in section 5.2)
3. When [Pr. PC29] is set to "TC/TLA setting (0 _ _ _)", the value in [Pr. PC05 Internal speed command 1] is applied.

You can change the speed during rotation. To accelerate/decelerate, set acceleration/deceleration time constant in [Pr. PC01] or [Pr. PC02].

When the internal speed commands are used to command a speed, the speed does not vary with the ambient temperature.

(2) SA (Speed reached)

SA turns on when the servo motor speed has nearly reached the speed set to the internal speed command or analog speed command.



(3) Torque limit

When "VC setting (1 _ _ _)" is set in [Pr. PC29], the analog torque limit is not available. Use the internal torque limit. When "TC/TLA setting (0 _ _ _)" (initial value) is set in [Pr. PC29], it is the same as section 3.6.1 (5).

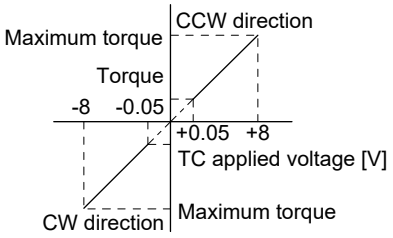
3.6.3 Torque control mode

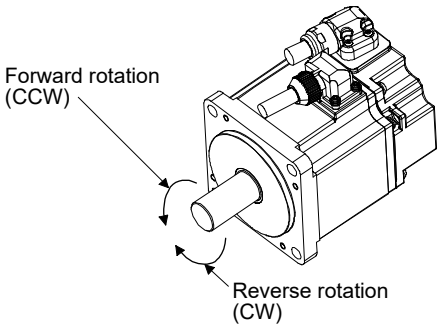
(1) Torque limit

(a) Torque command and torque

The following shows a relation between the applied voltage of TC (Analog torque command) and the torque by the servo motor.

The maximum torque is generated at ±8 V. The speed at ±8 V can be changed with [Pr. PC13].





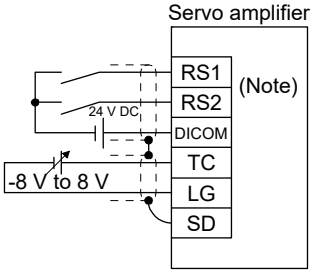
Generated torque command values will vary about 5% relative to the voltage depending on products. The torque may vary if the voltage is low (-0.05 V to 0.05 V) and the actual speed is close to the limit value. In such a case, increase the speed limit value.

The following table indicates the torque generation directions determined by RS1 (Forward rotation selection) and RS2 (Reverse rotation selection) when TC (Analog torque command) is used.

Input device (Note)		Rotation direction		
RS2	RS1	TC (Analog torque command)		
		Polarity: +	0 V	Polarity: -
0	0	Torque is not generated.	Torque is not generated.	Torque is not generated.
0	1	CCW (Forward rotation in power running mode/reverse rotation in regenerative mode)		CW (Reverse rotation in power running mode/forward rotation in regenerative mode)
1	0	CW (Reverse rotation in power running mode/forward rotation in regenerative mode)		CCW (Forward rotation in power running mode/reverse rotation in regenerative mode)
1	1	Torque is not generated.		Torque is not generated.

Note. 0: Off
1: On

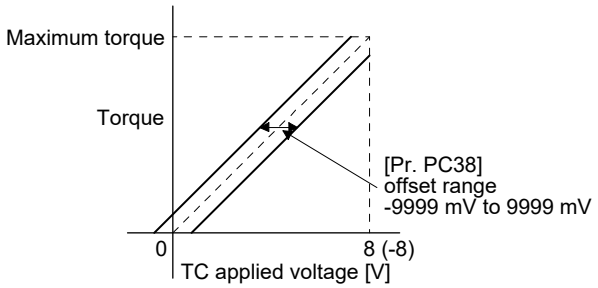
Normally, connect as follows.



Note. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.

(b) Analog torque command offset

Using [Pr. PC38], the offset voltage of -9999 mV to 9999 mV can be added to the TC applied voltage as follows.



(2) Torque limit

By setting [Pr. PA11 Forward rotation torque limit] or [Pr. PA12 Reverse rotation torque limit], torque is always limited to the maximum value during operation. A relation between limit value and servo motor torque is as in section 3.6.1 (5).

Note that TLA (Analog torque limit) is unavailable.

(3) Speed limit

(a) Speed limit value and speed

The speed is limited to the values set with [Pr. PC05 Internal speed limit 1] to [Pr. PC11 Internal speed limit 7].

The following table indicates the limit direction according to RS1 (Forward rotation selection) and RS2 (Reverse rotation selection) combination.

Input device (Note)		Speed limit direction
RS1	RS2	
1	0	CCW
0	1	CW

Note. 0: Off
1: On

(b) Speed limit value selection

To select a speed limit value of internal speed limit 1 to 7, enable SP1 (Speed selection 1), SP2 (Speed selection 2), and SP3 (Speed selection 3) with [Pr. PD05] to [Pr. PD27].

Input device (Note)			Speed limit
SP3	SP2	SP1	
0	0	0	Pr. PC05 Internal speed limit 1
0	0	1	Pr. PC05 Internal speed limit 1
0	1	0	Pr. PC06 Internal speed limit 2
0	1	1	Pr. PC07 Internal speed limit 3
1	0	0	Pr. PC08 Internal speed limit 4
1	0	1	Pr. PC09 Internal speed limit 5
1	1	0	Pr. PC10 Internal speed limit 6
1	1	1	Pr. PC11 Internal speed limit 7

Note. 0: Off
1: On

When the internal speed limits 1 to 7 are used to limit a speed, the speed does not vary with the ambient temperature.

(c) VLC (Limiting speed)
VLC turns on when the servo motor speed reaches a speed limited with internal speed limits 1 to 7.

3.6.4 Position/speed control switching mode

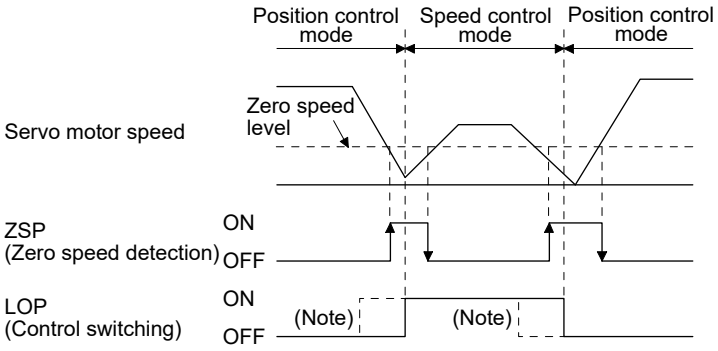
Set " _ _ _ 1" in [Pr. PA01] to switch to the position/speed control switching mode.

(1) LOP (control switching)
Use LOP (Control switching) to switch between the position control mode and the speed control mode with an external contact. The following shows a relation between LOP and control modes.

(Note) LOP	Control mode
0	Position control mode
1	Speed control mode

Note. 0: Off
1: On

You can switch the control mode in the zero speed status. To ensure safety, switch modes after the servo motor has stopped. When position control mode is switched to speed control mode, droop pulses will be reset.
If LOP is switched on/off at the speed higher than the zero speed, the control mode cannot be changed regardless of the speed. The following shows a switching timing chart.



Note. When ZSP is not turned on, the control mode is not switched even if LOP is turned on/off. After LOP is turned on/off, even if ZSP is turned on, the control mode is not switched.

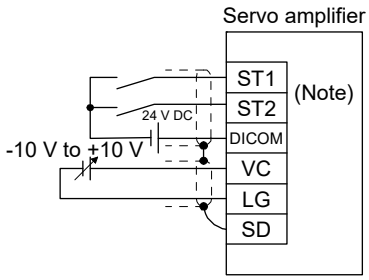
(2) Torque limit in position control mode
As in section 3.6.1 (5)

(3) Speed setting in speed control mode

(a) Speed command and speed

The servo motor is run at the speeds set in the parameters or at the speed set in the applied voltage of VC (Analog speed command). The relation between an applied voltage of VC (Analog speed command) and servo motor speed, and the rotation direction with turning on ST1/ST2 are the same as section 3.6.2 (1) (a).

Normally, connect as follows.



Note. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.

(b) Speed command value selection

To select a speed command value of internal speed commands 1 to 7, enable SP1 (Speed selection 1), SP2 (Speed selection 2), and SP3 (Speed selection 3) with [Pr. PD05] to [Pr. PD27].

Input device (Note)			Speed command value
SP3	SP2	SP1	
0	0	0	Pr. PC05 Internal speed command 1
0	0	1	Pr. PC05 Internal speed command 1
0	1	0	Pr. PC06 Internal speed command 2
0	1	1	Pr. PC07 Internal speed command 3
1	0	0	Pr. PC08 Internal speed command 4
1	0	1	Pr. PC09 Internal speed command 5
1	1	0	Pr. PC10 Internal speed command 6
1	1	1	Pr. PC11 Internal speed command 7

Note. 0: Off
1: On

You can change the speed during rotation. Acceleration/deceleration is performed with the setting values of [Pr. PC01] and [Pr. PC02].

When the internal speed commands 1 to 7 are used to command a speed, the speed does not vary with the ambient temperature.

(c) SA (Speed reached)

As in section 3.6.2 (2)

3.6.5 Speed/torque control switching mode

POINT
●To use this mode, select "TC/ TLA setting (0 _ _ _)" (initial value) in [Pr. PC29]. ●"Speed/torque control switching (_ _ _ 3)" in [Pr. PA01] cannot be selected when "VC setting (1 _ _ _)" is selected in [Pr. PC29]. When this is selected, [AL. 37 Parameter error] occurs.

Set " _ _ _ 3" in [Pr. PA01] to switch to the speed/torque control switching mode.

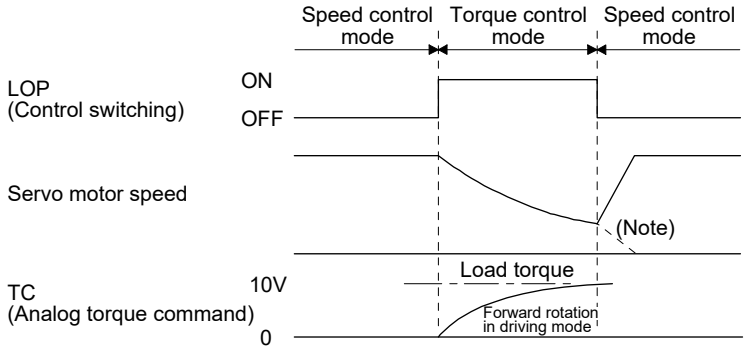
(1) LOP (control switching)

Use LOP (Control switching) to switch between the speed control mode and the torque control mode with an external contact. The following shows a relation between LOP and control modes.

(Note) LOP	Control mode
0	Speed control mode
1	Torque control mode

Note. 0: Off
1: On

The control mode may be switched at any time. The following shows a switching timing chart.



Note. When ST1 (Forward rotation start) and ST2 (Reverse rotation start) are switched off as soon as a mode is switched to the speed control, the servo motor comes to a stop according to the deceleration time constant. A shock may occur at switching control modes.

(2) Speed setting in speed control mode

As in section 3.6.2 (1) VC (Analog speed command) cannot be used.

(3) Torque limit in speed control mode

As in section 3.6.1 (5)

(4) Speed limit in torque control mode

(a) Speed limit value and speed

The speed is limited to the limit value set in the parameter.

(b) Speed limit value selection

To select a speed limit value of internal speed limit 1 to 7, enable SP1 (Speed selection 1), SP2 (Speed selection 2), and SP3 (Speed selection 3) with [Pr. PD05] to [Pr. PD27].

Input device (Note)			Speed limit
SP3	SP2	SP1	
0	0	0	Pr. PC05 Internal speed limit 1
0	0	1	Pr. PC05 Internal speed limit 1
0	1	0	Pr. PC06 Internal speed limit 2
0	1	1	Pr. PC07 Internal speed limit 3
1	0	0	Pr. PC08 Internal speed limit 4
1	0	1	Pr. PC09 Internal speed limit 5
1	1	0	Pr. PC10 Internal speed limit 6
1	1	1	Pr. PC11 Internal speed limit 7

Note. 0: Off
1: On

When the internal speed command 1 is used to command a speed, the speed does not vary with the ambient temperature.

(c) VLC (Limiting speed)

As in section 3.6.3 (3) (c)

(5) Torque control in torque control mode

As in section 3.6.3 (1)

(6) Torque limit in torque control mode

As in section 3.6.3 (2)

3.6.6 Torque/position control switching mode

POINT
●To use this mode, select "TC/ TLA setting (0 _ _ _)" (initial value) in [Pr. PC29]. ●"Torque/position control switching (_ _ _ 5)" in [Pr. PA01] cannot be selected when "VC setting (1 _ _ _)" is selected in [Pr. PC29]. When this is selected, [AL. 37 Parameter error] occurs.

Set "_ _ _ 5" in [Pr. PA01] to switch to the torque/position control switching mode.

(1) LOP (control switching)

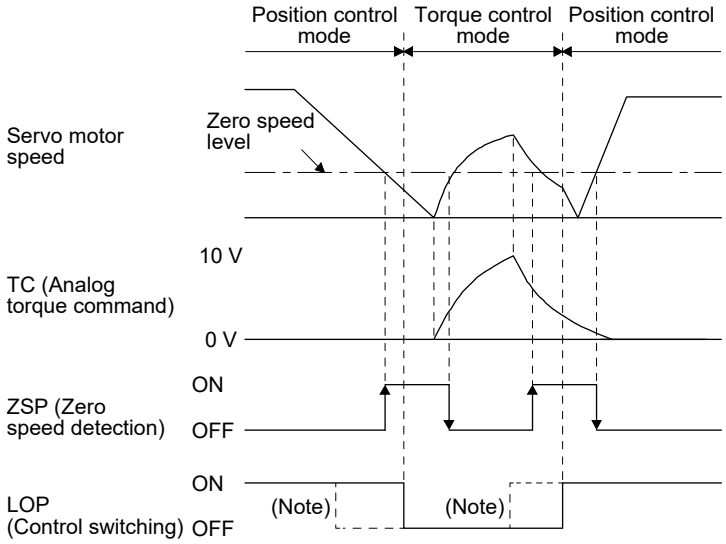
Use LOP (Control switching) to switch between the torque control mode and the position control mode with an external contact. The following shows a relation between LOP and control modes.

(Note) LOP	Control mode
0	Torque control mode
1	Position control mode

Note. 0: Off
1: On

You can switch the control mode in the zero speed status. To ensure safety, switch modes after the servo motor has stopped. When position control mode is switched to torque control mode, droop pulses will be reset.

If LOP is switched on/off at the speed higher than the zero speed, the control mode cannot be changed regardless of the speed. The following shows a switching timing chart.



Note. When ZSP is not turned on, the control mode is not switched even if LOP is turned on/off. After LOP is turned on/off, even if ZSP is turned on, the control mode is not switched.

(2) Speed limit in torque control mode

As in section 3.6.3 (3)

(3) Torque control in torque control mode
As in section 3.6.3 (1)

(4) Torque limit in torque control mode
As in section 3.6.3 (2)

(5) Torque limit in position control mode
As in section 3.6.1 (5)

3.7 Forced stop deceleration function

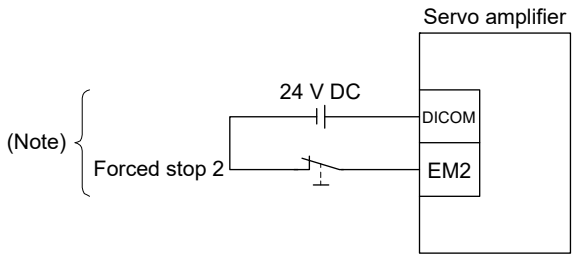
POINT

- When alarms not related to the forced stop function occur, control of motor deceleration cannot be guaranteed. (Refer to chapter 8.)
- In the torque control mode, the forced stop deceleration function is not available.
- Disable the forced stop deceleration function for a machine in which multiple axes are connected together, such as a tandem structure. If an alarm occurs with the forced stop deceleration function disabled, the servo motor will stop with the dynamic brake.
- Maintain servo-on when EM2 (Forced stop 2) is off. In case of servo-off, forced stop deceleration, base cut-off delay and vertical axis freefall prevention will not function.

3.7.1 Forced stop deceleration function

When EM2 is turned off, dynamic brake will start to stop the servo motor after forced stop deceleration. During this sequence, the display shows [AL. E6 Servo forced stop warning].
During normal operation, do not use EM2 (Forced stop 2) to alternate stop and drive. The servo amplifier life may be shortened.

(1) Connection diagram



Note. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.

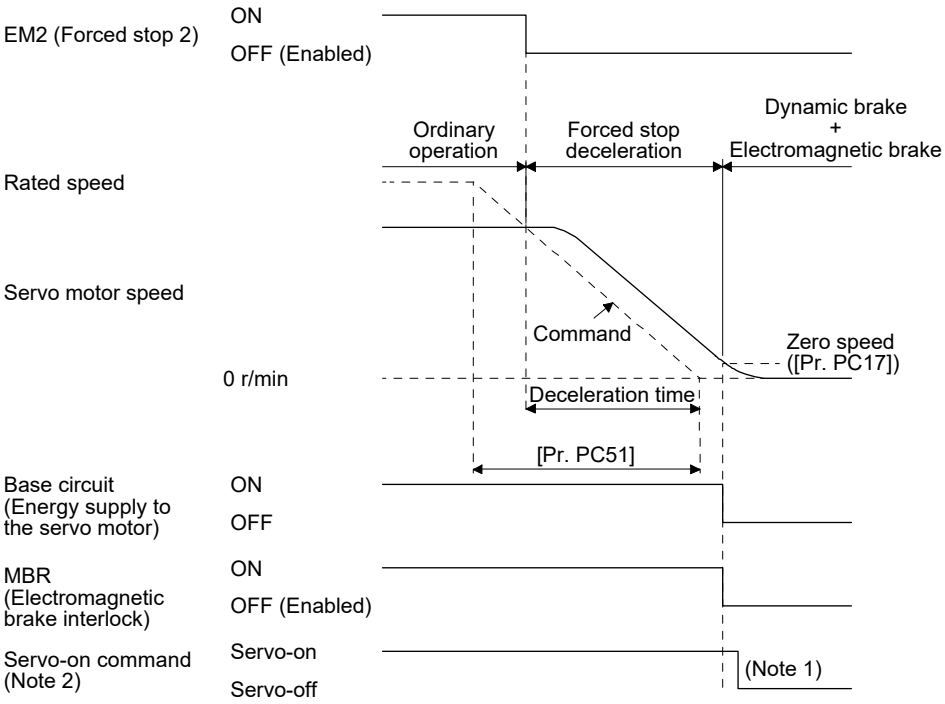
(2) Timing chart

POINT

●When LSP/LSN is turned on during a forced stop deceleration, the motor will stop depending on the setting of [Pr. PD35] as follows.

[Pr. PD35]	Stop system
_ _ _ 0	Switching to sudden stop
_ _ _ 1	Continuing forced stop deceleration

When EM2 (Forced stop 2) is turned off, the motor will decelerate according to [Pr. PC51 Forced stop deceleration time constant]. Once the motor speed is below [Pr. PC17 Zero speed] after completion of the deceleration command, base power is cut and the dynamic brake activates.



Note 1. Shut off the base circuit of the servo amplifier, then shut the servo off.

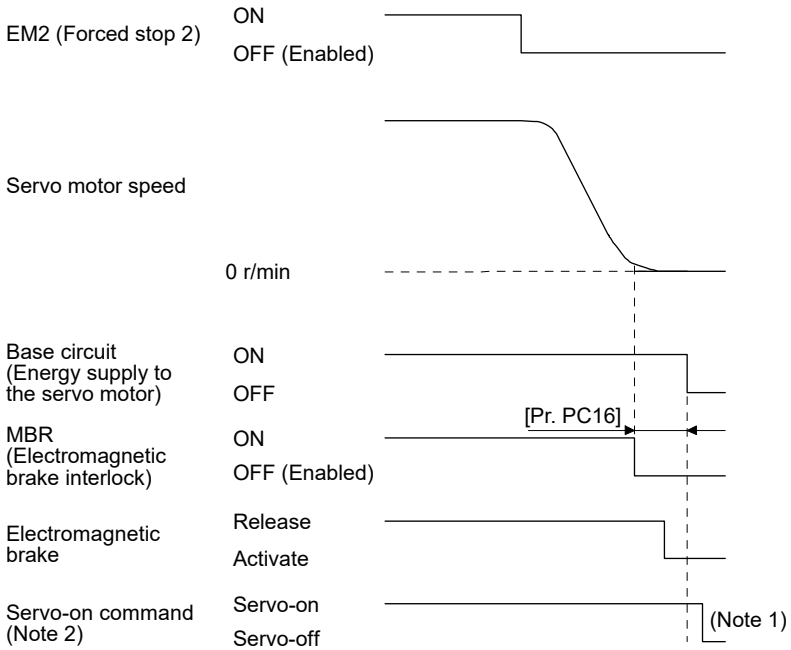
2. In the profile mode and when using the positioning mode with the communication interface, issuing a command from the master station (controller) to the servo amplifier enables servo-on/servo-off.
Servo-on: Enable Operation command is issued
Servo-off: Disable Operation command is issued

3.7.2 Base circuit shut-off delay time function

The base circuit shut-off delay time function is used to prevent vertical axis from dropping at a forced stop (EM2 goes off) or alarm occurrence due to delay time of the electromagnetic brake. Use [Pr. PC16] to set the delay time between completion of EM2 (Forced stop 2) or activation of MBR (Electromagnetic brake interlock) due to an alarm occurrence, and shut-off of the base circuit.

(1) Timing chart

When EM2 (Forced stop 2) turns off or an alarm occurs during driving, the servo motor will decelerate based on the deceleration time constant. MBR (Electromagnetic brake interlock) will turn off, and then after the delay time set in [Pr. PC16], the servo amplifier will be base circuit shut-off status.



Note 1. Shut off the base circuit of the servo amplifier, then shut the servo off.
2. In the profile mode and when using the positioning mode with the communication interface, issuing a command from the master station (controller) to the servo amplifier enables servo-on/servo-off.
Servo-on: Enable Operation command is issued
Servo-off: Disable Operation command is issued

(2) Adjustment

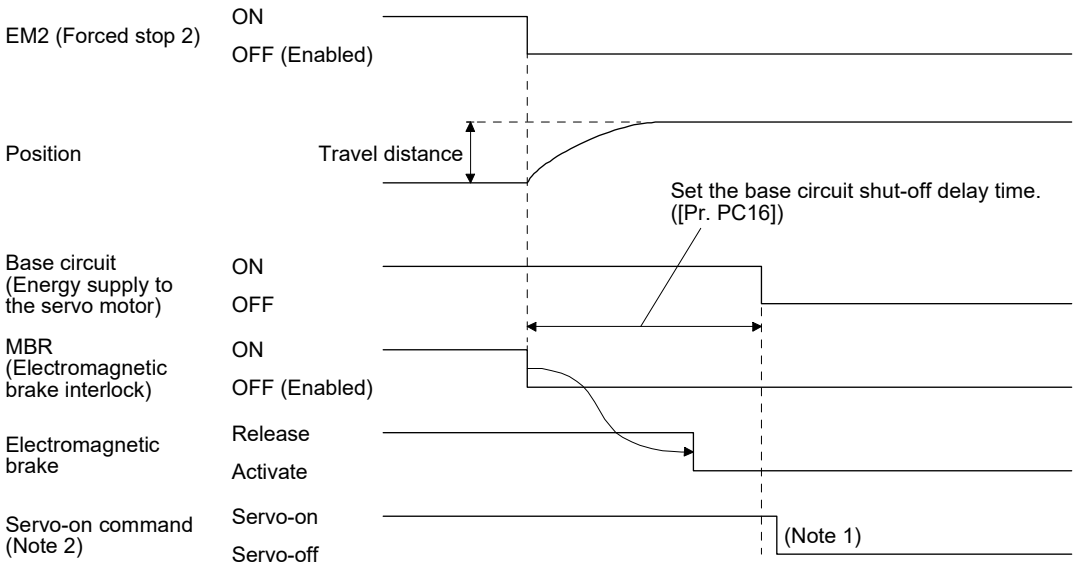
While the servo motor is stopped, turn off EM2 (Forced stop 2), adjust the base circuit shut-off delay time in [Pr. PC16], and set the value to approximately 1.5 times of the smallest delay time in which the servo motor shaft does not freefall.

3.7.3 Vertical axis freefall prevention function

The vertical axis freefall prevention function avoids machine damage by pulling up the shaft slightly like the following case.
When the servo motor is used for operating vertical axis, the servo motor electromagnetic brake and the base circuit shut-off delay time function avoid dropping axis at forced stop. However, the functions may not avoid dropping axis a few μm due to the backlash of the servo motor electromagnetic brake.
The vertical axis freefall prevention function is enabled with the following conditions.

- Other than "0" is set to [Pr. PC54 Vertical axis freefall prevention compensation amount].
- The servo motor speed decelerates lower than the value of zero speed by turning off EM2 (Forced stop 2) or by an alarm occurrence.
- The base circuit shut-off delay time function is enabled.
- EM2 (Forced stop 2) turned off or an alarm occurred while the servo motor speed is zero speed or less.

(1) Timing chart



Note 1. Shut off the base circuit of the servo amplifier, then shut the servo off.
2. In the profile mode and when using the positioning mode with the communication interface, issuing a command from the master station (controller) to the servo amplifier enables servo-on/servo-off.
Servo-on: Enable Operation command is issued
Servo-off: Disable Operation command is issued

(2) Adjustment

- Set the freefall prevention compensation amount in [Pr. PC54].
- While the servo motor is stopped, turn off the EM2 (Forced stop 2). Adjust the base circuit shut-off delay time in [Pr. PC16] in accordance with the travel distance ([Pr. PC54). Adjust it considering the freefall prevention compensation amount by checking the servo motor speed, torque ripple, etc.

3.7.4 Residual risks of the forced stop function (EM2)

(1) The forced stop function is not available for alarms that activate the dynamic brake when the alarms occur.

(2) When an alarm that activates the dynamic brake during forced stop deceleration occurs, the braking distance until the servo motor stops will be longer than that of normal forced stop deceleration without the dynamic brake.

3.8 Alarm occurrence timing chart

CAUTION	●When an alarm has occurred, remove its cause, make sure that the operation signal is not being input, ensure safety, and reset the alarm before restarting operation.

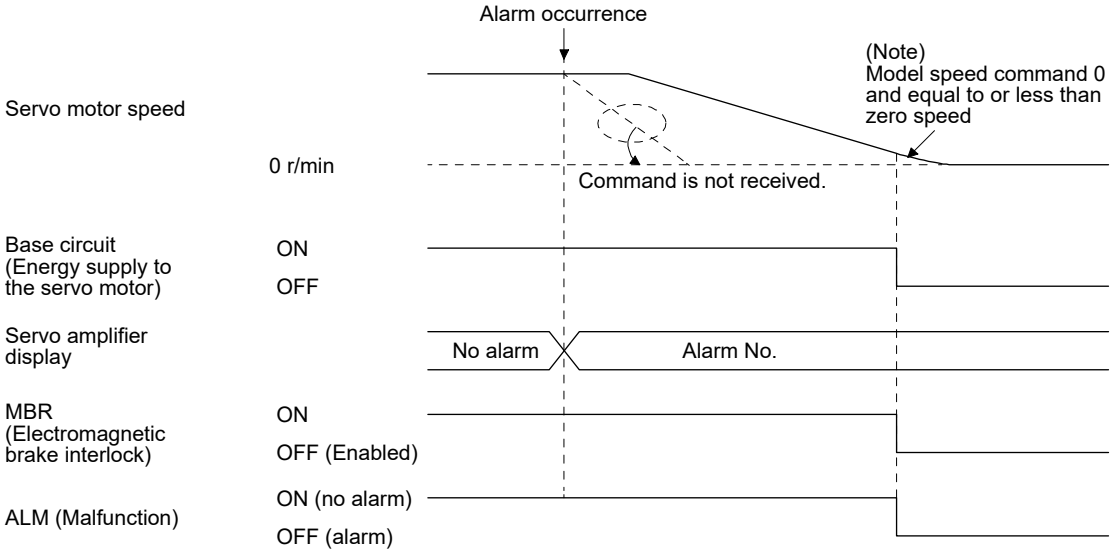
POINT
●In the torque control mode, the forced stop deceleration function is not available.

To deactivate an alarm, cycle the power, push the "SET" button in the current alarm window, or cycle the RES (Reset) However, the alarm cannot be deactivated unless its cause is removed.

3.8.1 When you use the forced stop deceleration function

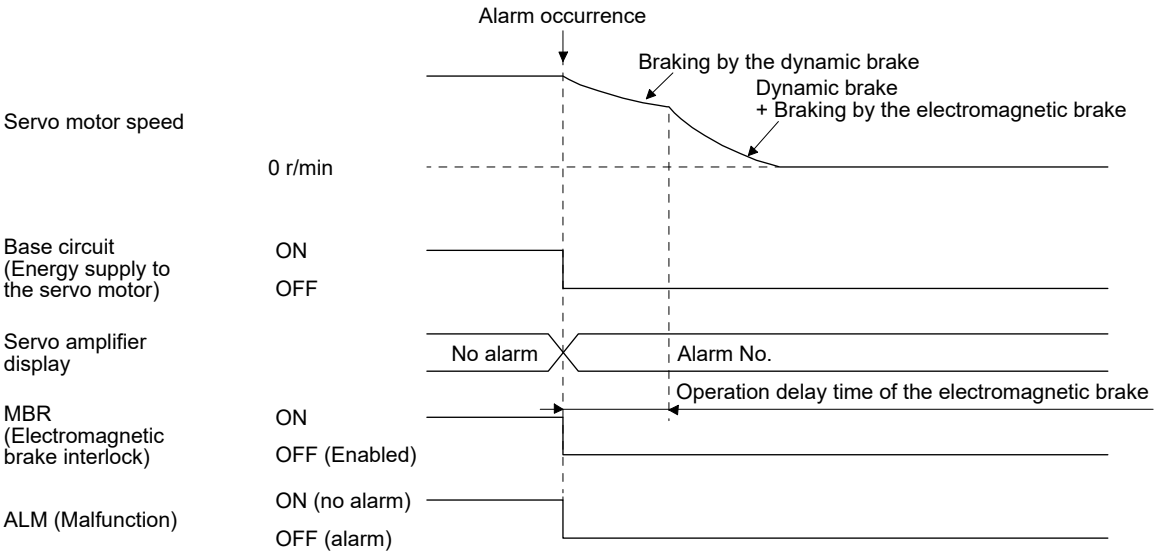
POINT
●To enable the function, set "2 _ _ _ (initial value)" in [Pr. PA04]. ●Disable the forced stop deceleration function for a machine in which multiple axes are connected together, such as a tandem structure. If an alarm occurs with the forced stop deceleration function disabled, the servo motor will stop with the dynamic brake.

(1) When the forced stop deceleration function is enabled



Note. The model speed command is a speed command generated in the servo amplifier for forced stop deceleration of the servo motor.

(2) When the forced stop deceleration function is not enabled



3.8.2 When you do not use the forced stop deceleration function

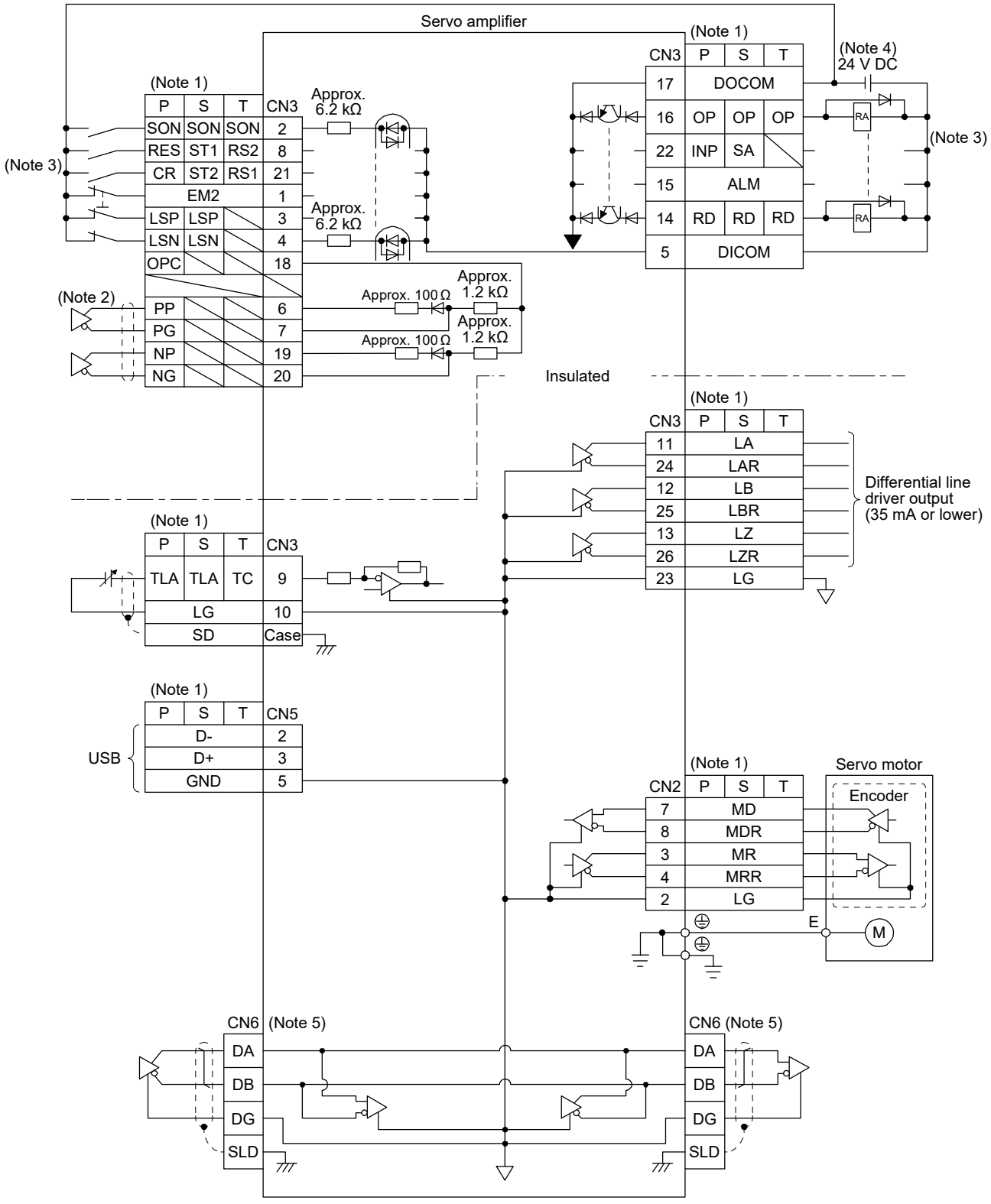
POINT
●To disable the function, set "0 _ _ _" in [Pr. PA04].

The operation status during an alarm is the same as section 3.8.1 (2).

3.9 Interfaces

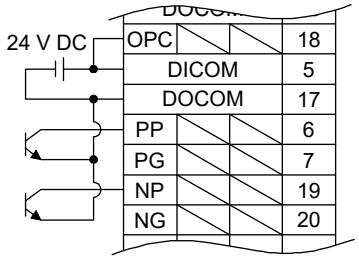
3.9.1 Internal connection diagram

The following diagram is for sink I/O interface when command pulse train input is differential line driver type.



Note 1. P: position control mode, S: speed control mode, T: torque control mode

2. This is for the differential line driver pulse train input. For the open-collector pulse train input, connect as follows.



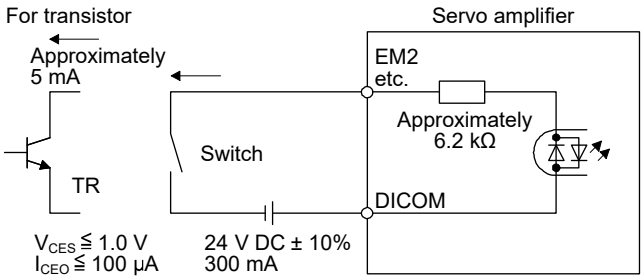
3. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
4. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.
5. When the RS - 485 communication function is used and if this servo amplifier is the last axis, connect a 150 Ω resistor between DA and DB, and terminate the servo amplifier. For details, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".

3.9.2 Detailed explanation of interfaces

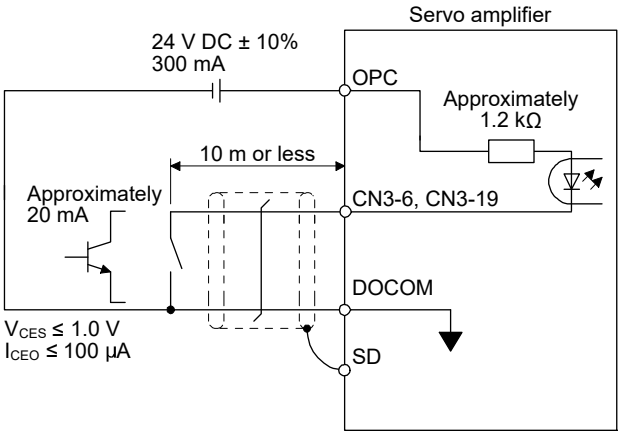
This section provides the details of the I/O signal interfaces (refer to the I/O division in the table) given in section 3.5. Refer to this section and make connection with the external device.

(1) Digital input interface DI-1

This is an input circuit whose photocoupler cathode side is input terminal. Transmit signals from sink (open-collector) type transistor output, relay switch, etc. The following is a connection diagram for sink input. Refer to section 3.9.3 for source input.



The following shows when the CN3-6 pin and the CN3-19 pin are used as digital input interface:



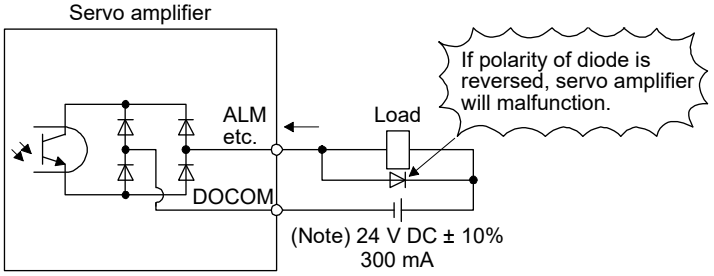
(2) Digital output interface DO-1

This is a circuit in which the collector of the output transistor is the output terminal. When the output transistor is turned on, the current will flow to the collector terminal.

A lamp, relay or photocoupler can be driven. Install a diode (D) for an inductive load, or install an inrush current suppressing resistor (R) for a lamp load.

(Rated current: 40 mA or less, maximum current: 50 mA or less, inrush current: 100 mA or less) A maximum of 2.6 V voltage drop occurs in the servo amplifier.

The following shows a connection diagram for sink output. Refer to section 3.9.3 for source output.



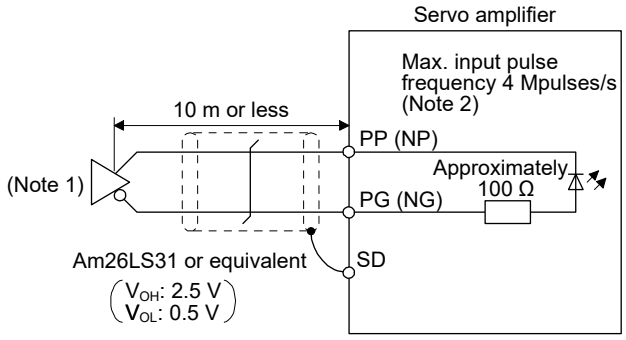
Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

(3) Pulse train input interface DI-2

Give a pulse train signal in the differential line driver type or open-collector type.

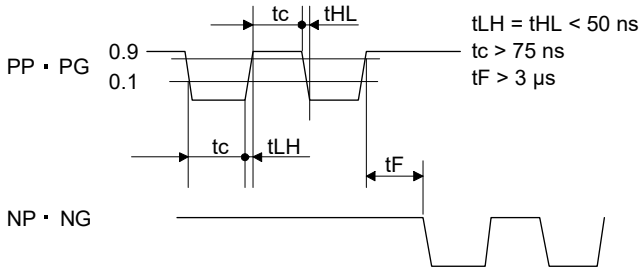
(a) Differential line driver type

1) Interface



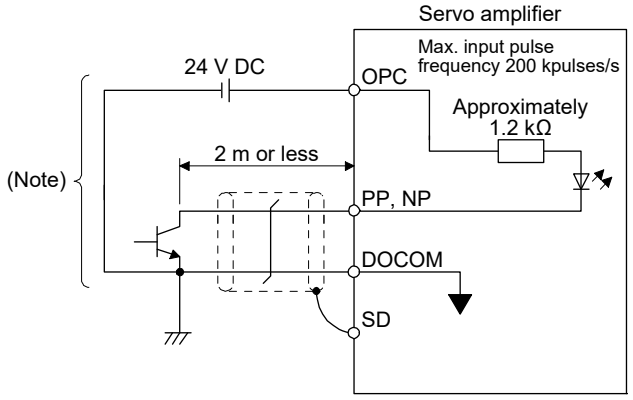
Note 1. Pulse train input interface is comprised of a photocoupler.
If a resistor is connected to the pulse train signal line, it may malfunction due to reduction in current.
2. When the input pulse frequency is 4 Mpulses/s, set [Pr. PA13] to "_ 0 _ _".

2) Input pulse condition



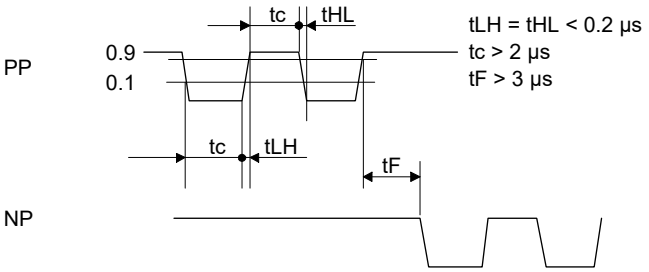
(b) Open-collector type

1) Interface



Note. Pulse train input interface is comprised of a photocoupler.
If a resistor is connected to the pulse train signal line, it may malfunction due to reduction in current.

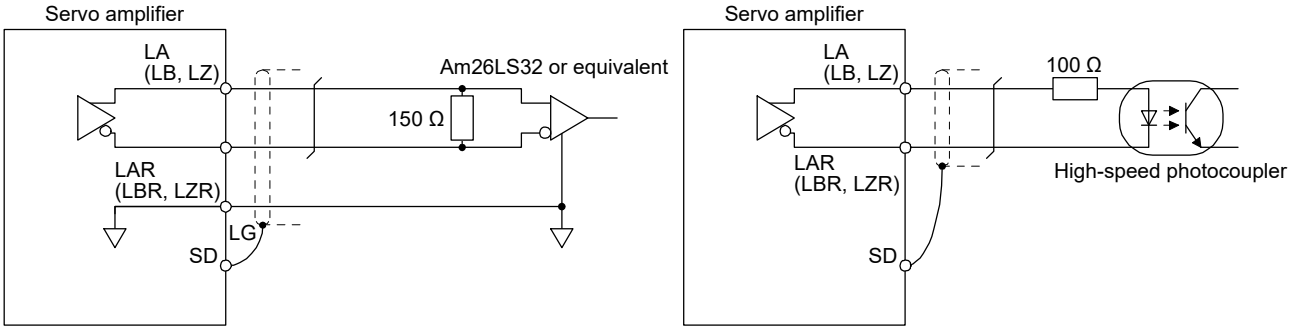
2) Input pulse condition



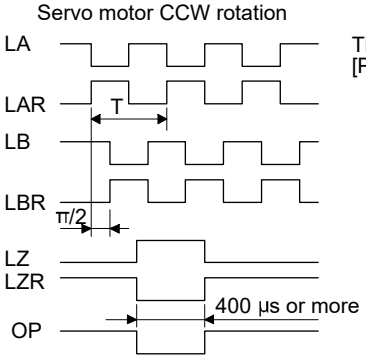
(4) Encoder output pulse DO-2 (Differential line driver type)

(a) Interface

Maximum output current: 35 mA



(b) Output pulse

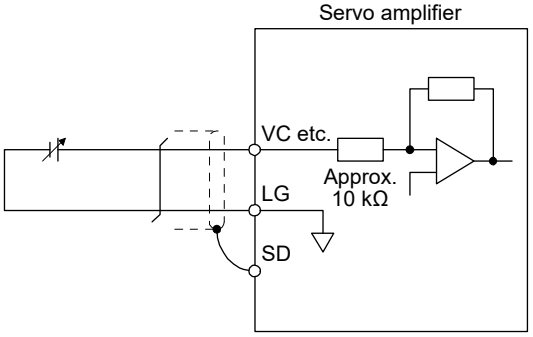


Time cycle (T) is determined by the settings of [Pr. PA15] and [Pr. PC19].

(5) Analog input

Input impedance

10 kΩ to 12 kΩ

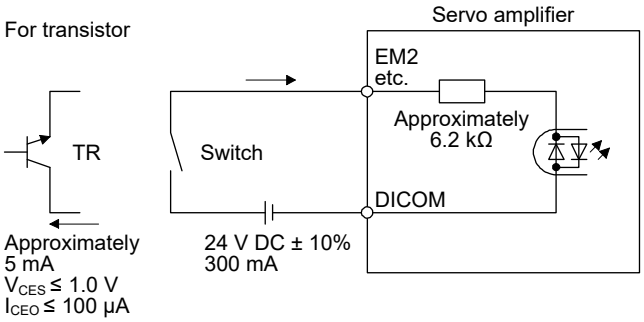


3.9.3 Source I/O interfaces

In this servo amplifier, source type I/O interfaces can be used.

(1) Digital input interface DI-1

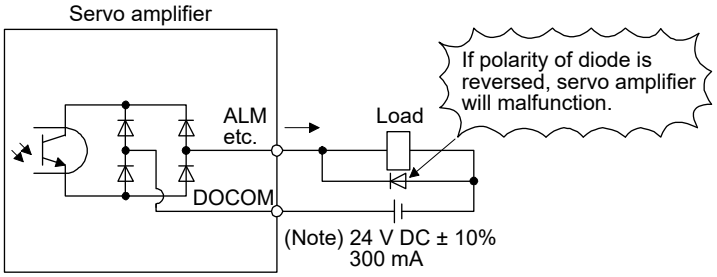
This is an input circuit whose photocoupler anode side is the input terminal. Transmit signals from source (open-collector) type transistor output, relay switch, etc.



(2) Digital output interface DO-1

This is a circuit in which the emitter of the output transistor is the output terminal. When the output transistor is turned on, the current will flow from the output terminal to a load.

A maximum of 2.6 V voltage drop occurs in the servo amplifier.

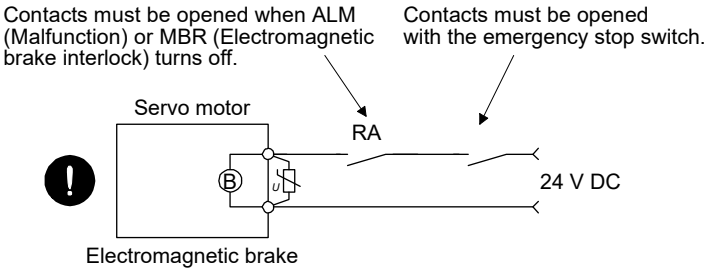


Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

3.10 Servo motor with an electromagnetic brake

3.10.1 Safety precautions

●Configure an electromagnetic brake circuit which is interlocked with an external emergency stop switch.



⚠CAUTION

●Failure of MBR (Electromagnetic brake interlock) or ALM (Malfunction) may cause brake malfunction.

●The electromagnetic brake is provided for holding purpose and must not be used for ordinary braking.

●Before operating the servo motor, be sure to confirm that the electromagnetic brake operates properly.

●Do not use the 24 V DC interface power supply for the electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake. Otherwise, it may cause a malfunction.

●When using EM2 (Forced stop 2), use MBR (Electromagnetic brake interlock) for operating the electromagnetic brake. Operating the electromagnetic brake without using MBR during deceleration to a stop will saturate servo motor torques at the maximum value due to brake torques of the electromagnetic brake and can result in delay of the deceleration to a stop from a set value.

POINT

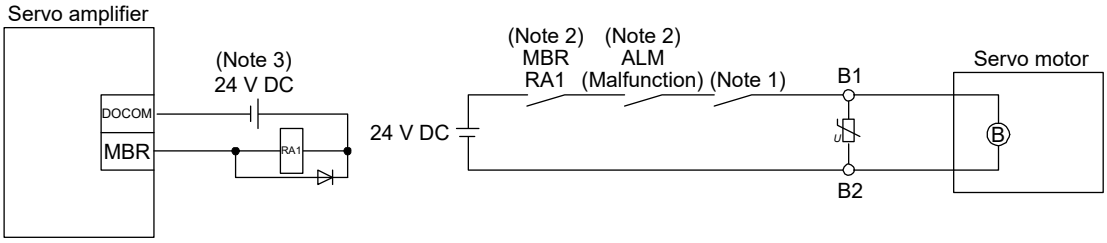
●Refer to "HG-KN/HG-SN Servo Motor Instruction Manual" for specifications such as the power supply capacity and operation delay time of the electromagnetic brake.

●Refer to "HG-KN/HG-SN Servo Motor Instruction Manual" for the selection of a surge absorber for the electromagnetic brake.

Note the following when the servo motor with an electromagnetic brake is used.

1) The brake will operate when the power (24 V DC) turns off.
2) The status is base circuit shut-off during RES (Reset) on. When you use the motor in vertical axis system, use MBR (Electromagnetic brake interlock).
3) Turn servo-off after the servo motor has stopped.

(1) Connection diagram



Note 1. Create the circuit in order to shut off by interlocking with the emergency stop switch.
2. Failure of MBR or ALM may cause brake malfunction.
3. Do not use the 24 V DC interface power supply for the electromagnetic brake.

(2) Setting

(a) Enable MBR (Electromagnetic brake interlock) with [Pr. PD05] to [Pr. PD27].

(b) In [Pr. PC16 Electromagnetic brake sequence output], set a delay time (Tb) from MBR (Electromagnetic brake interlock) off to base circuit shut-off at a servo-off as in the timing chart in section 3.10.2 (1).

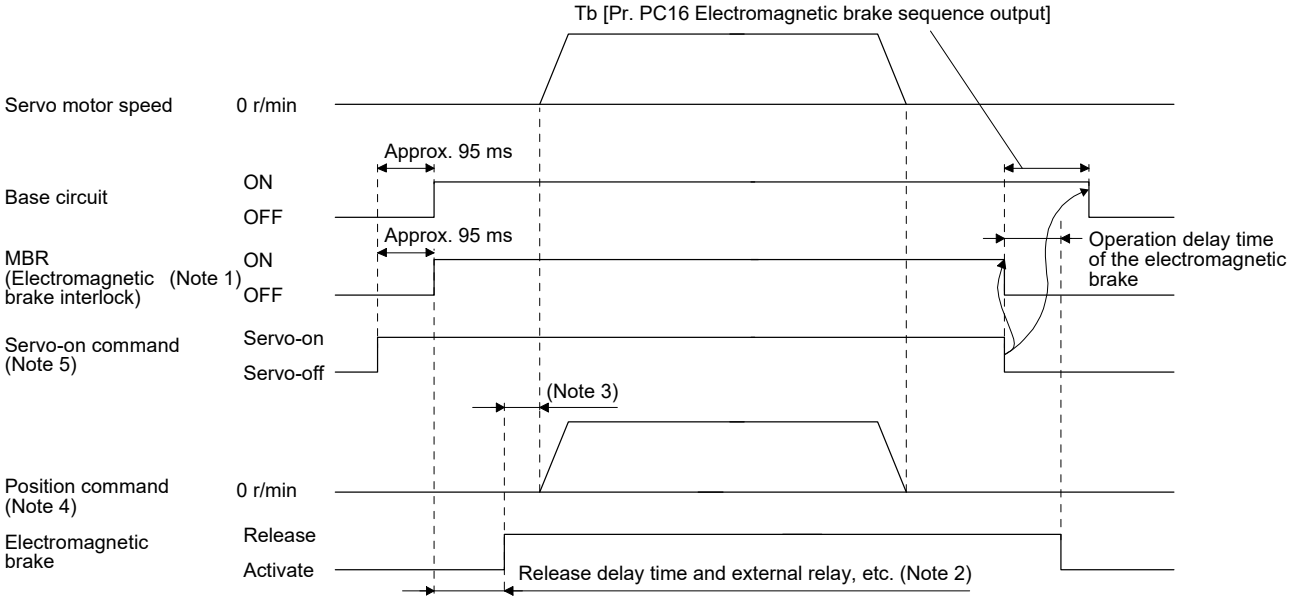
3.10.2 Timing chart

(1) When you use the forced stop deceleration function

POINT
●To enable the function, set "2 _ _ _ (initial value)" in [Pr. PA04].

(a) Servo-on/Servo-off

When the servo is turned off, servo lock is released after Tb [ms] and the motor goes into free-running state. If the electromagnetic brake is enabled during servo-lock, the brake life may be shorter. Therefore, set Tb about 1.5 times of the minimum delay time where the moving part will not drop down for a vertical axis system, etc.



Note 1. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.

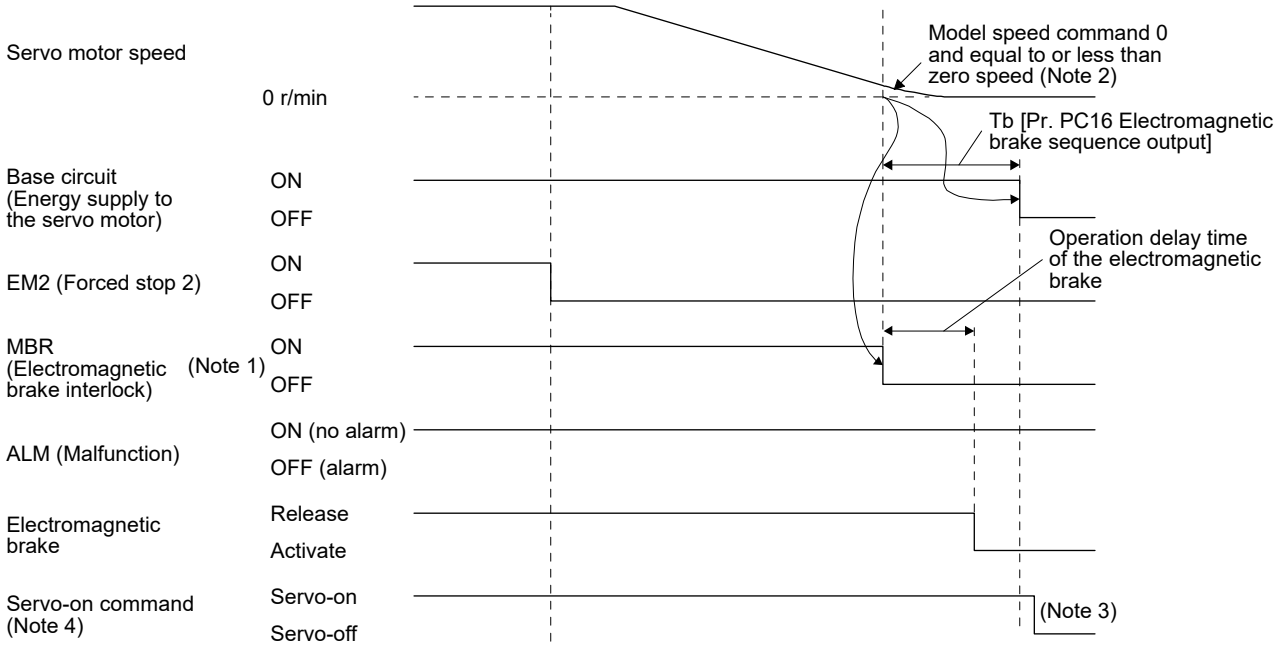
2. Electromagnetic brake is released after delaying for the release delay time of electromagnetic brake and operation time of external circuit relay. For the release delay time of electromagnetic brake, refer to "HG-KN/HG-SN Servo Motor Instruction Manual".
3. Give a position command after the electromagnetic brake is released.
4. This is in position control mode.
5. In the profile mode and when using the positioning mode with the communication interface, issuing a command from the master station (controller) to the servo amplifier enables servo-on/servo-off.
Servo-on: Enable Operation command is issued
Servo-off: Disable Operation command is issued

(b) Forced stop 2 on/off

POINT

●In the torque control mode, the forced stop deceleration function is not available.

●Maintain servo-on when EM2 (Forced stop 2) is off. When the servo turns off before EM2 (Forced stop 2), the operation state of the servo amplifier is the same as (1) (a) in this section.

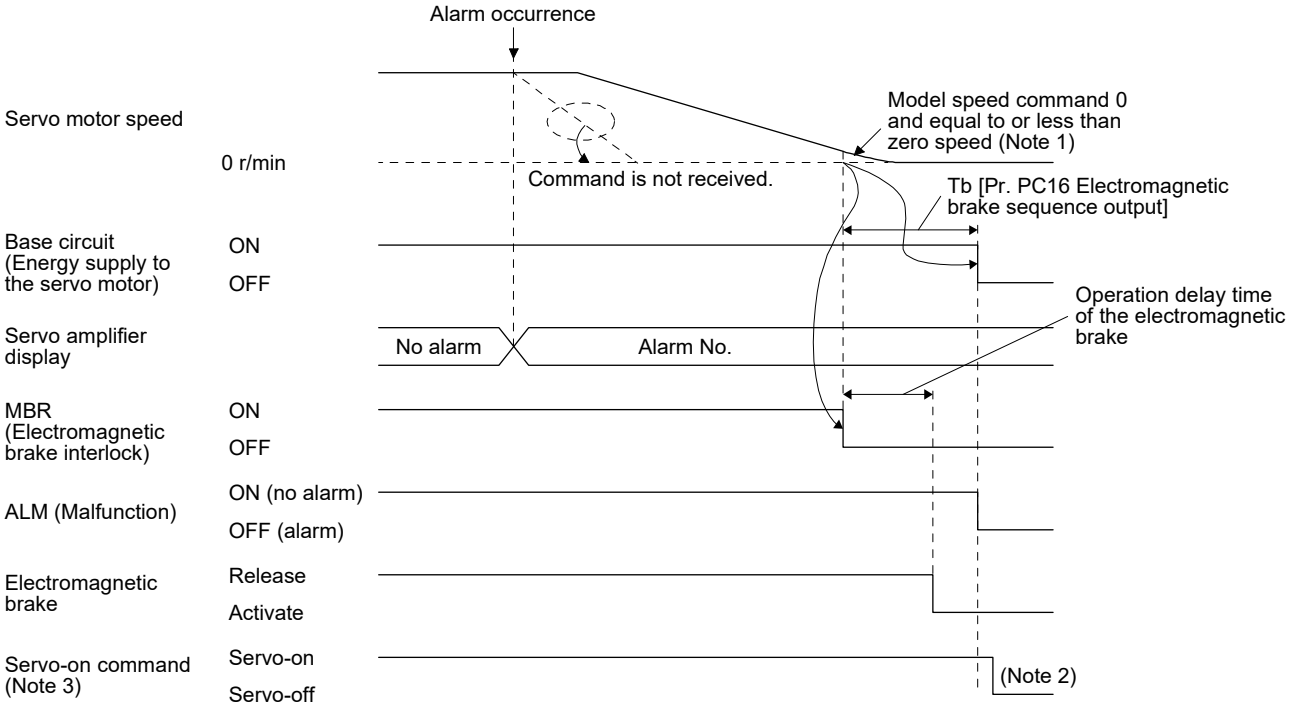


Note 1. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.

2. The model speed command is a speed command generated in the servo amplifier for forced stop deceleration of the servo motor.
3. Shut off the base circuit of the servo amplifier, then shut the servo off.
4. In the profile mode and when using the positioning mode with the communication interface, issuing a command from the master station (controller) to the servo amplifier enables servo-on/servo-off.
Servo-on: Enable Operation command is issued
Servo-off: Disable Operation command is issued

(c) Alarm occurrence

1) When the forced stop deceleration function is enabled



Note 1. The model speed command is a speed command generated in the servo amplifier for forced stop deceleration of the servo motor.

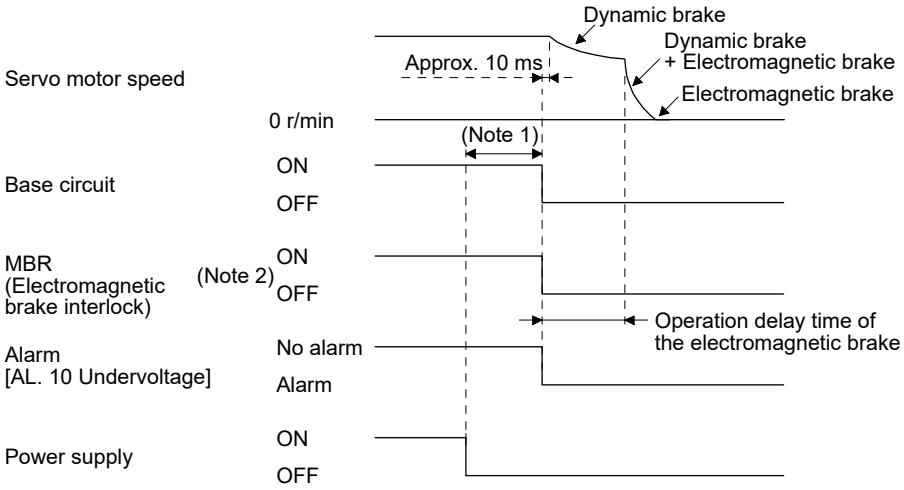
2. Shut off the base circuit of the servo amplifier, then shut the servo off.

3. In the profile mode and when using the positioning mode with the communication interface, issuing a command from the master station (controller) to the servo amplifier enables servo-on/servo-off.
   Servo-on: Enable Operation command is issued
   Servo-off: Disable Operation command is issued

2) When the forced stop deceleration function is disabled

The operation status is the same as section 3.8.1 (2).

(d) Power off



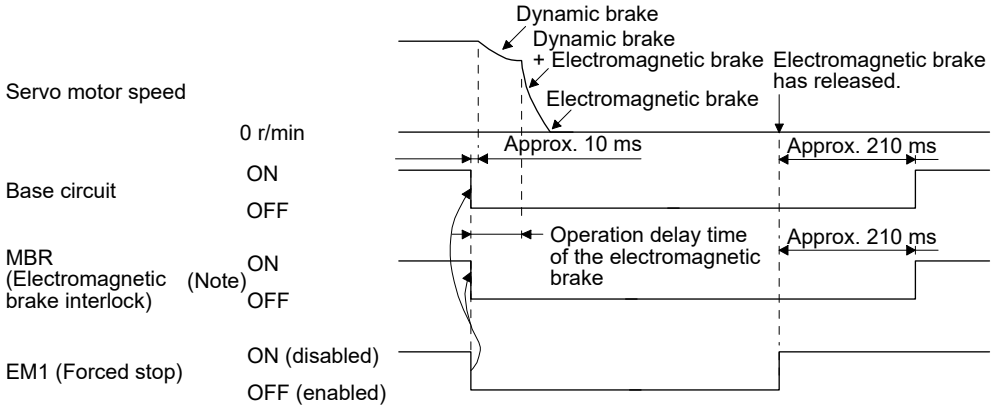
Note 1. Variable according to the operation status.
2. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.

(2) When you do not use the forced stop deceleration function

POINT
●To disable the function, set "0 _ _ _" in [Pr. PA04].

(a) Servo-on/Servo-off
It is the same as (1) (a) in this section.

(b) EM1 (Forced stop 1) on/off



Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.

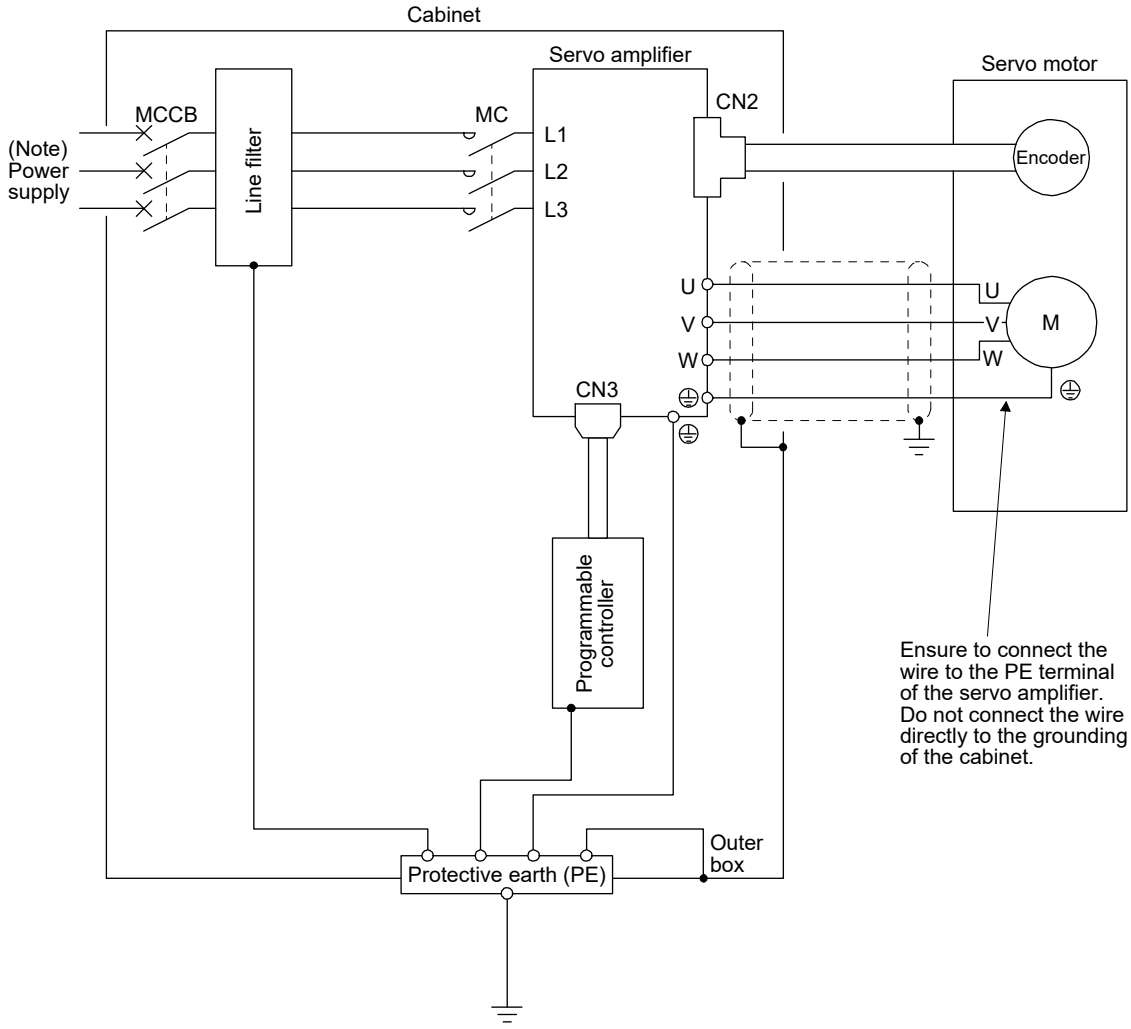
(c) Alarm occurrence
The operation status during an alarm is the same as section 3.8.2.

(d) Power off
It is the same as (1) (d) in this section.

3.11 Grounding

WARNING
- Ground the servo amplifier and servo motor securely.
- To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.

The servo amplifier switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cable routing, the servo amplifier may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram and always ground.
To conform to the EMC Directive, refer to "EMC Installation Guidelines".



Note. For the power supply specifications, refer to section 1.3.

4. STARTUP

⚠WARNING	●When executing a test run, follow the notice and procedures in this instruction manual. Otherwise, it may cause a malfunction, damage to the machine, or injury. ●Do not operate the switches with wet hands. Otherwise, it may cause an electric shock.

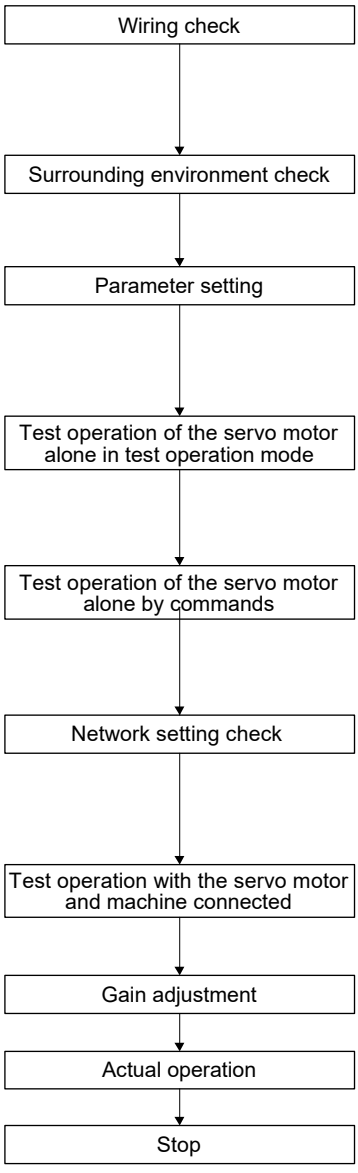
⚠CAUTION	●Before starting operation, check the parameters. Improper settings may cause some machines to operate unexpectedly. ●The servo amplifier heat sink, regenerative resistor, servo motor, etc., may be hot while the power is on and for some time after power-off. Take safety measures such as providing covers to avoid accidentally touching them by hands and parts such as cables. ●During operation, never touch the rotor of the servo motor. Otherwise, it may cause injury. ●Before wiring, switch operation, etc., eliminate static electricity. Otherwise, it may cause a malfunction.

4. STARTUP

4.1 Switching power on for the first time

When switching power on for the first time, follow this section to make a startup.

4.1.1 Startup procedure



Check whether the servo amplifier and servo motor are wired correctly using visual inspection, DO forced output function (section 4.7.1), etc. (Refer to section 4.1.2.)

Check the surrounding environment of the servo amplifier and servo motor. (Refer to section 4.1.3.)

Set the parameters as necessary, such as the used operation mode and regenerative option selection. (Refer to chapter 5, and sections 4.2.4, 4.3.4, and 4.4.4.)

For the test operation, with the servo motor disconnected from the machine and operated at the speed as low as possible, check whether the servo motor rotates correctly. (Refer to sections 4.2.3, 4.3.3, and 4.4.3.)

For the test operation with the servo motor disconnected from the machine and operated at the speed as low as possible, give commands to the servo amplifier and check whether the servo motor rotates correctly.

Check the network setting to connect the controller.
For network setting, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".

After connecting the servo motor with the machine, check machine motions with sending operation commands from the controller.

Make gain adjustment to optimize the machine motions. (Refer to chapter 6.)

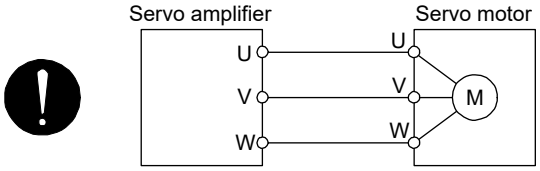
Stop giving commands and stop operation. Other conditions that stop the servo motor are mentioned in sections 4.2.2, 4.3.2, and 4.4.2.

4.1.2 Wiring check

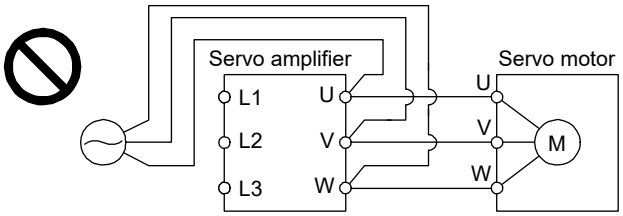
(1) Power supply system wiring
Before switching on the power supply, check the following items.

(a) Power supply system wiring
The power supplied to the power input terminals (L1/L2/L3) of the servo amplifier should satisfy the defined specifications. (Refer to section 1.3.)

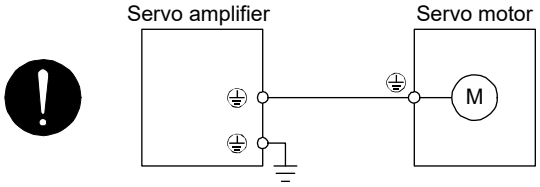
(b) Connection of servo amplifier and servo motor
1) The servo amplifier power output (U/V/W) should match in phase with the servo motor power input terminals (U/V/W).



2) The power supplied to the servo amplifier should not be connected to the power outputs (U/V/W). Otherwise, the servo amplifier and servo motor will fail.



3) The grounding terminal of the servo motor is connected to the PE terminal of the servo amplifier.



4) The CN2 connector of the servo amplifier should be connected to the encoder of the servo motor securely using the encoder cable.

(c) When you use an option and peripheral equipment
1) When you use a regenerative option for 1 kW or less servo amplifiers
- The built-in regenerative resistor and wirings should be removed from the servo amplifier.
- The lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should not be connected.
- The regenerative option should be connected to P+ terminal and C terminal.
- Twisted wires should be used. (Refer to section 11.2.4.)

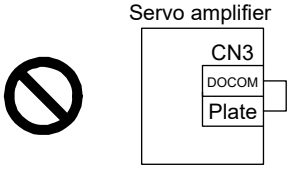
2) When you use a regenerative option for 2 kW or more servo amplifiers
- The lead wire between P+ terminal and D terminal should not be connected.
- The regenerative option should be connected to P+ terminal and C terminal.
- Twisted wires should be used. (Refer to section 11.2.4.)

(2) I/O signal wiring

(a) The I/O signals should be connected correctly.
Use DO forced output to forcibly turn on/off the pins of the CN3 connector. You can use the function to check the wiring. Switch off SON (Servo-on) to enable the function.
Refer to section 3.2 for details of I/O signal connection.

(b) A voltage exceeding 24 V DC is not applied to the pins of the CN3 connector.

(c) Between Plate and DOCOM of the CN3 connector should not be shorted.



4.1.3 Surrounding environment

(1) Cable routing

(a) The wiring cables should not be stressed.

(b) The encoder cable should not be used in excess of its bending life. (Refer to section 10.4.)

(c) The connector of the servo motor should not be stressed.

(2) Environment
Signal cables and power cables are not shorted by wire offcuts, metallic dust or the like.

4.2 Startup in position control mode

Make a startup in accordance with section 4.1. This section provides descriptions specific to the position control mode.

4.2.1 Power on and off procedures

(1) Power-on

Switch power on in the following procedure. Always follow this procedure at power-on.

1) Switch off SON (Servo-on).
2) Make sure that a command pulse train is not input.
3) Turn on the power.
   "C01" is shown on the display (when the identification No. is 01).

In the absolute position detection system, first power-on results in [AL. 25 Absolute position erased] and the servo system cannot be switched on. The alarm can be deactivated by then switching power off once and on again.
Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like. Power must therefore be switched on when the servo motor is at a stop.

(2) Power-off

1) Make sure that a command pulse train is not input.
2) Switch off SON (Servo-on).
3) Shut off the power.

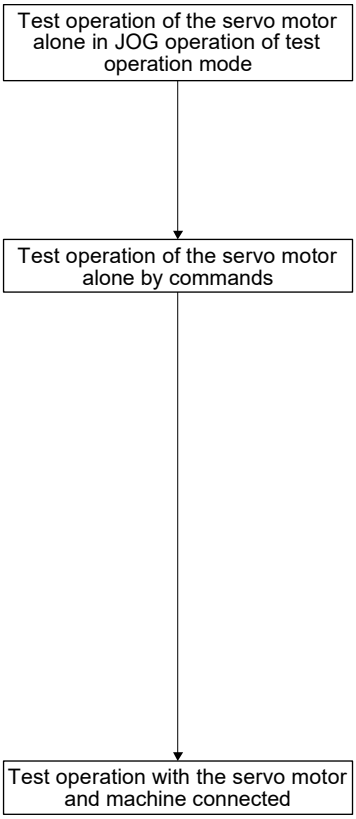
4.2.2 Stop

Turn off SON (Servo-on) after the servo motor has stopped, and then switch the power off.
If any of the following situations occurs, the servo amplifier suspends the running of the servo motor and brings it to a stop. Refer to section 3.10 for the servo motor with an electromagnetic brake.

Operation/command	Stopping condition
Switch off SON (Servo-on).	The base circuit is shut off and the servo motor coasts.
Alarm occurrence	The servo motor decelerates to a stop with the command. With some alarms, however, the dynamic brake operates to bring the servo motor to a stop. (Refer to chapter 8.)
EM2 (Forced stop 2) off	The servo motor decelerates to a stop with the command. [AL. E6 Servo forced stop warning] occurs. EM2 has the same function as EM1 in the torque control mode. Refer to section 3.5 for EM1.
LSP (Forward rotation stroke end) off, LSN (Reverse rotation stroke end) off	It will bring the motor to a sudden stop and make it servo-locked. It can be run in the opposite direction.

4.2.3 Test operation

Before starting actual operation, perform test operation to make sure that the machine operates normally. Refer to section 4.2.1 for how to power on and off the servo amplifier.



In this step, confirm that the servo amplifier and servo motor operate normally.
With the servo motor disconnected from the machine, use the test operation mode and check whether the servo motor correctly rotates at the slowest speed. Refer to section 4.7 for the test operation mode.

In this step, confirm that the servo motor correctly rotates at the slowest speed under the commands from the controller.
Make sure that the servo motor rotates in the following procedure.

1) Switch on EM2 (Forced stop 2) and SON (Servo-on). When the servo amplifier is put in a servo-on status, RD (Ready) switches on.
2) Switch on LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end).
3) When a pulse train is input from the controller, the servo motor starts rotating. Give a low speed command at first and check the rotation direction, etc. of the servo motor. If the machine does not operate in the intended direction, check the input signal.

In this step, connect the servo motor with the machine and confirm that the machine operates normally under the commands from the controller.
Make sure that the servo motor rotates in the following procedure.

1) Switch on EM2 (Forced stop 2) and SON (Servo-on). When the servo amplifier is put in a servo-on status, RD (Ready) switches on.
2) Switch on LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end).
3) When a pulse train is input from the controller, the servo motor starts rotating. Give a low speed command at first and check the operation direction, etc. of the machine. If the machine does not operate in the intended direction, check the input signal. In the status display, check for any problems of the servo motor speed, command pulse frequency, load ratio, etc.
4) Then, check automatic operation with the program of the controller.

4.2.4 Parameter setting

POINT

●The following encoder cables are of four-wire type. When using any of these encoder cables, set [Pr. PC22] to "1 _ _ _" to select the four-wire type. Incorrect setting will result in [AL. 16 Encoder initial communication error 1].
MR-EKCBL30M-L
MR-EKCBL30M-H
MR-EKCBL40M-H
MR-EKCBL50M-H

In the position control mode, the servo amplifier can be used by merely changing the basic setting parameters ([Pr. PA _ _]) mainly.
As necessary, set other parameters.

4.2.5 Actual operation

Start actual operation after confirmation of normal operation by test operation and completion of the corresponding parameter settings. Perform a home position return as necessary.

4.2.6 Trouble at start-up

> **CAUTION** ●Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable.

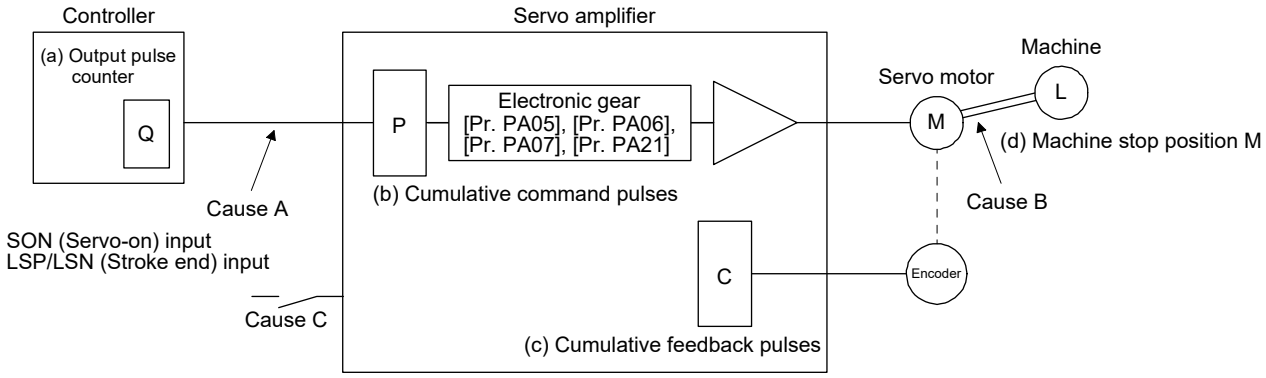
> **POINT**
> ●Using the optional MR Configurator2, you can refer to reason for rotation failure, etc.

The following faults may occur at start-up. If any of such faults occurs, take the corresponding action.

(1) Troubleshooting

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
1	Power on	・7-segment LED is not lit. ・7-segment LED blinks.	Not improved even if CN3 and CN2 connectors are disconnected.	1. Power supply voltage fault 2. The servo amplifier is malfunctioning.	
			Improved when CN3 connector is disconnected.	Power supply of CN3 cabling is shorted.	
			Improved when CN2 connector is disconnected.	1. Power supply of encoder cabling is shorted. 2. Encoder is malfunctioning.	
		Alarm occurs.	Refer to chapter 8 and remove cause.		Chapter 8
2	Switch on SON (Servo-on).	Alarm occurs.	Refer to chapter 8 and remove cause.		Chapter 8
		Servo motor shaft is not servo-locked. (Servo motor shaft is free.)	1. Check if "dxx (servo-on)" is shown on the display. 2. Check if SON (servo-on) shown on the I/O monitor of MR Configurator2.	1. SON (Servo-on) is not input. (wiring mistake) 2. 24 V DC power is not supplied to DICOM.	Section 4.5.3
3	Input command pulse (test operation).	Servo motor does not rotate.	Check the cumulative command pulses shown on the I/O monitor of MR Configurator2.	1. Wiring mistake (a) For open collector pulse train input, 24 V DC power is not supplied to OPC. (b) LSP and LSN are not on. 2. Pulse is not input from the controller.	
				Mistake in setting of [Pr. PA13].	Chapter 5
		Servo motor run in reverse direction.		1. Mistake in wiring to controller. 2. Mistake in setting of [Pr. PA14].	
4	Gain adjustment	Rotation ripples (speed fluctuations) are large at low speed.	Make gain adjustment in the following procedure. 1. Increase the auto tuning response level. 2. Repeat acceleration and deceleration three times to complete auto tuning.	Gain adjustment fault	Chapter 6
		Large load inertia moment causes the servo motor shaft to oscillate side to side.	If the servo motor may be driven with safety, repeat acceleration and deceleration three times to complete auto tuning.	Gain adjustment fault	Chapter 6
5	Cyclic operation	Position shift occurs	Confirm the cumulative command pulses, cumulative feedback pulses and actual servo motor position.	Pulse counting error, etc. due to noise.	(2) in this section

(2) How to find the cause of position shift



When a position shift occurs, check (a) output pulse counter Q, (b) cumulative command pulse P, (c) cumulative feedback pulse C, and (d) machine stop position M in the above diagram.
Also, Causes A, B, and C indicate the causes of position mismatch. For example, Cause A indicates that noise entered the wiring between the controller and servo amplifier, causing command input pulses to be miscounted.

In a normal status without position shift, there are the following relationships.

1) Q = P (Output counter = Cumulative command pulses)

2) When [Pr. PA21] is "0 _ _ _"

$$P \bullet \frac{\text{CMX [Pr. PA06]}}{\text{CDV [Pr. PA07]}} = C$$ (Cumulative command pulses × Electronic gear = Cumulative feedback pulses)

3) When [Pr. PA21] is "1 _ _ _"

$$P \bullet \frac{131072}{\text{FBP [Pr. PA05]}} = C$$

4) $C \bullet \Delta\ell = M$ (Cumulative feedback pulses × Travel distance per pulse = Machine position)

Check for a position mismatch in the following sequence.

1) When $Q \neq P$
Noise entered the pulse train signal wiring between the controller and servo amplifier, causing command input pulses to be miscounted. (Cause A)
Make the following check or take the following measures.
- Check how the shielding is done.
- Change the open collector type to the differential line driver type.
- Run wiring away from the power circuit.
- Install a data line filter. (Refer to section 11.10 (2) (a).)
- Change the [Pr. PA13 Command pulse input form] setting.

2) When $P \cdot \frac{CMX}{CDV} \neq C$

During operation, SON (Servo-on), LSP (Forward rotation stroke end), or LSN (Reverse rotation stroke end) was switched off; or CR (Clear) or RES (Reset) was switched on. (Cause C)

3) When $C \cdot \Delta\ell \neq M$

Mechanical slip occurred between the servo motor and machine. (Cause B)

4.3 Startup in speed control mode

Make a startup in accordance with section 4.1. This section provides the methods specific to the speed control mode.

4.3.1 Power on and off procedures

(1) Power-on

Switch power on in the following procedure. Always follow this procedure at power-on.

1) Switch off SON (Servo-on).
2) Make sure that ST1 (Forward rotation start) and ST2 (Reverse rotation start) are off.
3) Turn on the power.
"C01" is shown on the display (when the identification No. is 01).

(2) Power-off

1) Switch off ST1 (Forward rotation start) and ST2 (Reverse rotation start).
2) Switch off SON (Servo-on).
3) Shut off the power.

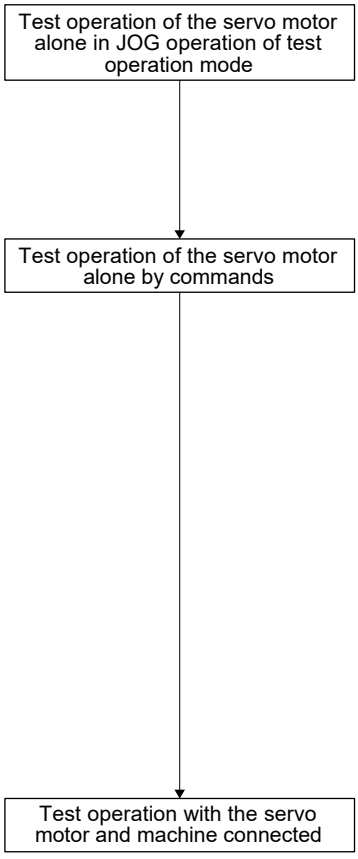
4.3.2 Stop

Turn off SON (Servo-on) after the servo motor has stopped, and then switch the power off.
If any of the following situations occurs, the servo amplifier suspends the running of the servo motor and brings it to a stop.
Refer to section 3.10 for the servo motor with an electromagnetic brake.

Operation/command	Stopping condition
Switch off SON (Servo-on).	The base circuit is shut off and the servo motor coasts.
Alarm occurrence	The servo motor decelerates to a stop with the command. With some alarms, however, the dynamic brake operates to bring the servo motor to a stop. (Refer to chapter 8.)
EM2 (Forced stop 2) off	The servo motor decelerates to a stop with the command. [AL. E6 Servo forced stop warning] occurs. EM2 has the same function as EM1 in the torque control mode. Refer to section 3.5 for EM1.
LSP (Forward rotation stroke end) off, LSN (Reverse rotation stroke end) off	It will bring the motor to a sudden stop and make it servo-locked. It can be run in the opposite direction.
Simultaneous on or off of ST1 (Forward rotation start) and ST2 (Reverse rotation start)	The servo motor is decelerated to a stop.

4.3.3 Test operation

Before starting actual operation, perform test operation to make sure that the machine operates normally. Refer to section 4.3.1 for how to power on and off the servo amplifier.



In this step, confirm that the servo amplifier and servo motor operate normally.
With the servo motor disconnected from the machine, use the test operation mode and check whether the servo motor correctly rotates at the slowest speed. Refer to section 4.7 for the test operation mode.

In this step, confirm that the servo motor correctly rotates at the slowest speed under the commands from the controller.
Make sure that the servo motor rotates in the following procedure.

1) Switch on EM2 (Forced stop 2) and SON (Servo-on). When the servo amplifier is put in a servo-on status, RD (Ready) switches on.
2) Switch on LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end).
3) When VC (Analog speed command) is input from the controller and ST1 (Forward rotation start) or ST2 (Reverse rotation start) is switched on, the servo motor starts rotating. Give a low speed command at first and check the rotation direction, etc. of the servo motor. If the machine does not operate in the intended direction, check the input signal.

In this step, connect the servo motor with the machine and confirm that the machine operates normally under the commands from the controller.
Make sure that the servo motor rotates in the following procedure.

1) Switch on EM2 (Forced stop 2) and SON (Servo-on). When the servo amplifier is put in a servo-on status, RD (Ready) switches on.
2) Switch on LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end).
3) When VC (Analog speed command) is input from the controller and ST1 (Forward rotation start) or ST2 (Reverse rotation start) is switched on, the servo motor starts rotating. Give a low speed command at first and check the operation direction, etc. of the machine. If the machine does not operate in the intended direction, check the input signal. In the status display, check for any problems of the servo motor speed, load ratio, etc.
4) Then, check automatic operation with the program of the controller.

4.3.4 Parameter setting

POINT

●The following encoder cables are of four-wire type. When using any of these encoder cables, set [Pr. PC22] to "1 _ _ _" to select the four-wire type. Incorrect setting will result in [AL. 16 Encoder initial communication error 1].
MR-EKCBL30M-L
MR-EKCBL30M-H
MR-EKCBL40M-H
MR-EKCBL50M-H

When using this servo in the speed control mode, change [Pr. PA01] setting to select the speed control mode. In the speed control mode, the servo can be used by merely changing the basic setting parameters ([Pr. PA _ _]) and extension setting parameters ([Pr. PC _ _]) mainly.
As necessary, set other parameters.

4.3.5 Actual operation

Start actual operation after confirmation of normal operation by test operation and completion of the corresponding parameter settings.

4.3.6 Trouble at start-up

⚠CAUTION ●Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable.

POINT

●Using the optional MR Configurator2, you can refer to reason for rotation failure, etc.

The following faults may occur at start-up. If any of such faults occurs, take the corresponding action.

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
1	Power on	・7-segment LED is not lit. ・7-segment LED blinks.	Not improved even if CN3 and CN2 connectors are disconnected.	1. Power supply voltage fault 2. The servo amplifier is malfunctioning.	
			Improved when CN3 connector is disconnected.	Power supply of CN3 cabling is shorted.	
			Improved when CN2 connector is disconnected.	1. Power supply of encoder cabling is shorted. 2. Encoder is malfunctioning.	
		Alarm occurs.	Refer to chapter 8 and remove cause.		Chapter 8
2	Switch on SON (Servo-on).	Alarm occurs.	Refer to chapter 8 and remove cause.		Chapter 8
		Servo motor shaft is not servo-locked. (Servo motor shaft is free.)	1. Check if "dxx (servo-on)" is shown on the display. 2. Check if SON (servo-on) shown on the I/O monitor of MR Configurator2.	1. SON (Servo-on) is not input. (wiring mistake) 2. 24 V DC power is not supplied to DICOM.	Section 4.5.3
3	Switch on ST1 (Forward rotation start) or ST2 (Reverse rotation start).	Servo motor does not rotate.	Check the input voltage of VC (Analog speed command) on the I/O monitor of MR Configurator2.	Analog speed command is 0 V.	
			Check the on/off status of the input signal on the I/O monitor of MR Configurator2.	LSP, LSN, ST1, and ST2 are off.	
			Check the internal speed commands 1 to 7 ([Pr. PC05] to [Pr. PC11]).	Set value is 0.	Section 5.2.3
			Check the forward rotation torque limit ([Pr. PA11]) and the reverse rotation torque limit ([Pr. PA12]).	Torque limit level is too low as compared to the load torque.	Section 5.2.1
			When TLA (Analog torque limit) is usable, check the input voltage on the I/O monitor of MR Configurator2.	Torque limit level is too low as compared to the load torque.	

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
4	Gain adjustment	Rotation ripples (speed fluctuations) are large at low speed.	Make gain adjustment in the following procedure. 1. Increase the auto tuning response level. 2. Repeat acceleration and deceleration three times to complete auto tuning.	Gain adjustment fault	Chapter 6
		Large load inertia moment causes the servo motor shaft to oscillate side to side.	If the servo motor may be driven with safety, repeat acceleration and deceleration three times to complete auto tuning.	Gain adjustment fault	Chapter 6

4.4 Startup in torque control mode

Make a startup in accordance with section 4.1. This section provides the methods specific to the torque control mode.

4.4.1 Power on and off procedures

(1) Power-on

Switch power on in the following procedure. Always follow this procedure at power-on.

1) Switch off SON (Servo-on).

2) Make sure that RS1 (Forward rotation selection) and RS2 (Reverse rotation selection) are off.

3) Turn on the power.
"C01" is shown on the display (when the identification No. is 01).

(2) Power-off

1) Switch off RS1 (Forward rotation selection) or RS2 (Reverse rotation selection).

2) Switch off SON (Servo-on).

3) Shut off the power.

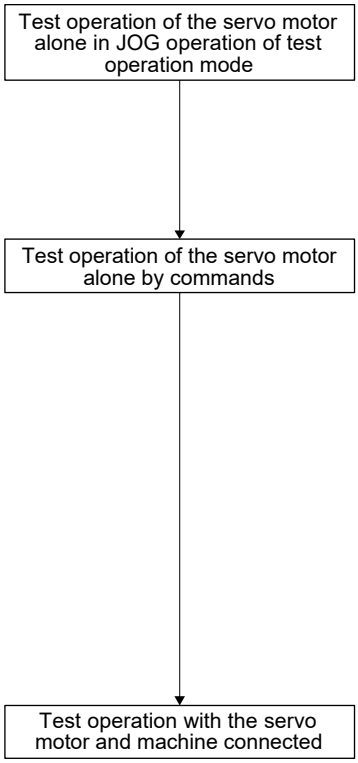
4.4.2 Stop

Turn off SON (Servo-on) after the servo motor has stopped, and then switch the power off.
If any of the following situations occurs, the servo amplifier suspends the running of the servo motor and brings it to a stop. Refer to section 3.10 for the servo motor with an electromagnetic brake.

Operation/command	Stopping condition
Switch off SON (Servo-on).	The base circuit is shut off and the servo motor coasts.
Alarm occurrence	The servo motor decelerates to a stop with the command. With some alarms, however, the dynamic brake operates to bring the servo motor to a stop. (Refer to chapter 8.)
EM2 (Forced stop 2) off	This stops the servo motor with the dynamic brake. [AL. E6 Servo forced stop warning] occurs. EM2 has the same function as EM1 in the torque control mode. Refer to section 3.5 for EM1.
Simultaneous on or off of RS1 (Forward rotation selection) and RS2 (Reverse rotation selection)	The servo motor coasts.

4.4.3 Test operation

Before starting actual operation, perform test operation to make sure that the machine operates normally. Refer to section 4.4.1 for how to power on and off the servo amplifier.



In this step, confirm that the servo amplifier and servo motor operate normally.
With the servo motor disconnected from the machine, use the test operation mode and check whether the servo motor correctly rotates at the slowest speed. Refer to section 4.7 for the test operation mode.

In this step, confirm that the servo motor correctly rotates at the slowest speed under the commands from the controller.
Make sure that the servo motor rotates in the following procedure.

1) Switch on SON (Servo-on). When the servo amplifier is put in a servo-on status, RD (Ready) switches on.
2) When TC (Analog speed command) is input from the controller and RS1 (Forward rotation start) or RS2 (Reverse rotation start) is switched on, the servo motor starts rotating. Give a low torque command at first and check the rotation direction, etc. of the servo motor. If the machine does not operate in the intended direction, check the input signal.

In this step, connect the servo motor with the machine and confirm that the machine operates normally under the commands from the controller.
Make sure that the servo motor rotates in the following procedure.

1) Switch on SON (Servo-on). When the servo amplifier is put in a servo-on status, RD (Ready) switches on.
2) When TC (Analog speed command) is input from the controller and RS1 (Forward rotation start) or RS2 (Reverse rotation start) is switched on, the servo motor starts rotating. Give a low torque command at first and check the operation direction, etc. of the machine. If the machine does not operate in the intended direction, check the input signal. In the status display, check for any problems of the servo motor speed, load ratio, etc.
3) Then, check automatic operation with the program of the controller.

4.4.4 Parameter setting

POINT

●The following encoder cables are of four-wire type. When using any of these encoder cables, set [Pr. PC22] to "1 _ _ _" to select the four-wire type. Incorrect setting will result in [AL. 16 Encoder initial communication error 1].
MR-EKCBL30M-L
MR-EKCBL30M-H
MR-EKCBL40M-H
MR-EKCBL50M-H

When using this servo in the torque control mode, change [Pr. PA01] setting to select the torque control mode. In the torque control mode, the servo can be used by merely changing the basic setting parameters ([Pr. PA _ _]) and extension setting parameters ([Pr. PC _ _]) mainly.
As necessary, set other parameters.

4.4.5 Actual operation

Start actual operation after confirmation of normal operation by test operation and completion of the corresponding parameter settings.

4.4.6 Trouble at start-up

⚠CAUTION ●Never make a drastic adjustment or change to the parameter values as doing so will make the motion unstable.

POINT

●Using the optional MR Configurator2, you can refer to reason for rotation failure, etc.

The following faults may occur at start-up. If any of such faults occurs, take the corresponding action.

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
1	Power on	・7-segment LED is not lit. ・7-segment LED blinks.	Not improved even if CN3 and CN2 connectors are disconnected.	1. Power supply voltage fault 2. The servo amplifier is malfunctioning.	
			Improved when CN3 connector is disconnected.	Power supply of CN3 cabling is shorted.	
			Improved when CN2 connector is disconnected.	1. Power supply of encoder cabling is shorted. 2. Encoder is malfunctioning.	
		Alarm occurs.	Refer to chapter 8 and remove cause.		Chapter 8
2	Switch on SON (Servo-on).	Alarm occurs.	Refer to chapter 8 and remove cause.		Chapter 8
		Servo motor shaft is free.	Check the on/off status of the input signal on the I/O monitor of MR Configurator2.	1. SON (Servo-on) is not input. (wiring mistake) 2. 24 V DC power is not supplied to DICOM.	
3	Switch on RS1 (Forward rotation start) or RS2 (Reverse rotation start).	Servo motor does not rotate.	Check the input voltage of TC (Analog torque command) on the I/O monitor of MR Configurator2.	Analog torque command is 0 V.	
			Check the on/off status of the input signal on the I/O monitor of MR Configurator2.	RS1 and RS2 are off.	
			Check the internal speed limit 1 to 7 ([Pr. PC05] to [Pr. PC11]).	Set value is 0.	Section 5.2.3
			Check the analog torque command maximum output ([Pr. PC13]) value.	Torque command level is too low as compared to the load torque.	Section 5.2.3
			Check the forward rotation torque limit ([Pr. PA11]) and the reverse rotation torque limit ([Pr. PA12]).	Set value is 0.	Section 5.2.1

4.5 Display and operation sections

POINT

- MR-JE_C displays the identification No. on the right two digits of the 3-digit, 7-segment LED.
- In "communication function selection" of [Pr. PN08], when selecting "Ethernet communication (CC-Link IE field network Basic, SLMP and Modbus/TCP) (0 _ _ _)", the identification number is the IP address fourth octet.
- In "communication function selection" of [Pr. PN08], when selecting "RS-485 communication (Modbus RTU) (1 _ _ _)", the identification number is Modbus RTU station number.

The identification No. can be set with switches on the servo amplifier.
On the servo amplifier display (3-digit, 7 segment LED), check the identification No. and carry out failure diagnosis when alarms occur. The communication status can be checked with the CN1 connector LED.

4.5.1 Summary

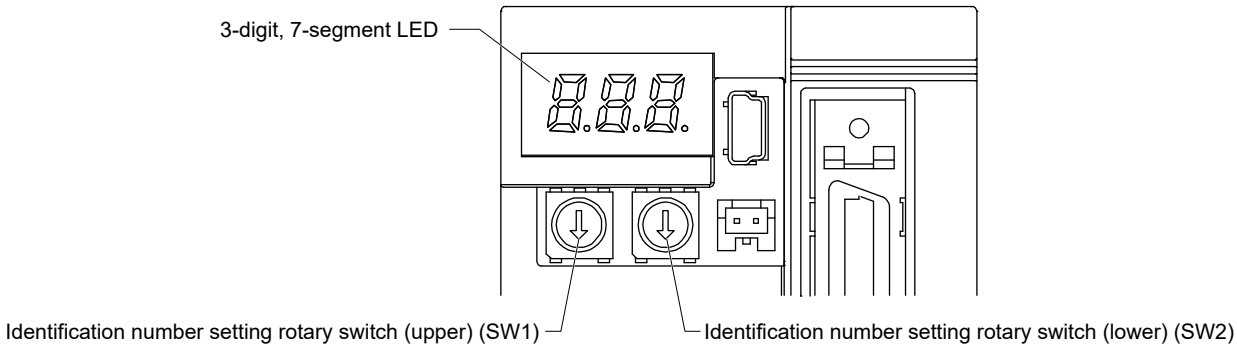
⚠WARNING

- When switching the identification number setting rotary switch (SW1/SW2), use an insulated screw driver. Do not use a metal screw driver. Touching patterns on electronic boards, lead of electronic parts, etc. may cause an electric shock.

POINT

- The identification number setting rotary switch (SW1/SW2) setting becomes enabled after cycling the power.

The following figure shows the identification number setting rotary switch.

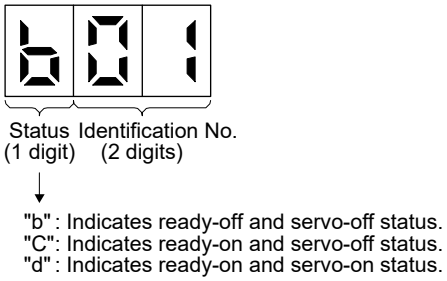


Set the identification number of the servo amplifier in hexadecimal. For setting, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".

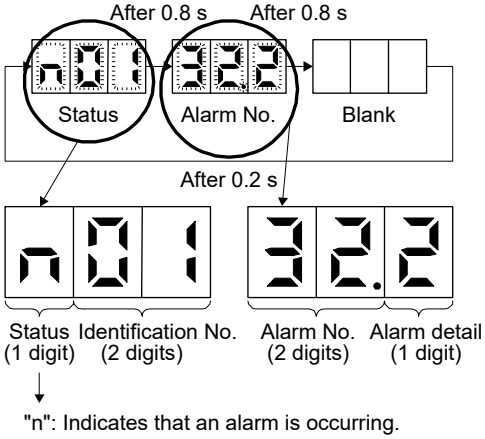
4.5.2 Scrolling display

Identification number will be displayed in hexadecimal.

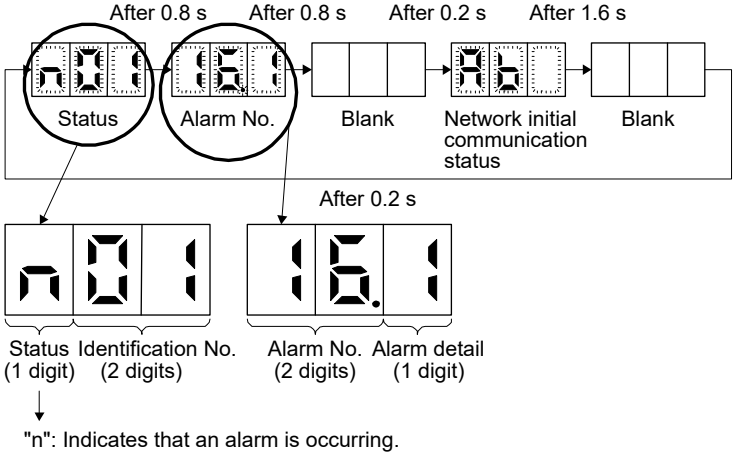
(1) Normal display
When there is no alarm, the identification number is displayed.



(2) Alarm display
When an alarm occurs, the alarm number (two digits) and the alarm detail (one digit) are displayed following the status display. For example, the following shows when [AL. 32 Overcurrent] is occurring.

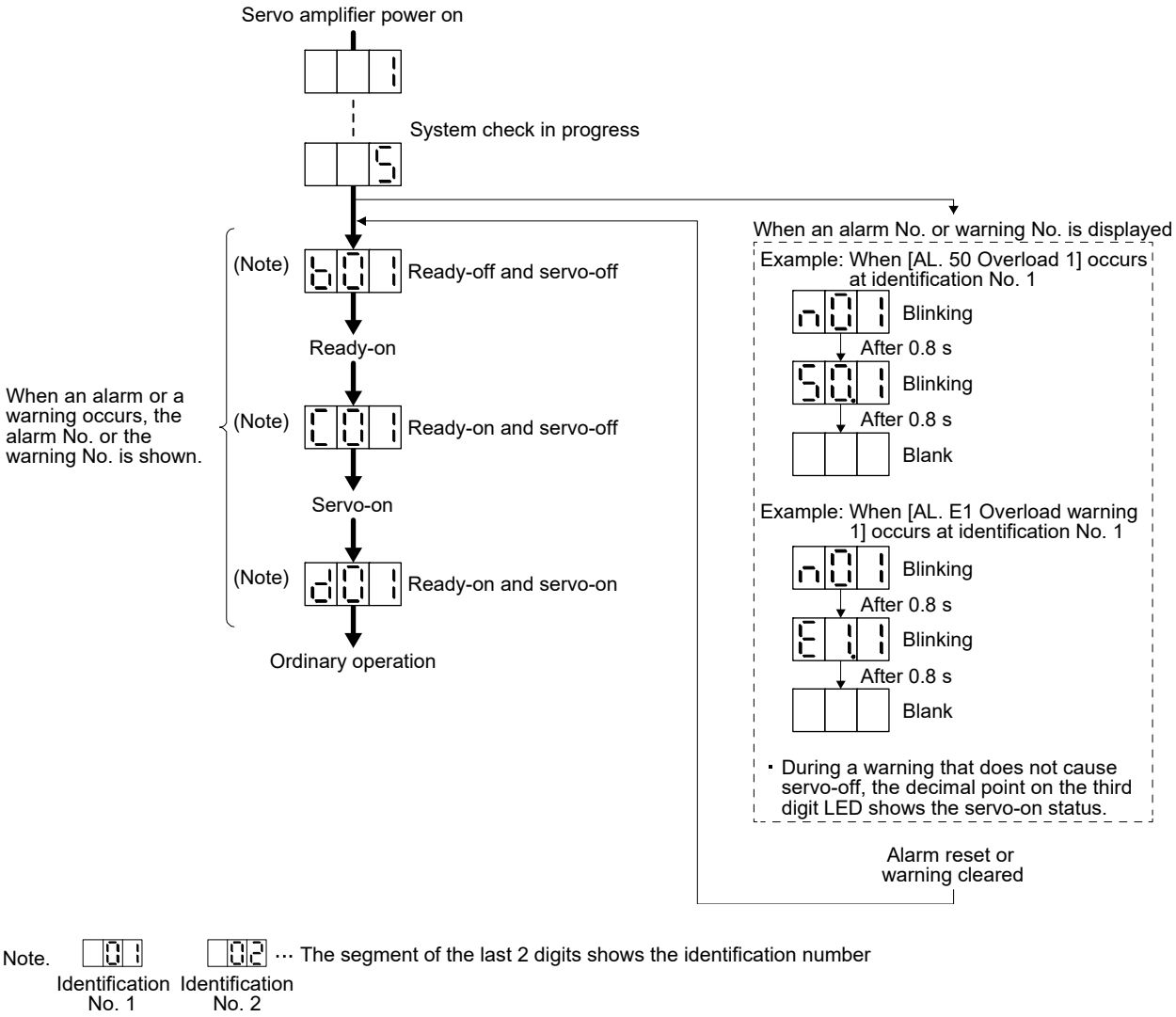


If an alarm occurs during initial communication through a network, the status, the alarm number (two digits) and alarm detail (one digit), and the network initial communication status are displayed, in that order. For example, the following shows when [AL. 16.1 Encoder initial communication - Receive data error 1] is occurring.



4.5.3 Status display mode

(1) Display sequence



Note. ⋯ The segment of the last 2 digits shows the identification number

Identification No. 1 Identification No. 2

(2) Indication list

Display	Status	Description
1 ⋮ 5	Initializing	System check in progress
(Note 1) b##	Ready-off	The ready-off command was received.
(Note 1) C##	Ready-on, servo-off	The servo-off command was received.
(Note 1) d##	Ready-on, servo-on	The servo-on command was received.
(Note 1) n##	Alarm occurring	An alarm or warning has occurred in the servo amplifier.
(Note 2) ***	Alarm and warning	The alarm No. and the warning No. that occurred are displayed. (Refer to chapter 8. (Note 4))
888	CPU error	A CPU watchdog error has occurred.
(Note 1) b#. C#. d#.	(Note 3) Test operation mode Adjustment	During test operation JOG operation, positioning operation, program operation, output signal (DO) forced output, single-step feed (Note 5), or motor-less operation was set. Machine analyzer function

Note 1. ## is displayed in hexadecimal. The following table shows the description.

##	[Pr. PN08]	Description
00 to FF	0 _ _ _	Identification number (4th octet of the IP address) is displayed. The 4th octet of the IP address can be set with the rotary switch (SW1/SW2) or [Pr. PN14].
	1 _ _ _	Identification number (station number) is displayed. The station number can be set with the rotary switch (SW1/SW2) or [Pr. PC70].

2. "***" indicates the alarm No. and the warning No.
3. Requires the MR Configurator2.
4. Only a list of alarms and warnings is listed in chapter 8. Refer to "MELSERVO-JE Servo Amplifier Instruction Manual (Troubleshooting)" for details of alarms and warnings.
5. The single-step feed can only be used for the point table method. For details, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Positioning Mode)".

4.5.4 Ethernet status display LED

The following shows the Ethernet status display LED.

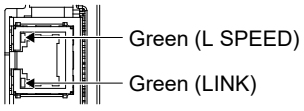


Table 4.1 LED indication list

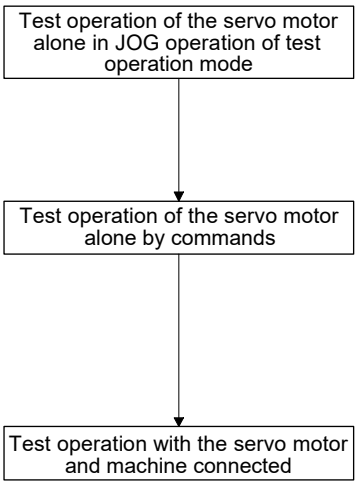
LED	Name	Lighting status	Description
L SPEED (CN1)	100 Mbps communication status	Lit	During 100 Mbps communication
		Extinguished	Communication speed error or disconnection
LINK (CN1)	Link status	Lit	Linking up
		Blinking	During data transfer
		Extinguished	Link unestablished

4.6 Test operation

Before starting actual operation, perform test operation to make sure that the machine operates normally. Refer to section 4.2.1, section 4.3.1, and section 4.4.1 for how to power on and off the servo amplifier.

POINT

- If necessary, verify controller programs by using motor-less operation. Refer to section 4.7.2 for the motor-less operation.



In this step, confirm that the servo amplifier and servo motor operate normally. With the servo motor disconnected from the machine, use the test operation mode and check whether the servo motor rotates correctly. Refer to section 4.7 for the test operation mode.

In this step, confirm that the servo motor rotates correctly under the commands from the controller.
Give a low speed command first and check the rotation direction, etc. of the servo motor. If the machine does not operate in the intended direction, check the input signal.

In this step, connect the servo motor with the machine and confirm that the machine operates normally under the commands from the controller.
Give a low speed command first and check the operation direction, etc. of the machine. If the machine does not operate in the intended direction, check the input signal.
Check any problems with the servo motor speed, load ratio, and other status display items with MR Configurator2.
Then, check automatic operation with the program of the controller.

4.7 Test operation mode

⚠CAUTION

- The test operation mode is designed for checking servo operation. It is not for checking machine operation. Do not use this mode with the machine. Always use the servo motor alone.
- If the servo motor operates abnormally, use EM2 (Forced stop 2) to stop it.

POINT

- The content described in this section indicates that the servo amplifier and a personal computer are directly connected.

By using a personal computer and MR Configurator2, you can execute JOG operation, positioning operation, output signal forced output, single-step feed, and program operation without connecting the controller.

4.7.1 Test operation mode in MR Configurator2

POINT
●MR Configurator2 is required to perform positioning operation. ●Test operation cannot be performed unless SON (Servo-on) is not turned off. ●When performing JOG operation, turn on EM2, LSP and LSN. LSP and LSN can be set to automatic on by setting [Pr. PD01] to " _ C _ _ ".

(1) Test operation mode

(a) JOG operation

JOG operation can be performed without using the controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on or off and whether the controller is connected or not.

Exercise control on the JOG operation screen of MR Configurator2.

1) Operation pattern

Item	Initial value	Setting range
Speed [r/min]	200	0 to maximum speed
Acceleration/deceleration time constant [ms]	1000	0 to 50000

2) Operation method

・The check box "Rotation only while the CCW or CW button is being pushed" is checked.

Operation	Screen control
Forward rotation start	Keep pressing "Forward CCW".
Reverse rotation start	Keep pressing "Reverse CW".
Stop	Release "Forward CCW" or "Reverse CW".
Forced stop	Click "Forced Stop".

・The check box "Rotation only while the CCW or CW button is being pushed" is unchecked.

Operation	Screen control
Forward rotation start	Click "Forward CCW".
Reverse rotation start	Click "Reverse CW".
Stop	Click "Stop".
Forced stop	Click "Forced Stop".

(b) Positioning operation

Positioning operation can be performed without using the controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on or off and whether the controller is connected or not.

Exercise control on the positioning operation screen of MR Configurator2.

1) Operation pattern

Item	Initial value	Setting range
Travel distance [pulse]	4000	0 to 99999999
Speed [r/min]	200	0 to maximum speed
Acceleration/deceleration time constant [ms]	1000	0 to 50000
Repeat pattern	Fwd. rot. (CCW) to rev. rot. (CW)	Fwd. rot. (CCW) to rev. rot. (CW) Fwd. rot. (CCW) to fwd. rot. (CCW) Rev. rot. (CW) to fwd. rot. (CCW) Rev. rot. (CW) to rev. rot. (CW)
Dwell time [s]	2.0	0.1 to 50.0
Number of repeats [time]	1	1 to 9999

2) Operation method

Operation	Screen control
Forward rotation start	Click "Forward CCW".
Reverse rotation start	Click "Reverse CW".
Pause	Click "Pause".
Stop	Click "Stop".
Forced stop	Click "Forced Stop".

(c) Program operation

Positioning operation can be performed in two or more operation patterns combined, without using the controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on or off and whether the controller is connected or not. Exercise control on the program operation screen of MR Configurator2. For details, refer to Help of MR Configurator2.

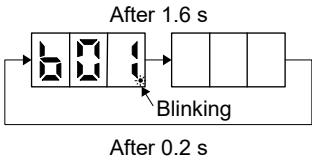
Operation	Screen control
Start	Click "Operation Start".
Pause	Click "Pause".
Stop	Click "Stop".
Forced stop	Click "Forced Stop".

(d) Output signal (DO) forced output

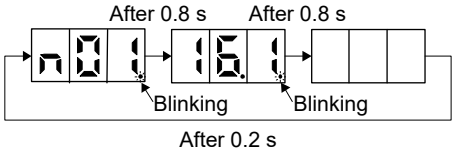
Output signals can be switched on or off forcibly independently of the servo status. This function is used for output signal wiring check, etc. Exercise control on the DO forced output screen of MR Configurator2.

(2) Operation procedure

1) Set "_ _ 1 0" in [Pr. PC60] and cycle the power.
When initialization is completed, the decimal point on the first digit will blink.



When an alarm or warning also occurs during the test operation, the decimal point on the first digit will blink as follows.



2) Start operation with the personal computer.

4.7.2 Motor-less operation in the controller

POINT
●Use motor-less operation which is available by making the controller parameter setting. ●Connect the servo amplifier with the controller before the motor-less operation.

(1) Motor-less operation

Without connecting a servo motor to the servo amplifier, output signals or status displays can be provided in response to the input device and controller commands as if the servo motor is actually running. This operation may be used to check the controller sequence. Use this operation with the forced stop reset. Use this operation with the servo amplifier connected to the controller.
To stop the motor-less operation, set the motor-less operation selection to "Disable" in the servo parameter setting of the controller. When the power supply is turned on next time, motor-less operation will be disabled.

(a) Load conditions

Load item	Condition
Load torque	0
Load to motor inertia ratio	[Pr. PB06 Load to motor inertia ratio]

(b) Alarms

The following alarms and warnings do not occur. However, the other alarms and warnings occur as when the servo motor is connected.

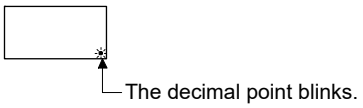
- [AL. 16 Encoder initial communication error 1]
- [AL. 1E Encoder initial communication error 2]
- [AL. 1F Encoder initial communication error 3]
- [AL. 20 Encoder normal communication error 1]
- [AL. 21 Encoder normal communication error 2]
- [AL. 25 Absolute position erased]
- [AL. 92 Battery cable disconnection warning]
- [AL. 9F Battery warning]

(2) Operation procedure

1) Set the servo amplifier to the servo-off status.

2) Set "_ _ 0 1" in [Pr. PC60] and cycle the power.

3) Start the motor-less operation with the controller.
The display shows the following screen.



5. PARAMETERS

⚠CAUTION	●Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable. ●Do not change the parameter settings as described below. Doing so may cause an unexpected condition, such as failing to start up the servo amplifier. ・Changing the values of the parameters for manufacturer setting ・Setting a value out of the range ・Changing the fixed values in the digits of a parameter ●When you write parameters with the controller, make sure that the identification No. of the servo amplifier is set correctly. Otherwise, the parameter settings of another identification No. may be written, possibly causing the servo amplifier to be an unexpected condition.

5.1 Parameter list

POINT

●To enable a parameter whose symbol is preceded by *, turn off the power for 1 s or more after setting and turn it on again. However, the time will be longer depending on a setting value of [Pr. PF25 instantaneous power failure tough drive - detection time] when "Instantaneous power failure tough drive selection" is enabled in [Pr. PA20].

●The symbols in the control mode column mean as follows.
P: Position control mode
S: Speed control mode
T: Torque control mode

5.1.1 Basic setting parameters ([Pr. PA_ _])

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PA01	*STY	Operation mode	1000h		○	○	○
PA02	*REG	Regenerative option	0000h		○	○	○
PA03	*ABS	Absolute position detection system	0000h		○		
PA04	*AOP1	Function selection A-1	2000h		○	○	
PA05	*FBP	Number of command input pulses per revolution	10000		○		
PA06	CMX	Electronic gear numerator (command pulse multiplication numerator)	1		○		
PA07	CDV	Electronic gear denominator (command pulse multiplication denominator)	1		○		
PA08	ATU	Auto tuning mode	0001h		○	○	
PA09	RSP	Auto tuning response	16		○	○	
PA10	INP	In-position range	100	[pulse]	○		
PA11	TLP	Forward rotation torque limit	1000.0	[%]	○	○	○
PA12	TLN	Reverse rotation torque limit	1000.0	[%]	○	○	○
PA13	*PLSS	Command pulse input form	0100h		○		
PA14	*POL	Rotation direction selection	0		○		
PA15	*ENR	Encoder output pulses	4000	[pulse/rev]	○	○	○
PA16	*ENR2	Encoder output pulses 2	1		○	○	○
PA17		For manufacturer setting	0000h				
PA18			0000h				
PA19	*BLK	Parameter writing inhibit	00AAh		○	○	○
PA20	*TDS	Tough drive setting	0000h		○	○	○
PA21	*AOP3	Function selection A-3	0001h		○	○	
PA22		For manufacturer setting	0000h				
PA23	DRAT	Drive recorder arbitrary alarm trigger setting	0000h		○	○	○
PA24	AOP4	Function selection A-4	0000h		○	○	
PA25	OTHOV	One-touch tuning - Overshoot permissible level	0	[%]	○	○	
PA26	*AOP5	Function selection A-5	0000h		○	○	
PA27		For manufacturer setting	0000h				
PA28	*AOP6	Function selection A-6	0000h		○	○	○
PA29		For manufacturer setting	0000h				
PA30			0000h				
PA31			0000h				
PA32			0000h				

5.1.2 Gain/filter setting parameters ([Pr. PB_ _])

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PB01	FILT	Adaptive tuning mode (adaptive filter II)	0000h		○	○	○
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control II)	0000h		○		
PB03	PST	Position command acceleration/deceleration time constant (position smoothing)	0	[ms]	○		
PB04	FFC	Feed forward gain	0	[%]	○		
PB05		For manufacturer setting	500				
PB06	GD2	Load to motor inertia ratio	7.00	[Multiplier]	○	○	
PB07	PG1	Model loop gain	15.0	[rad/s]	○	○	
PB08	PG2	Position loop gain	37.0	[rad/s]	○		
PB09	VG2	Speed loop gain	823	[rad/s]	○	○	
PB10	VIC	Speed integral compensation	33.7	[ms]	○	○	
PB11	VDC	Speed differential compensation	980		○	○	
PB12	OVA	Overshoot amount compensation	0	[%]	○		
PB13	NH1	Machine resonance suppression filter 1	4500	[Hz]	○	○	○
PB14	NHQ1	Notch shape selection 1	0000h		○	○	○
PB15	NH2	Machine resonance suppression filter 2	4500	[Hz]	○	○	○

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PB16	NHQ2	Notch shape selection 2	0000h		○	○	○
PB17	NHF	Shaft resonance suppression filter	0000h		○	○	○
PB18	LPF	Low-pass filter setting	3141	[rad/s]	○	○	
PB19	VRF11	Vibration suppression control 1 - Vibration frequency	100.0	[Hz]	○		
PB20	VRF12	Vibration suppression control 1 - Resonance frequency	100.0	[Hz]	○		
PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping	0.00		○		
PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping	0.00		○		
PB23	VFBF	Low-pass filter selection	0100h		○	○	○
PB24	*MVS	Slight vibration suppression control	0000h		○		
PB25	*BOP1	Function selection B-1	0000h		○	○	
PB26	*CDP	Gain switching function	0000h		○	○	
PB27	CDL	Gain switching condition	10	[kpulse/s]/ [pulse]/ [r/min]	○	○	
PB28	CDT	Gain switching time constant	1	[ms]	○	○	
PB29	GD2B	Load to motor inertia ratio after gain switching	7.00	[Multiplier]	○	○	
PB30	PG2B	Position loop gain after gain switching	0.0	[rad/s]	○		
PB31	VG2B	Speed loop gain after gain switching	0	[rad/s]	○	○	
PB32	VICB	Speed integral compensation after gain switching	0.0	[ms]	○	○	
PB33	VRF11B	Vibration suppression control 1 - Vibration frequency after gain switching	0.0	[Hz]	○		
PB34	VRF12B	Vibration suppression control 1 - Resonance frequency after gain switching	0.0	[Hz]	○		
PB35	VRF13B	Vibration suppression control 1 - Vibration frequency damping after gain switching	0.00		○		
PB36	VRF14B	Vibration suppression control 1 - Resonance frequency damping after gain switching	0.00		○		
PB37		For manufacturer setting	1600				
PB38			0.00				
PB39			0.00				
PB40			0.00				
PB41			0000h				
PB42			0000h				
PB43			0000h				
PB44			0.00				
PB45	CNHF	Command notch filter	0000h		○		
PB46	NH3	Machine resonance suppression filter 3	4500	[Hz]	○	○	○
PB47	NHQ3	Notch shape selection 3	0000h		○	○	○
PB48	NH4	Machine resonance suppression filter 4	4500	[Hz]	○	○	○
PB49	NHQ4	Notch shape selection 4	0000h		○	○	○
PB50	NH5	Machine resonance suppression filter 5	4500	[Hz]	○	○	○
PB51	NHQ5	Notch shape selection 5	0000h		○	○	○
PB52	VRF21	Vibration suppression control 2 - Vibration frequency	100.0	[Hz]	○		
PB53	VRF22	Vibration suppression control 2 - Resonance frequency	100.0	[Hz]	○		
PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping	0.00		○		
PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping	0.00		○		
PB56	VRF21B	Vibration suppression control 2 - Vibration frequency after gain switching	0.0	[Hz]	○		
PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching	0.0	[Hz]	○		
PB58	VRF23B	Vibration suppression control 2 - Vibration frequency damping after gain switching	0.00		○		
PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching	0.00		○		
PB60	PG1B	Model loop gain after gain switching	0.0	[rad/s]	○	○	
PB61		For manufacturer setting	0.0				
PB62			0000h				
PB63			0000h				
PB64			0000h				

5.1.3 Extension setting parameters ([Pr. PC_ _])

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PC01	STA	Acceleration time constant	0	[ms]		○	○
PC02	STB	Deceleration time constant	0	[ms]		○	○
PC03	STC	S-pattern acceleration/deceleration time constant	0	[ms]		○	○
PC04	TQC	Torque command time constant	0	[ms]			○
PC05	SC1	Internal speed command 1	100.00	[r/min]		○	
		Internal speed limit 1					○
PC06	SC2	Internal speed command 2	500.00	[r/min]		○	
		Internal speed limit 2					○
PC07	SC3	Internal speed command 3	1000.00	[r/min]		○	
		Internal speed limit 3					○
PC08	SC4	Internal speed command 4	200.00	[r/min]		○	
		Internal speed limit 4					○
PC09	SC5	Internal speed command 5	300.00	[r/min]		○	
		Internal speed limit 5					○
PC10	SC6	Internal speed command 6	500.00	[r/min]		○	
		Internal speed limit 6					○
PC11	SC7	Internal speed command 7	800.00	[r/min]		○	
		Internal speed limit 7					○
PC12	VCM	Analog speed command - Maximum speed	0.00	[r/min]		○	
PC13	TLC	Analog torque command maximum output	100.0	[%]			○
PC14		For manufacturer setting	0000h				
PC15			0000h				
PC16	MBR	Electromagnetic brake sequence output	0	[ms]	○	○	○
PC17	ZSP	Zero speed	50	[r/min]	○	○	○
PC18	*BPS	Alarm history clear	0000h		○	○	○
PC19	*ENRS	Encoder output pulse selection	0000h		○	○	○
PC20		For manufacturer setting	0				
PC21			0000h				
PC22	*COP1	Function selection C-1	0020h		○	○	○
PC23	*COP2	Function selection C-2	0000h			○	○
PC24	*COP3	Function selection C-3	0000h		○		
PC25		For manufacturer setting	0000h				
PC26	*COP5	Function selection C-5	0000h		○	○	
PC27	*COP6	Function selection C-6	0000h		○	○	○
PC28		For manufacturer setting	0000h				
PC29	*COP8	Function selection C-8	0120h		○	○	○
PC30	STA2	Acceleration time constant 2	0	[ms]		○	○
PC31	STB2	Deceleration time constant 2	0	[ms]		○	○
PC32	CMX2	Command input pulse multiplication numerator 2	1		○		
PC33	CMX3	Command input pulse multiplication numerator 3	1		○		
PC34	CMX4	Command input pulse multiplication numerator 4	1		○		
PC35	TL2	Internal torque limit 2	1000.0	[%]	○	○	○
PC36		For manufacturer setting	0000h				
PC37	VCO	Analog speed command offset	0	[mV]		○	
PC38	TPO	Analog torque command offset	0	[mV]			○
		Analog torque limit offset				○	
PC39		For manufacturer setting	0				
PC40			0				
PC41			0				
PC42			0				
PC43	ERZ	Error excessive alarm detection level	0	[rev]	○		

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PC44		For manufacturer setting	0000h				
PC45			0000h				
PC46			0				
PC47			0				
PC48			0				
PC49			0				
PC50			0000h				
PC51	RSBR	Forced stop deceleration time constant	100	[ms]	○	○	
PC52		For manufacturer setting	0				
PC53			0				
PC54	RSUP1	Vertical axis freefall prevention compensation amount	0	[0.0001 rev]	○		
PC55		For manufacturer setting	0				
PC56			100				
PC57			0000h				
PC58			0				
PC59			0000h				
PC60	*COPD	Function selection C-D	0000h		○	○	○
PC61		For manufacturer setting	0000h				
PC62			0000h				
PC63			0000h				
PC64			0000h				
PC65			0000h				
PC66			0				
PC67			0				
PC68			0				
PC69			0				
PC70			0				
PC71			0040h				
PC72			0000h				
PC73	ERW	Error excessive warning level	0	[rev]	○		
PC74		For manufacturer setting	0000h				
PC75			0000h				
PC76			00C0h				
PC77			10				
PC78			0000h				
PC79			0000h				
PC80			0000h				

5.1.4 I/O setting parameters ([Pr. PD_ _])

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PD01	*DIA1	Input signal automatic on selection 1	0000h		○	○	○
PD02		For manufacturer setting	0000h				
PD03			0000h				
PD04			0000h				
PD05	*DI1L	Input device selection 1L	0202h		○	○	
PD06	*DI1M	Input device selection 1M	0202h				○
PD07		For manufacturer setting	002Bh				
PD08	*DI2L	Input device selection 2L	0A0Ah		○	○	
PD09	*DI2M	Input device selection 2M	0700h				○
PD10		For manufacturer setting	000Ah				
PD11	*DI3L	Input device selection 3L	0B0Bh		○	○	
PD12	*DI3M	Input device selection 3M	0800h				○

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PD13		For manufacturer setting	000Bh				
PD14	*DI4L	Input device selection 4L	0703h		○	○	
PD15	*DI4M	Input device selection 4M	3807h				○
PD16		For manufacturer setting	0000h				
PD17	*DI5L	Input device selection 5L	0806h		○	○	
PD18	*DI5M	Input device selection 5M	2008h				○
PD19		For manufacturer setting	0000h				
PD20			0000h				
PD21			0000h				
PD22			0000h				
PD23	*DI7L	Input device selection 7L	0000h		○	○	
PD24	*DI7M	Input device selection 7M	0000h				○
PD25		For manufacturer setting	002Ch				
PD26	*DI8L	Input device selection 8L	0000h		○	○	
PD27	*DI8M	Input device selection 8M	0000h				○
PD28		For manufacturer setting	0000h				
PD29	*DO1	Output device selection 1	0002h		○	○	○
PD30	*DO2	Output device selection 2	0003h		○	○	○
PD31	*DO3	Output device selection 3	0000h		○	○	○
PD32	*DO4	Output device selection 4	0004h		○	○	○
PD33		For manufacturer setting	0000h				
PD34	*DIF	Input filter setting	0004h		○	○	○
PD35	*DOP1	Function selection D-1	0101h		○	○	○
PD36		For manufacturer setting	0000h				
PD37	*DOP3	Function selection D-3	0000h		○		
PD38	*DOP4	Function selection D-4	3000h		○	○	○
PD39	*DOP5	Function selection D-5	0000h		○	○	○
PD40		For manufacturer setting	0000h				
PD41			0000h				
PD42			0				
PD43			0000h				
PD44			0000h				
PD45			0000h				
PD46			0000h				
PD47			0000h				
PD48			0000h				

5.1.5 Extension setting 2 parameters ([Pr. PE_ _])

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PE01		For manufacturer setting	0000h				
PE02			0000h				
PE03			0000h				
PE04			0				
PE05			0				
PE06			0				
PE07			0				
PE08			0				
PE09			0000h				
PE10			0000h				
PE11			0000h				
PE12			0000h				
PE13			0000h				
PE14			0111h				
PE15			20				
PE16			0000h				
PE17			0000h				
PE18			0000h				
PE19			0000h				
PE20			0000h				
PE21			0000h				
PE22			0000h				
PE23			0000h				
PE24			0000h				
PE25			0000h				
PE26			0000h				
PE27			0000h				
PE28			0000h				
PE29			0000h				
PE30			0000h				
PE31			0000h				
PE32			0000h				
PE33			0000h				
PE34			0				
PE35			0				
PE36			0.0				
PE37			0.00				
PE38			0.00				
PE39			0				
PE40			0000h				
PE41	EOP3	Function selection E-3	0000h		○	○	○
PE42		For manufacturer setting	0				
PE43			0.0				
PE44	LMCP	Lost motion compensation positive-side compensation value selection	0	[0.01%]	○		
PE45	LMCN	Lost motion compensation negative-side compensation value selection	0	[0.01%]	○		
PE46	LMFLT	Lost motion filter setting	0	[0.1 ms]	○		
PE47	TOF	Torque offset	0	[0.01%]	○	○	○
PE48	*LMOP	Lost motion compensation function selection	0000h		○		
PE49	LMCD	Lost motion compensation timing	0	[0.1 ms]	○		
PE50	LMCT	Lost motion compensation non-sensitive band	0	[pulse]/ [kpulse]	○		

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PE51		For manufacturer setting	0000h				
PE52			0000h				
PE53			0000h				
PE54			0000h				
PE55			0000h				
PE56			0000h				
PE57			0000h				
PE58			0000h				
PE59			0000h				
PE60			0000h				
PE61			0.00				
PE62			0.00				
PE63			0.00				
PE64			0.00				

5.1.6 Extension setting 3 parameters ([Pr. PF_ _])

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PF01		For manufacturer setting	0000h				
PF02			0000h				
PF03			0000h				
PF04			0				
PF05			0				
PF06			0000h				
PF07			1				
PF08			1				
PF09	*FOP5	Function selection F-5	0003h		○	○	○
PF10			0000h				
PF11			0000h				
PF12			10000				
PF13			100				
PF14			100				
PF15	DBT	Electronic dynamic brake operating time	2000	[ms]	○	○	○
PF16			0000h				
PF17			10				
PF18			0000h				
PF19			0000h				
PF20			0000h				
PF21	DRT	Drive recorder switching time setting	0	[s]	○	○	○
PF22		For manufacturer setting	200				
PF23	OSCL1	Vibration tough drive - Oscillation detection level	50	[%]	○	○	
PF24	*OSCL2	Vibration tough drive function selection	0000h		○	○	
PF25	CVAT	Instantaneous power failure tough drive - detection time	200	[ms]	○	○	○
PF26		For manufacturer setting	0				
PF27			0				
PF28			0				
PF29			0000h				
PF30			0				
PF31	FRIC	Machine diagnosis function - Friction judgment speed	0	[r/min]	○	○	○

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PF32		For manufacturer setting	50				
PF33			0000h				
PF34			0000h				
PF35			0000h				
PF36			0000h				
PF37			0000h				
PF38			0000h				
PF39			0000h				
PF40			0				
PF41			0				
PF42			0				
PF43			0				
PF44			0				
PF45			0000h				
PF46			0				
PF47			0000h				
PF48			0000h				

5.1.7 Network setting parameters ([Pr. PN_ _])

POINT

●For details of the network setting parameters, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PN01		For manufacturer setting	0h				
PN02	CERT	Communication error detection time	1000	[ms]	○	○	○
PN03		For manufacturer setting	0000h				
PN04			0000h				
PN05			0000h				
PN06			0000h				
PN07			0000h				
PN08	*NOP2	Function selection N-2	0000h		○	○	○
PN09		For manufacturer setting	1				
PN10	EIC	Ethernet communication time-out selection	0	[s]	○	○	○
PN11	*IPAD1	IP address setting 1	192		○	○	○
PN12	*IPAD2	IP address setting 2	168		○	○	○
PN13	*IPAD3	IP address setting 3	3		○	○	○
PN14	*IPAD4	IP address setting 4	0		○	○	○
PN15	*SNMK1	Subnet mask setting 1	255		○	○	○
PN16	*SNMK2	Subnet mask setting 2	255		○	○	○
PN17	*SNMK3	Subnet mask setting 3	255		○	○	○
PN18	*SNMK4	Subnet mask setting 4	0		○	○	○
PN19	*DGW1	Default gateway setting 1	192		○	○	○
PN20	*DGW2	Default gateway setting 2	168		○	○	○
PN21	*DGW3	Default gateway setting 3	3		○	○	○
PN22	*DGW4	Default gateway setting 4	1		○	○	○
PN23	*KAA	KeepAlive time	3600	[s]	○	○	○
PN24	*IPAF1	IP address filter 1	0		○	○	○
PN25	*IPAF2	IP address filter 2	0		○	○	○
PN26	*IPAF3	IP address filter 3	0		○	○	○
PN27	*IPAF4	IP address filter 4	0		○	○	○

No.	Symbol	Name	Initial value	Unit	Control mode		
					P	S	T
PN28	*IPFR2	IP address filter 2 range setting	256		○	○	○
PN29	*IPFR3	IP address filter 3 range setting	256		○	○	○
PN30	*IPFR4	IP address filter 4 range setting	256		○	○	○
PN31	*IPOA1	Operation specification IP address 1	0		○	○	○
PN32	*IPOA2	Operation specification IP address 2	0		○	○	○
PN33	*IPOA3	Operation specification IP address 3	0		○	○	○
PN34	*IPOA4	Operation specification IP address 4	0		○	○	○
PN35	*IPOR3	Operation specification IP address 3 range specification	256		○	○	○
PN36	*IPOR4	Operation specification IP address 4 range specification	256		○	○	○
PN37		For manufacturer setting	0000h				
PN38			0000h				
PN39			0000h				
PN40			0000h				
PN41			0000h				
PN42			0000h				
PN43			0000h				
PN44			0000h				
PN45			0000h				
PN46			0000h				
PN47			0000h				
PN48			0000h				

5.2 Detailed list of parameters

POINT

●Set a value to each "x" in the "Setting digit" columns.

5.2.1 Basic setting parameters ([Pr. PA_ _])

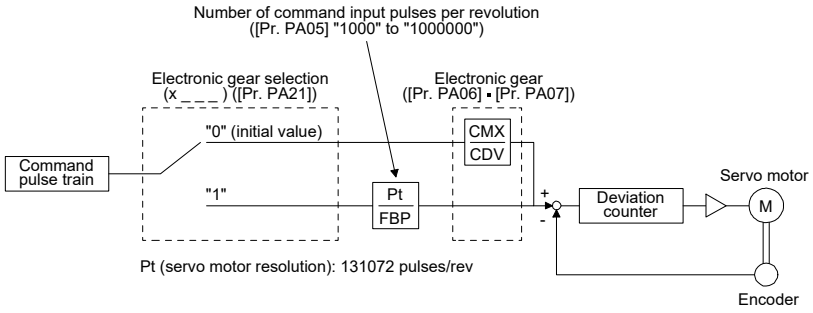
No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PA01 *STY Operation mode	_ _ _ x	Control mode selection Select a control mode. 0: Position control mode (P) 1: Position control mode and speed control mode (P/S) 2: Speed control mode (S) 3: Speed control mode and torque control mode (S/T) 4: Torque control mode (T) 5: Torque control mode and position control mode (T/P) 6: Positioning mode (point table method) (CP) (Note) 8: Positioning mode (indexer method) (PS) (Note) 9: Profile mode (pp/pv/tq) Setting "7" triggers [AL. 37.1]. Note. These setting value can be used on servo amplifiers with software version A4 or later. When this value is set on the servo amplifier with prior to A3 software version, [AL. 37.1] is triggered.	0h	○	○	○
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _		1h			

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode P	S	T
PA02 *REG Regenerative option	_ _ x x	Regenerative option Select a regenerative option. Incorrect setting may cause the regenerative option to burn. If a selected regenerative option is not for use with the servo amplifier, [AL. 37 Parameter error] occurs. 00: Regenerative option is not used. ▪ For servo amplifier of 200 W or less, regenerative resistor is not used. ▪ For servo amplifier of 0.4 kW to 3 kW, built-in regenerative resistor is used. 02: MR-RB032 03: MR-RB12 04: MR-RB32 05: MR-RB30 (Note) 06: MR-RB50 (Cooling fan is required.) (Note) Note. The setting value is available with servo amplifier with software version A3 or later.	00h	○	○	○
	_ x _ _	For manufacturer setting	0h			
	x _ _ _		0h			
PA03 *ABS Absolute position detection system	_ _ _ x	Absolute position detection system selection Select the absolute position detection system. 0: Disabled (used in the incremental system) 2: Enabled (absolute position detection system by communication) Setting "1" will trigger [AL. 37].	0h	○		
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _		0h			
PA04 *AOP1 Function selection A-1	_ _ _ x	For manufacturer setting	0h			
	_ _ x _		0h			
	_ x _ _		0h			
	x _ _ _	Forced stop deceleration function selection 0: Forced stop deceleration function disabled (EM1) 2: Forced stop deceleration function enabled (EM2) Refer to table 5.1 for details.	2h	○	○	

Table 5.1 Deceleration method

Setting value	EM2/EM1	Deceleration method	
		EM2 or EM1 is off	Alarm occurred
0 _ _ _	EM1	MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.	MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.
2 _ _ _	EM2	MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.	MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.

PA05 *FBP Number of command input pulses per revolution		The servo motor rotates based on set command input pulses. To enable the parameter value, select "Number of command input pulses per revolution (1 _ _ _)" of "Electronic gear selection" in [Pr. PA21]. Setting range: 1000 to 1000000	10000	○		

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PA06 CMX Electronic gear numerator (command pulse multiplication numerator)		Set the numerator of the electronic gear. To enable the parameter, select "Electronic gear (0 _ _ _)" of "Electronic gear selection" in [Pr. PA21]. The following shows a standard of the setting range of the electronic gear. $\frac{1}{10} < \frac{CMX}{CDV} < 4000$ If the set value is outside this range, noise may be generated during acceleration/deceleration or operation may not be performed at the preset speed and/or acceleration/deceleration time constants.  Always set the electronic gear with servo-off state to prevent unexpected operation due to improper setting. Setting range: 1 to 16777215	1	○		
PA07 CDV Electronic gear denominator (command pulse multiplication denominator)		Set the denominator of the electronic gear. To enable the parameter, select "Electronic gear (0 _ _ _)" of "Electronic gear selection" in [Pr. PA21]. Setting range: 1 to 16777215	1	○		

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PA08 ATU Auto tuning mode	_ _ _ x	Gain adjustment mode selection Select the gain adjustment mode. 0: 2 gain adjustment mode 1 (interpolation mode) 1: Auto tuning mode 1 2: Auto tuning mode 2 3: Manual mode 4: 2 gain adjustment mode 2 Refer to table 5.2 for details.	1h	○	○	
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _		0h			

Table 5.2 Gain adjustment mode selection

Setting value	Gain adjustment mode	Automatically adjusted parameter
_ _ _ 0	2 gain adjustment mode 1 (interpolation mode)	[Pr. PB06 Load to motor inertia ratio] [Pr. PB08 Position loop gain] [Pr. PB09 Speed loop gain] [Pr. PB10 Speed integral compensation]
_ _ _ 1	Auto tuning mode 1	[Pr. PB06 Load to motor inertia ratio] [Pr. PB07 Model loop gain] [Pr. PB08 Position loop gain] [Pr. PB09 Speed loop gain] [Pr. PB10 Speed integral compensation]
_ _ _ 2	Auto tuning mode 2	[Pr. PB07 Model loop gain] [Pr. PB08 Position loop gain] [Pr. PB09 Speed loop gain] [Pr. PB10 Speed integral compensation]
_ _ _ 3	Manual mode	
_ _ _ 4	2 gain adjustment mode 2	[Pr. PB08 Position loop gain] [Pr. PB09 Speed loop gain] [Pr. PB10 Speed integral compensation]

<table>
<tr><th rowspan="2">No./symbol/ name</th><th rowspan="2">Setting digit</th><th rowspan="2">Function</th><th rowspan="2">Initial value [unit]</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>PA09
RSP
Auto tuning response</td><td></td><td>Set a response of the auto tuning.

<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Machine characteristic</th><th rowspan="2">Setting value</th><th colspan="2">Machine characteristic</th></tr>
<tr><th>Response</th><th>Guideline for machine resonance frequency [Hz]</th><th>Response</th><th>Guideline for machine resonance frequency [Hz]</th></tr>
<tr><td>1</td><td rowspan="20">Low response
↑
↓
Middle response</td><td>2.7</td><td>21</td><td rowspan="20">Middle response
↑
↓
High response</td><td>67.1</td></tr>
<tr><td>2</td><td>3.6</td><td>22</td><td>75.6</td></tr>
<tr><td>3</td><td>4.9</td><td>23</td><td>85.2</td></tr>
<tr><td>4</td><td>6.6</td><td>24</td><td>95.9</td></tr>
<tr><td>5</td><td>10.0</td><td>25</td><td>108.0</td></tr>
<tr><td>6</td><td>11.3</td><td>26</td><td>121.7</td></tr>
<tr><td>7</td><td>12.7</td><td>27</td><td>137.1</td></tr>
<tr><td>8</td><td>14.3</td><td>28</td><td>154.4</td></tr>
<tr><td>9</td><td>16.1</td><td>29</td><td>173.9</td></tr>
<tr><td>10</td><td>18.1</td><td>30</td><td>195.9</td></tr>
<tr><td>11</td><td>20.4</td><td>31</td><td>220.6</td></tr>
<tr><td>12</td><td>23.0</td><td>32</td><td>248.5</td></tr>
<tr><td>13</td><td>25.9</td><td>33</td><td>279.9</td></tr>
<tr><td>14</td><td>29.2</td><td>34</td><td>315.3</td></tr>
<tr><td>15</td><td>32.9</td><td>35</td><td>355.1</td></tr>
<tr><td>16</td><td>37.0</td><td>36</td><td>400.0</td></tr>
<tr><td>17</td><td>41.7</td><td>37</td><td>446.6</td></tr>
<tr><td>18</td><td>47.0</td><td>38</td><td>501.2</td></tr>
<tr><td>19</td><td>52.9</td><td>39</td><td>571.5</td></tr>
<tr><td>20</td><td>59.6</td><td>40</td><td>642.7</td></tr>
</table>

Setting range: 1 to 40</td><td>16</td><td>○</td><td>○</td><td></td></tr>
<tr><td>PA10
INP
In-position range</td><td></td><td>Set an in-position range per command pulse.
To change it to the servo motor encoder pulse unit, set [Pr. PC24].

Setting range: 0 to 65535</td><td>100
[pulse]</td><td>○</td><td></td><td></td></tr>
<tr><td>PA11
TLP
Forward rotation torque limit</td><td></td><td>You can limit the torque generated by the servo motor. Set the parameter referring to section 3.6.1 (5).
Set the rated torque to 100.0 [%]. Set the parameter to limit the torque of the servo motor in the CW power running or CCW regeneration.
The polarity of the torque limit changes depending on the [Pr. PA14] setting. Set this parameter to "0.0" to generate no torque.

If a value larger than the servo motor's maximum torque is set, that value will be limited to the servo motor's maximum torque value.

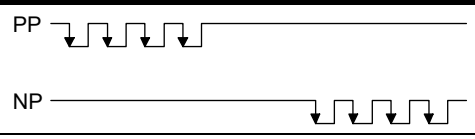
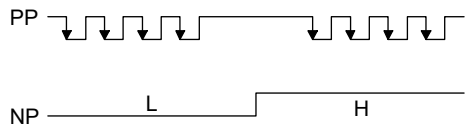
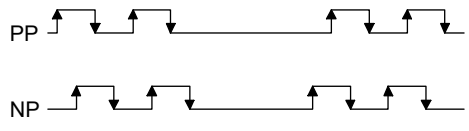
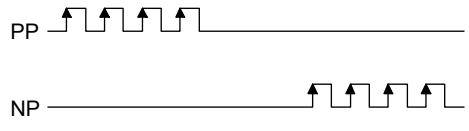
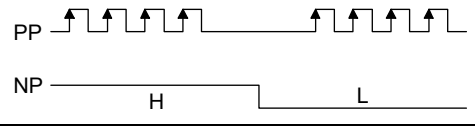
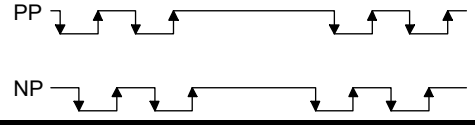
Setting range: 0.0 to 1000.0</td><td>1000.0
[%]</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>PA12
TLN
Reverse rotation torque limit</td><td></td><td>You can limit the torque generated by the servo motor. Set the parameter referring to section 3.6.1 (5).
Set the rated torque to 100.0 [%]. Set this parameter when limiting the torque of the servo motor in the CW power running or CCW regeneration.
The polarity of the torque limit changes depending on the [Pr. PA14] setting. Set this parameter to "0.0" to generate no torque.

If a value larger than the servo motor's maximum torque is set, that value will be limited to the servo motor's maximum torque value.

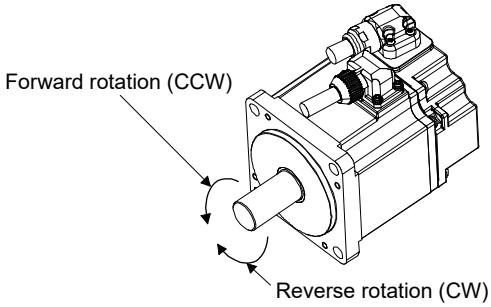
Setting range: 0.0 to 1000.0</td><td>1000.0
[%]</td><td>○</td><td>○</td><td>○</td></tr>
</table>

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode P	S	T
PA13 *PLSS Command pulse input form	_ _ _ x	Command input pulse train form selection 0: Forward/reverse rotation pulse train 1: Signed pulse train 2: A-phase/B-phase pulse train (The servo amplifier imports input pulses after multiplying by four.) Refer to table 5.3 for settings.	0h	○		
	_ _ x _	Pulse train logic selection 0: Positive logic 1: Negative logic Select the same one as a logic of command pulse train from controller to connect. Refer to POINT of section 3.6.1 for logic of MELSEC iQ-R series/MELSEC-Q series/MELSEC-L series/MELSEC-F series. Refer to table 5.3 for settings.	0h	○		
	_ x _ _	Command input pulse train filter selection Selecting proper filter enables to enhance noise tolerance. 0: Command input pulse train is 4 Mpulses/s or less. 1: Command input pulse train is 1 Mpulse/s or less. 2: Command input pulse train is 500 kpulses/s or less. 3: Command input pulse train is 200 kpulses/s or less. 1 Mpulse/s or lower commands are supported by "1". When inputting commands over 1 Mpulse/s and 4 Mpulses/s or lower, set "0". Setting a value not according to the command pulse frequency may cause the following malfunctions. ・Setting a value higher than actual command will lower noise tolerance. ・Setting a value lower than actual command will cause a position mismatch.	1h	○		
	x _ _ _	For manufacturer setting	0h			

Table 5.3 Command input pulse train form selection

Setting value	Pulse train form		Forward rotation command	Reverse rotation command
_ _ 1 0	Negative logic	Forward rotation pulse train Reverse rotation pulse train		
_ _ 1 1		Signed pulse train		
_ _ 1 2		A-phase pulse train B-phase pulse train		
_ _ 0 0	Positive logic	Forward rotation pulse train Reverse rotation pulse train		
_ _ 0 1		Signed pulse train		
_ _ 0 2		A-phase pulse train B-phase pulse train		

Arrows in the table indicate the timing of importing pulse trains. A-phase pulse train and B-phase pulse train are imported after they have been multiplied by 4.

<table>
<tr><th rowspan="2">No./symbol/ name</th><th rowspan="2">Setting digit</th><th rowspan="2">Function</th><th rowspan="2">Initial value [unit]</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>PA14
*POL
Rotation direction selection</td><td></td><td>Select servo motor rotation direction relative to the input pulse train.
<table><tr><th rowspan="2">Setting value</th><th colspan="2">Servo motor rotation direction</th></tr><tr><th>When forward rotation pulse is input</th><th>When reverse rotation pulse is input</th></tr><tr><td>0</td><td>CCW</td><td>CW</td></tr><tr><td>1</td><td>CW</td><td>CCW</td></tr></table>The following shows the servo motor rotation directions.

Setting range: 0, 1</td><td>0</td><td>○</td><td></td><td></td></tr>
<tr><td>PA15
*ENR
Encoder output pulses</td><td></td><td>Set the encoder output pulses from the servo amplifier by using the number of output pulses per revolution, dividing ratio, or electronic gear ratio. (after multiplication by 4)
Set a numerator of the electronic gear when "A-phase/B-phase pulse electronic gear setting (_ _ 3 _)" is selected in [Pr. PC19 Encoder output pulse selection].
The maximum output frequency is 4.6 Mpulses/s. Set the parameter within this range.
Select "Output pulse setting" or "Dividing ratio setting" in [Pr. PC19].

Setting range: 1 to 4194304</td><td>4000 [pulse/ rev]</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>PA16
*ENR2
Encoder output pulses 2</td><td></td><td>Set a denominator of the electronic gear for the A/B-phase pulse output.
To set a denominator of the electronic gear, select "A-phase/B-phase pulse electronic gear setting (_ _ 3 _)" of "Encoder output pulse setting selection" in [Pr. PC19].
When "Encoder output pulse setting selection" is set to "Disabled (_ _ 1 _)" in [Pr. PC19], the setting value of this parameter will be disabled.

Setting range: 1 to 4194304</td><td>1</td><td>○</td><td>○</td><td>○</td></tr>
</table>

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode P	S	T
PA19 *BLK Parameter writing inhibit		Select a reference range and writing range of the parameter. Refer to table 5.4 for settings.	00AAh	○	○	○

Table 5.4 [Pr. PA19] setting value and reading/writing range

PA19	Setting operation	PA	PB	PC	PD	PE	PF	PT (Note 1)	PN (Note 2)
Other than below	Reading	○							
	Writing	○							
000Ah	Reading	Only 19							
	Writing	Only 19							
000Bh	Reading	○	○	○					
	Writing	○	○	○					
000Ch	Reading	○	○	○	○				
	Writing	○	○	○	○				
00AAh (initial value)	Reading	○	○	○	○	○	○	○	○
	Writing	○	○	○	○	○	○	○	○
100Bh	Reading	○							
	Writing	Only 19							
100Ch	Reading	○	○	○	○				
	Writing	Only 19							
10AAh	Reading	○	○	○	○	○	○	○	○
	Writing	Only 19							

Note 1. For details, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Profile Mode)."
2. For details, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".

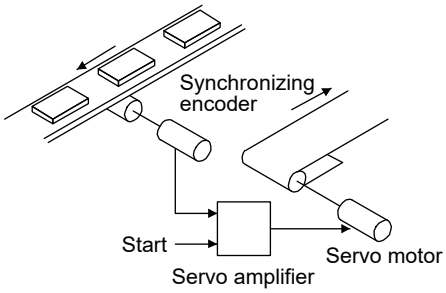
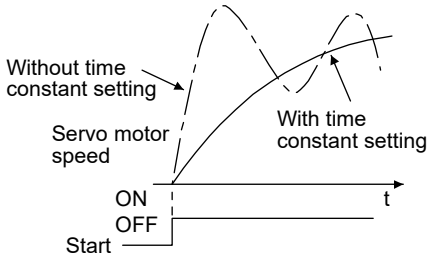
PA20 *TDS Tough drive setting	Alarms may not be avoided with the tough drive function depending on the situations of the power supply and load fluctuation. You can assign MTTR (During tough drive) to pins CN3-14 to CN3-16 and CN3-22 with [Pr. PD29] to [Pr. PD32].					
	_ _ _ x	For manufacturer setting	0h			
	_ _ x _	Vibration tough drive selection 0: Disabled 1: Enabled Selecting "1" enables to suppress vibrations by automatically changing setting values of [Pr. PB13 Machine resonance suppression filter 1] and [Pr. PB15 Machine resonance suppression filter 2] in case that the vibration exceed the value of the oscillation level set in [Pr. PF23]. To output the oscillation detection alarm as a warning, set [Pr. PF24 Vibration tough drive function selection]. Refer to section 7.3 for details.	0h	○	○	
	_ x _ _	Instantaneous power failure tough drive selection 0: Disabled 1: Enabled Selecting "1" enables to avoid occurring [AL. 10 Undervoltage] using the electrical energy charged in the capacitor in the servo amplifier in case that an instantaneous power failure occurs during operation. In [Pr. PF25 Instantaneous power failure tough drive - Detection time], set the time until the occurrence of [AL. 10.1 Voltage drop in the power]. When the digit is enabled, the power should be off for the setting value of [Pr. PF25] + 1 s or more before cycling the power to enable a parameter whose symbol is preceded by "*".	0h	○	○	○
	x _ _ _	For manufacturer setting	0h			

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PA21 *AOP3 Function selection A-3	_ _ _ x	One-touch tuning function selection 0: Disabled 1: Enabled When the digit is "0", the one-touch tuning is not available.	1h	○	○	
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _	Electronic gear selection 0: Electronic gear ([Pr. PA06] and [Pr. PA07]) 1: Number of command input pulses per revolution ([Pr. PA05])	0h	○		
PA23 DRAT Drive recorder arbitrary alarm trigger setting	_ _ x x	Alarm detail No. setting Set the digits when you execute the trigger with arbitrary alarm detail No. for the drive recorder function. When these digits are "0 0", only the arbitrary alarm No. setting will be enabled.	00h	○	○	○
	x x _ _	Alarm No. setting Set the digits when you execute the trigger with arbitrary alarm No. for the drive recorder function. When "0 0" are set, arbitrary alarm trigger of the drive recorder will be disabled.	00h	○	○	○
	Setting example: To activate the drive recorder when [AL. 50 Overload 1] occurs, set "5 0 0 0". To activate the drive recorder when [AL. 50.3 Thermal overload error 4 during operation] occurs, set "5 0 0 3".					
PA24 AOP4 Function selection A-4	_ _ _ x	Vibration suppression mode selection 0: Standard mode 1: 3 inertia mode 2: Low response mode When you select the standard mode or low response mode, "Vibration suppression control 2" is not available. When you select the 3 inertia mode, the feed forward gain is not available. Before changing the control mode during the 3 inertia mode or low response mode, stop the motor.	0h	○	○	
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _		0h			
PA25 OTHOV One-touch tuning - Overshoot permissible level		Set a permissible value of overshoot amount for one-touch tuning as a percentage of the in-position range. However, setting "0" will be 50%. Setting range: 0 to 100	0 [%]	○	○	
PA26 *AOP5 Function selection A-5	_ _ _ x	Torque limit function selection at instantaneous power failure 0: Disabled 1: Enabled Selecting "1" for this digit will limit torques to save electric energy when an instantaneous power failure occurs during operation and will make [AL. 10 Undervoltage] less likely to occur. The torque limit function at instantaneous power failure is enabled when "Instantaneous power failure tough drive selection" in [Pr. PA20] is "Enabled (_ 1 _ _)".	0h	○	○	
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _		0h			

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PA28 *AOP6 Function selection A-6	_ _ _ x	Selection of the HG-KN series servo motor maximum speed Select the maximum speed of the HG-KN series servo motor. 0: A maximum speed of 5000 r/min 1: A maximum speed of 6000 r/min This digit is disabled when a servo motor other than HG-KN series is connected.	0h	○	○	○
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _		0h			

5.2.2 Gain/filter setting parameters ([Pr. PB_ _])

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PB01 FILT Adaptive tuning mode (adaptive filter II)	_ _ _ x	Filter tuning mode selection Set the adaptive tuning. Select the adjustment mode of the machine resonance suppression filter 1. Refer to section 7.1.2 for details. 0: Disabled 1: Automatic setting (Do not use this in the torque control mode.) 2: Manual setting	0h	○	○	○
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _	Tuning accuracy selection 0: Standard 1: High accuracy The frequency is estimated more accurately in the high accuracy mode compared to the standard mode. However, the tuning sound may be larger in the high accuracy mode.	0h	○	○	○
PB02 VRFT Vibration suppression control tuning mode (advanced vibration suppression control II)	_ _ _ x	Vibration suppression control 1 tuning mode selection Select the tuning mode of the vibration suppression control 1. Refer to section 7.1.5 for details. 0: Disabled 1: Automatic setting 2: Manual setting	0h	○		
	_ _ x _	Vibration suppression control 2 tuning mode selection Select the tuning mode of the vibration suppression control 2. To enable the digit, select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24]. Refer to section 7.1.5 for details. 0: Disabled 1: Automatic setting 2: Manual setting	0h	○		
	_ x _ _	For manufacturer setting	0h			
	x _ _ _		0h			

<table>
<tr><th rowspan="2">No./symbol/ name</th><th rowspan="2">Setting digit</th><th rowspan="2">Function</th><th rowspan="2">Initial value [unit]</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>PB03
PST
Position command acceleration/ deceleration time constant (position smoothing)</td><td></td><td>Set the constant of a primary delay to the position command.
You can select a control method from "Primary delay" or "Linear acceleration/ deceleration" in [Pr. PB25 Position acceleration/deceleration filter type selection].
The setting range of "Linear acceleration/deceleration" is 0 ms to 10 ms. Setting of longer than 10 ms will be recognized as 10 ms.
When the linear acceleration/deceleration is selected, do not set the "Control mode selection" ([Pr. PA01]) to the setting other than "_ _ _ 0". Doing so will cause the servo motor to make a sudden stop at the time of position control mode switching.
(Example) When a command is given from a synchronizing encoder, synchronous operation will start smoothly even if it start during line operation.


Setting range: 0 to 65535</td><td>0
[ms]</td><td>○</td><td></td><td></td></tr>
<tr><td>PB04
FFC
Feed forward gain</td><td></td><td>Set the feed forward gain.
When the setting is 100%, the droop pulses during operation at constant speed are nearly zero. However, sudden acceleration/deceleration will increase the overshoot. As a guideline, when the feed forward gain setting is 100%, set 1 s or more as the acceleration time constant up to the rated speed.

Setting range: 0 to 100</td><td>0
[%]</td><td>○</td><td></td><td></td></tr>
<tr><td>PB06
GD2
Load to motor inertia ratio</td><td></td><td>Set the load to motor inertia ratio.
Setting a value considerably different from the actual load moment of inertia may cause an unexpected operation such as an overshoot.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the following table for details. When the parameter is automatic setting, the value will vary between 0.00 and 100.00.

Setting range: 0.00 to 300.00</td><td>7.00
[Multiplier]</td><td>○</td><td>○</td><td></td></tr>
<tr><td></td><td></td><td><table><tr><th>Pr. PA08</th><th>This parameter</th></tr><tr><td>_ _ _ 0: (2 gain adjustment mode 1 (interpolation mode))</td><td rowspan="2">Automatic setting</td></tr><tr><td>_ _ _ 1: (Auto tuning mode 1)</td></tr><tr><td>_ _ _ 2: (Auto tuning mode 2)</td><td rowspan="3">Manual setting</td></tr><tr><td>_ _ _ 3: (Manual mode)</td></tr><tr><td>_ _ _ 4: (2 gain adjustment mode 2)</td></tr></table></td><td></td><td></td><td></td><td></td></tr>
</table>

<table>
<tr><th rowspan="2">No./symbol/ name</th><th rowspan="2">Setting digit</th><th rowspan="2">Function</th><th rowspan="2">Initial value [unit]</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>PB07
PG1
Model loop gain</td><td></td><td>Set the response gain up to the target position.
Increasing the setting value will also increase the response level to the position command but will be liable to generate vibration and noise.
For the vibration suppression control tuning mode, the setting range of [Pr. PB07] is limited. Refer to section 7.1.5 (4) for details.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the following table for details.

Setting range: 1.0 to 2000.0</td><td>15.0
[rad/s]</td><td>○</td><td>○</td><td></td></tr>
<tr><td colspan="7"><table>
<tr><th>Pr. PA08</th><th>This parameter</th></tr>
<tr><td>_ _ _ 0: (2 gain adjustment mode 1 (interpolation mode))</td><td>Manual setting</td></tr>
<tr><td>_ _ _ 1: (Auto tuning mode 1)</td><td rowspan="2">Automatic setting</td></tr>
<tr><td>_ _ _ 2: (Auto tuning mode 2)</td></tr>
<tr><td>_ _ _ 3: (Manual mode)</td><td rowspan="2">Manual setting</td></tr>
<tr><td>_ _ _ 4: (2 gain adjustment mode 2)</td></tr>
</table></td></tr>
<tr><td>PB08
PG2
Position loop gain</td><td></td><td>Set the gain of the position loop.
Set this parameter to increase the position response to level load disturbance.
Increasing the setting value will also increase the response level to the load disturbance but will be liable to generate vibration and noise.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the following table for details.

Setting range: 1.0 to 2000.0</td><td>37.0
[rad/s]</td><td>○</td><td></td><td></td></tr>
<tr><td colspan="7"><table>
<tr><th>Pr. PA08</th><th>This parameter</th></tr>
<tr><td>_ _ _ 0: (2 gain adjustment mode 1 (interpolation mode))</td><td rowspan="3">Automatic setting</td></tr>
<tr><td>_ _ _ 1: (Auto tuning mode 1)</td></tr>
<tr><td>_ _ _ 2: (Auto tuning mode 2)</td></tr>
<tr><td>_ _ _ 3: (Manual mode)</td><td>Manual setting</td></tr>
<tr><td>_ _ _ 4: (2 gain adjustment mode 2)</td><td>Automatic setting</td></tr>
</table></td></tr>
<tr><td>PB09
VG2
Speed loop gain</td><td></td><td>Set the gain of the speed loop.
Set this parameter when vibration occurs on machines of low rigidity or large backlash. Increasing the setting value will also increase the response level but will be liable to generate vibration and noise.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the table of [Pr. PB08] for details.

Setting range: 20 to 65535</td><td>823
[rad/s]</td><td>○</td><td>○</td><td></td></tr>
<tr><td>PB10
VIC
Speed integral compensation</td><td></td><td>Set the integral time constant of the speed loop.
Decreasing the setting value will increase the response level but will be liable to generate vibration and noise.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the table of [Pr. PB08] for details.

Setting range: 0.1 to 1000.0</td><td>33.7
[ms]</td><td>○</td><td>○</td><td></td></tr>
<tr><td>PB11
VDC
Speed differential compensation</td><td></td><td>Set the differential compensation.
To enable the setting value, turn on PC (proportional control).

Setting range: 0 to 1000</td><td>980</td><td>○</td><td>○</td><td></td></tr>
</table>

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PB12 OVA Overshoot amount compensation		Set the ratio of dynamic friction torque to the rated torque in percent at the rated speed of the servo motor. When the response level is low, or when the torque is limited, the efficiency of the parameter can be lower. Setting range: 0 to 100	0 [%]	○		
PB13 NH1 Machine resonance suppression filter 1		Set the notch frequency of the machine resonance suppression filter 1. When "Filter tuning mode selection" is set to "Automatic setting (_ _ _ 1)" in [Pr. PB01], this parameter will be adjusted automatically by adaptive tuning. When "Filter tuning mode selection" is set to "Manual setting (_ _ _ 2)" in [Pr. PB01], the setting value will be enabled. Setting range: 10 to 4500	4500 [Hz]	○	○	○
PB14 NHQ1 Notch shape selection 1	Set the shape of the machine resonance suppression filter 1. When "Filter tuning mode selection" is set to "Automatic setting (_ _ _ 1)" in [Pr. PB01], this parameter will be adjusted automatically by adaptive tuning. To enable the setting value, select the manual setting.					
	_ _ _ x	For manufacturer setting	0h			
	_ _ x _	Notch depth selection 0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0h	○	○	○
	_ x _ _	Notch width selection 0: α = 2 1: α = 3 2: α = 4 3: α = 5	0h	○	○	○
	x _ _ _	For manufacturer setting	0h			
PB15 NH2 Machine resonance suppression filter 2		Set the notch frequency of the machine resonance suppression filter 2. To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 2 selection" in [Pr. PB16]. Setting range: 10 to 4500	4500 [Hz]	○	○	○
PB16 NHQ2 Notch shape selection 2	Set the shape of the machine resonance suppression filter 2.					
	_ _ _ x	Machine resonance suppression filter 2 selection 0: Disabled 1: Enabled	0h	○	○	○
	_ _ x _	Notch depth selection 0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0h	○	○	○
	_ x _ _	Notch width selection 0: α = 2 1: α = 3 2: α = 4 3: α = 5	0h	○	○	○
	x _ _ _	For manufacturer setting	0h			

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode P	S	T
PB17 NHF Shaft resonance suppression filter		Set the shaft resonance suppression filter. Use this filter to suppress a low-frequency machine vibration. When you select "Automatic setting (_ _ _ 0)" of "Shaft resonance suppression filter selection" in [Pr. PB23], the value will be calculated automatically from the servo motor you use and load to motor inertia ratio. When "Manual setting (_ _ _ 1)" is selected, the setting written to the parameter is used. When "Shaft resonance suppression filter selection" is "Disabled (_ _ _ 2)" in [Pr. PB23], the setting value of this parameter will be disabled. When you select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 4 selection" in [Pr. PB49], the shaft resonance suppression filter is not available.				
	_ _ x x	Shaft resonance suppression filter setting frequency selection Refer to table 5.5 for settings. Set the value closest to the frequency you need.	00h	○	○	○
	_ x _ _	Notch depth selection 0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0h	○	○	○
	x _ _ _	For manufacturer setting	0h			

Table 5.5 Shaft resonance suppression filter setting frequency selection

Setting value	Frequency [Hz]	Setting value	Frequency [Hz]
_ _ 0 0	Disabled	_ _ 1 0	562
_ _ 0 1	Disabled	_ _ 1 1	529
_ _ 0 2	4500	_ _ 1 2	500
_ _ 0 3	3000	_ _ 1 3	473
_ _ 0 4	2250	_ _ 1 4	450
_ _ 0 5	1800	_ _ 1 5	428
_ _ 0 6	1500	_ _ 1 6	409
_ _ 0 7	1285	_ _ 1 7	391
_ _ 0 8	1125	_ _ 1 8	375
_ _ 0 9	1000	_ _ 1 9	360
_ _ 0 A	900	_ _ 1 A	346
_ _ 0 B	818	_ _ 1 B	333
_ _ 0 C	750	_ _ 1 C	321
_ _ 0 D	692	_ _ 1 D	310
_ _ 0 E	642	_ _ 1 E	300
_ _ 0 F	600	_ _ 1 F	290

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode P	S	T
PB18 LPF Low-pass filter setting		Set the low-pass filter. The following shows a relation of a required parameter to this parameter. Setting range: 100 to 18000	3141 [rad/s]	○	○	

[Pr. PB23]	[Pr. PB18]
_ _ 0 _ (Initial value)	Automatic setting
_ _ 1 _	Setting value enabled
_ _ 2 _	Setting value disabled

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PB19 VRF11 Vibration suppression control 1 - Vibration frequency		Set the vibration frequency for vibration suppression control 1 to suppress low-frequency machine vibration. When "Vibration suppression control 1 tuning mode selection" is set to "Automatic setting (_ _ _ 1)" in [Pr. PB02], this parameter will be set automatically. When "Manual setting (_ _ _ 2)" is selected, the setting written to the parameter is used. The setting range of this parameter varies, depending on the value in [Pr. PB07]. If a value out of the range is set, the vibration suppression control will be disabled. Refer to section 7.1.5 for details. Setting range: 0.1 to 300.0	100.0 [Hz]	○		
PB20 VRF12 Vibration suppression control 1 - Resonance frequency		Set the resonance frequency for vibration suppression control 1 to suppress low-frequency machine vibration. When "Vibration suppression control 1 tuning mode selection" is set to "Automatic setting (_ _ _ 1)" in [Pr. PB02], this parameter will be set automatically. When "Manual setting (_ _ _ 2)" is selected, the setting written to the parameter is used. The setting range of this parameter varies, depending on the value in [Pr. PB07]. If a value out of the range is set, the vibration suppression control will be disabled. Refer to section 7.1.5 for details. Setting range: 0.1 to 300.0	100.0 [Hz]	○		
PB21 VRF13 Vibration suppression control 1 - Vibration frequency damping		Set a damping of the vibration frequency for vibration suppression control 1 to suppress low-frequency machine vibration. When "Vibration suppression control 1 tuning mode selection" is set to "Automatic setting (_ _ _ 1)" in [Pr. PB02], this parameter will be set automatically. When "Manual setting (_ _ _ 2)" is selected, the setting written to the parameter is used. Refer to section 7.1.5 for details. Setting range: 0.00 to 0.30	0.00	○		
PB22 VRF14 Vibration suppression control 1 - Resonance frequency damping		Set a damping of the resonance frequency for vibration suppression control 1 to suppress low-frequency machine vibration. When "Vibration suppression control 1 tuning mode selection" is set to "Automatic setting (_ _ _ 1)" in [Pr. PB02], this parameter will be set automatically. When "Manual setting (_ _ _ 2)" is selected, the setting written to the parameter is used. Refer to section 7.1.5 for details. Setting range: 0.00 to 0.30	0.00	○		
PB23 VFBF Low-pass filter selection	_ _ _ x	Shaft resonance suppression filter selection Select the shaft resonance suppression filter. 0: Automatic setting 1: Manual setting 2: Disabled When "Machine resonance suppression filter 4 selection" is set to "Enabled (_ _ _ 1)" in [Pr. PB49], the shaft resonance suppression filter is not available.	0h	○	○	○
	_ _ x _	Low-pass filter selection Select the low-pass filter. 0: Automatic setting 1: Manual setting 2: Disabled	0h	○	○	
	_ x _ _	For manufacturer setting	1h			
	x _ _ _		0h			
PB24 *MVS Slight vibration suppression control	_ _ _ x	Slight vibration suppression control selection Select the slight vibration suppression control. 0: Disabled 1: Enabled To enable the slight vibration suppression control, select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08]. Slight vibration suppression control cannot be used in the speed control mode.	0h	○		
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _		0h			

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PB25 *BOP1 Function selection B-1	_ _ _ x	Model adaptive control selection 0: Enabled (model adaptive control) 2: Disabled (PID control) Refer to section 7.4 for disabling this function.	0h	○	○	
	_ _ x _	Position acceleration/deceleration filter type selection Select the position acceleration/deceleration filter type. 0: Primary delay 1: Linear acceleration/deceleration When you select "Linear acceleration/deceleration", do not switch the control mode. Doing so will cause the servo motor to make a sudden stop at the time of control mode switching.	0h	○		
	_ x _ _	For manufacturer setting	0h			
	x _ _ _		0h			
PB26 *CDP Gain switching function	Select the gain switching condition. Set conditions to enable the gain switching values set in [Pr. PB29] to [Pr. PB36] and [Pr. PB56] to [Pr. PB60].					
	_ _ _ x	Gain switching selection 0: Disabled 1: Switching is enabled by control command from controller (C_CDP) and Input device CDP (Gain switching). 2: Command frequency 3: Droop pulses 4: Servo motor speed	0h	○	○	
	_ _ x _	Gain switching condition selection 0: Gain after switching is enabled with gain switching condition or more 1: Gain after switching is enabled with gain switching condition or less	0h	○	○	
	_ x _ _	Gain switching time constant disabling condition selection 0: Switching time constant enabled 1: Switching time constant disabled 2: Return time constant disabled Refer to section 7.2.4 for details.	0h	○	○	
	x _ _ _	For manufacturing setting	0h			
PB27 CDL Gain switching condition		Set the value of gain switching (command frequency, droop pulses, and servo motor speed) selected in [Pr. PB26]. The set value unit differs depending on the switching condition item. (Refer to section 7.2.3.) Setting range: 0 to 65535	10 [kpulse/s] /[pulse] /[r/min]	○	○	
PB28 CDT Gain switching time constant		Set the time constant until the gains switch in response to the conditions set in [Pr. PB26] and [Pr. PB27]. Setting range: 0 to 100	1 [ms]	○	○	
PB29 GD2B Load to motor inertia ratio after gain switching		Set the load to motor inertia ratio for when gain switching is enabled. This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08]. Setting range: 0.00 to 300.00	7.00 [Multiplier]	○	○	
PB30 PG2B Position loop gain after gain switching		Set the position loop gain when the gain switching is enabled. When you set a value less than 1.0 rad/s, the value will be the same as [Pr. PB08]. This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08]. Setting range: 0.0 to 2000.0	0.0 [rad/s]	○		
PB31 VG2B Speed loop gain after gain switching		Set the speed loop gain when the gain switching is enabled. When you set a value less than 20 rad/s, the value will be the same as [Pr. PB09]. This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08]. Setting range: 0 to 65535	0 [rad/s]	○	○	

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PB32 VICB Speed integral compensation after gain switching		Set the speed integral compensation when the gain changing is enabled. When you set a value less than 0.1 ms, the value will be the same as [Pr. PB10]. This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08]. Setting range: 0.0 to 5000.0	0.0 [ms]	○	○	
PB33 VRF11B Vibration suppression control 1 - Vibration frequency after gain switching		Set the vibration frequency for vibration suppression control 1 when the gain switching is enabled. When you set a value less than 0.1 Hz, the value will be the same as [Pr. PB19]. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". • "Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". • "Gain switching selection" is set to "Switching is enabled by control command from controller (C_CDP) and Input device CDP (Gain switching). (_ _ _ 1)" in [Pr. PB26]. Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. Setting range: 0.0 to 300.0	0.0 [Hz]	○		
PB34 VRF12B Vibration suppression control 1 - Resonance frequency after gain switching		Set the resonance frequency for vibration suppression control 1 when the gain switching is enabled. When you set a value less than 0.1 Hz, the value will be the same as [Pr. PB20]. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". • "Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". • "Gain switching selection" is set to "Switching is enabled by control command from controller (C_CDP) and Input device CDP (Gain switching). (_ _ _ 1)" in [Pr. PB26]. Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. Setting range: 0.0 to 300.0	0.0 [Hz]	○		
PB35 VRF13B Vibration suppression control 1 - Vibration frequency damping after gain switching		Set a damping of the vibration frequency for vibration suppression control 1 when the gain switching is enabled. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". • "Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". • "Gain switching selection" is set to "Switching is enabled by control command from controller (C_CDP) and Input device CDP (Gain switching). (_ _ _ 1)" in [Pr. PB26]. Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. Setting range: 0.00 to 0.30	0.00	○		
PB36 VRF14B Vibration suppression control 1 - Resonance frequency damping after gain switching		Set a damping of the resonance frequency for vibration suppression control 1 when the gain switching is enabled. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". • "Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". • "Gain switching selection" is set to "Switching is enabled by control command from controller (C_CDP) and Input device CDP (Gain switching). (_ _ _ 1)" in [Pr. PB26]. Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. Setting range: 0.00 to 0.30	0.00	○		

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode P	S	T
PB45 CNHF Command notch filter	Set the command notch filter.					
	_ _ x x	Command notch filter setting frequency selection Refer to table 5.6 for the relation of setting values to frequency.	00h	○		
	_ x _ _	Notch depth selection Refer to table 5.7 for details.	0h	○		
	x _ _ _	For manufacturer setting	0h			

Table 5.6 Command notch filter setting frequency selection

Setting value	Frequency [Hz]	Setting value	Frequency [Hz]	Setting value	Frequency [Hz]
_ _ 0 0	Disabled	_ _ 2 0	70	_ _ 4 0	17.6
_ _ 0 1	2250	_ _ 2 1	66	_ _ 4 1	16.5
_ _ 0 2	1125	_ _ 2 2	62	_ _ 4 2	15.6
_ _ 0 3	750	_ _ 2 3	59	_ _ 4 3	14.8
_ _ 0 4	562	_ _ 2 4	56	_ _ 4 4	14.1
_ _ 0 5	450	_ _ 2 5	53	_ _ 4 5	13.4
_ _ 0 6	375	_ _ 2 6	51	_ _ 4 6	12.8
_ _ 0 7	321	_ _ 2 7	48	_ _ 4 7	12.2
_ _ 0 8	281	_ _ 2 8	46	_ _ 4 8	11.7
_ _ 0 9	250	_ _ 2 9	45	_ _ 4 9	11.3
_ _ 0 A	225	_ _ 2 A	43	_ _ 4 A	10.8
_ _ 0 B	204	_ _ 2 B	41	_ _ 4 B	10.4
_ _ 0 C	187	_ _ 2 C	40	_ _ 4 C	10
_ _ 0 D	173	_ _ 2 D	38	_ _ 4 D	9.7
_ _ 0 E	160	_ _ 2 E	37	_ _ 4 E	9.4
_ _ 0 F	150	_ _ 2 F	36	_ _ 4 F	9.1
_ _ 1 0	140	_ _ 3 0	35.2	_ _ 5 0	8.8
_ _ 1 1	132	_ _ 3 1	33.1	_ _ 5 1	8.3
_ _ 1 2	125	_ _ 3 2	31.3	_ _ 5 2	7.8
_ _ 1 3	118	_ _ 3 3	29.6	_ _ 5 3	7.4
_ _ 1 4	112	_ _ 3 4	28.1	_ _ 5 4	7.0
_ _ 1 5	107	_ _ 3 5	26.8	_ _ 5 5	6.7
_ _ 1 6	102	_ _ 3 6	25.6	_ _ 5 6	6.4
_ _ 1 7	97	_ _ 3 7	24.5	_ _ 5 7	6.1
_ _ 1 8	93	_ _ 3 8	23.4	_ _ 5 8	5.9
_ _ 1 9	90	_ _ 3 9	22.5	_ _ 5 9	5.6
_ _ 1 A	86	_ _ 3 A	21.6	_ _ 5 A	5.4
_ _ 1 B	83	_ _ 3 B	20.8	_ _ 5 B	5.2
_ _ 1 C	80	_ _ 3 C	20.1	_ _ 5 C	5.0
_ _ 1 D	77	_ _ 3 D	19.4	_ _ 5 D	4.9
_ _ 1 E	75	_ _ 3 E	18.8	_ _ 5 E	4.7
_ _ 1 F	72	_ _ 3 F	18.2	_ _ 5 F	4.5

Table 5.7 Notch depth selection

Setting value	Depth [dB]	Setting value	Depth [dB]
_ 0 _ _	-40.0	_ 8 _ _	-6.0
_ 1 _ _	-24.1	_ 9 _ _	-5.0
_ 2 _ _	-18.1	_ A _ _	-4.1
_ 3 _ _	-14.5	_ B _ _	-3.3
_ 4 _ _	-12.0	_ C _ _	-2.5
_ 5 _ _	-10.1	_ D _ _	-1.8
_ 6 _ _	-8.5	_ E _ _	-1.2

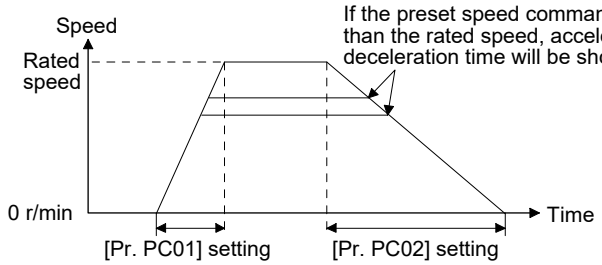
No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PB46 NH3 Machine resonance suppression filter 3		Set the notch frequency of the machine resonance suppression filter 3. To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 3 selection" in [Pr. PB47]. Setting range: 10 to 4500	4500 [Hz]	○	○	○
PB47 NHQ3 Notch shape selection 3	Set the shape of the machine resonance suppression filter 3.					
	_ _ _ x	Machine resonance suppression filter 3 selection 0: Disabled 1: Enabled	0h	○	○	○
	_ _ x _	Notch depth selection 0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0h	○	○	○
	_ x _ _	Notch width selection 0: α = 2 1: α = 3 2: α = 4 3: α = 5	0h	○	○	○
	x _ _ _	For manufacturer setting	0h			
PB48 NH4 Machine resonance suppression filter 4		Set the notch frequency of the machine resonance suppression filter 4. To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 4 selection" in [Pr. PB49]. Setting range: 10 to 4500	4500 [Hz]	○	○	○
PB49 NHQ4 Notch shape selection 4	Set the shape of the machine resonance suppression filter 4.					
	_ _ _ x	Machine resonance suppression filter 4 selection 0: Disabled 1: Enabled When you select "Enabled" of this digit, [Pr. PB17 Shaft resonance suppression filter] is not available.	0h	○	○	○
	_ _ x _	Notch depth selection 0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0h	○	○	○
	_ x _ _	Notch width selection 0: α = 2 1: α = 3 2: α = 4 3: α = 5	0h	○	○	○
	x _ _ _	For manufacturer setting	0h			
PB50 NH5 Machine resonance suppression filter 5		Set the notch frequency of the machine resonance suppression filter 5. To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 5 selection" in [Pr. PB51]. Setting range: 10 to 4500	4500 [Hz]	○	○	○

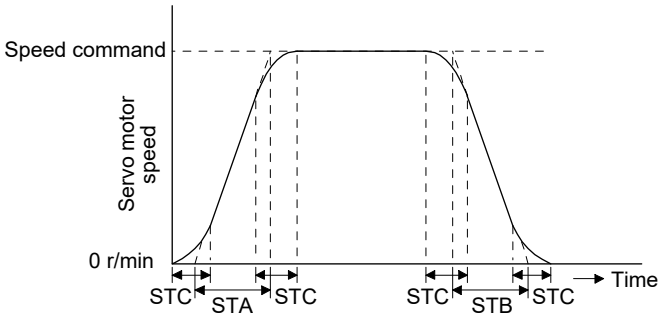
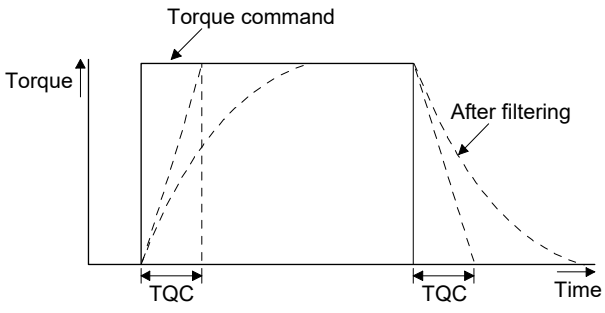
No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PB51 NHQ5 Notch shape selection 5	Set the shape of the machine resonance suppression filter 5. When you select "Enabled (_ _ _ 1)" of "Robust filter selection" in [Pr. PE41], the machine resonance suppression filter 5 is not available.					
	_ _ _ x	Machine resonance suppression filter 5 selection 0: Disabled 1: Enabled	0h	○	○	○
	_ _ x _	Notch depth selection 0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0h	○	○	○
	_ x _ _	Notch width selection 0: α = 2 1: α = 3 2: α = 4 3: α = 5	0h	○	○	○
	x _ _ _	For manufacturer setting	0h			
PB52 VRF21 Vibration suppression control 2 - Vibration frequency		Set the vibration frequency for vibration suppression control 2 to suppress low-frequency machine vibration. When "Vibration suppression control 2 tuning mode selection" is set to "Automatic setting (_ _ 1 _)" in [Pr. PB02], this parameter will be set automatically. When "Manual setting (_ _ 2 _)" is selected, the setting written to the parameter is used. The setting range of this parameter varies, depending on the value in [Pr. PB07]. If a value out of the range is set, the vibration suppression control will be disabled. Refer to section 7.1.5 for details. To enable the setting value, set "Vibration suppression mode selection" to "3 inertia mode (_ _ _ 1)" in [Pr. PA24]. Setting range: 0.1 to 300.0	100.0 [Hz]	○		
PB53 VRF22 Vibration suppression control 2 - Resonance frequency		Set the resonance frequency for vibration suppression control 2 to suppress low-frequency machine vibration. When "Vibration suppression control 2 tuning mode selection" is set to "Automatic setting (_ _ 1 _)" in [Pr. PB02], this parameter will be set automatically. When "Manual setting (_ _ 2 _)" is selected, the setting written to the parameter is used. The setting range of this parameter varies, depending on the value in [Pr. PB07]. If a value out of the range is set, the vibration suppression control will be disabled. Refer to section 7.1.5 for details. To enable the setting value, set "Vibration suppression mode selection" to "3 inertia mode (_ _ _ 1)" in [Pr. PA24]. Setting range: 0.1 to 300.0	100.0 [Hz]	○		
PB54 VRF23 Vibration suppression control 2 - Vibration frequency damping		Set a damping of the vibration frequency for vibration suppression control 2 to suppress low-frequency machine vibration. When "Vibration suppression control 2 tuning mode selection" is set to "Automatic setting (_ _ 1 _)" in [Pr. PB02], this parameter will be set automatically. When "Manual setting (_ _ 2 _)" is selected, the setting written to the parameter is used. Refer to section 7.1.5 for details. To enable the setting value, set "Vibration suppression mode selection" to "3 inertia mode (_ _ _ 1)" in [Pr. PA24]. Setting range: 0.00 to 0.30	0.00	○		
PB55 VRF24 Vibration suppression control 2 - Resonance frequency damping		Set a damping of the resonance frequency for vibration suppression control 2 to suppress low-frequency machine vibration. When "Vibration suppression control 2 tuning mode selection" is set to "Automatic setting (_ _ 1 _)" in [Pr. PB02], this parameter will be set automatically. When "Manual setting (_ _ 2 _)" is selected, the setting written to the parameter is used. Refer to section 7.1.5 for details. To enable the setting value, set "Vibration suppression mode selection" to "3 inertia mode (_ _ _ 1)" in [Pr. PA24]. Setting range: 0.00 to 0.30	0.00	○		

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PB56 VRF21B Vibration suppression control 2 - Vibration frequency after gain switching		Set the vibration frequency for vibration suppression control 2 when the gain switching is enabled. When you set a value less than 0.1 Hz, the value will be the same as [Pr. PB52]. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". • "Vibration suppression mode selection" in [Pr. PA24] is "3 inertia mode (_ _ _ 1)". • "Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". • "Gain switching selection" is set to "Switching is enabled by control command from controller (C_CDP) and Input device CDP (Gain switching). (_ _ _ 1)" in [Pr. PB26]. Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. Setting range: 0.0 to 300.0	0.0 [Hz]	○		
PB57 VRF22B Vibration suppression control 2 - Resonance frequency after gain switching		Set the resonance frequency for vibration suppression control 2 when the gain switching is enabled. When you set a value less than 0.1 Hz, the value will be the same as [Pr. PB53]. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". • "Vibration suppression mode selection" in [Pr. PA24] is "3 inertia mode (_ _ _ 1)". • "Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". • "Gain switching selection" is set to "Switching is enabled by control command from controller (C_CDP) and Input device CDP (Gain switching). (_ _ _ 1)" in [Pr. PB26]. Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. Setting range: 0.0 to 300.0	0.0 [Hz]	○		
PB58 VRF23B Vibration suppression control 2 - Vibration frequency damping after gain switching		Set a damping of the vibration frequency for vibration suppression control 2 when the gain switching is enabled. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". • "Vibration suppression mode selection" in [Pr. PA24] is "3 inertia mode (_ _ _ 1)". • "Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". • "Gain switching selection" is set to "Switching is enabled by control command from controller (C_CDP) and Input device CDP (Gain switching). (_ _ _ 1)" in [Pr. PB26]. Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. Setting range: 0.00 to 0.30	0.00	○		
PB59 VRF24B Vibration suppression control 2 - Resonance frequency damping after gain switching		Set a damping of the resonance frequency for vibration suppression control 2 when the gain switching is enabled. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". • "Vibration suppression mode selection" in [Pr. PA24] is "3 inertia mode (_ _ _ 1)". • "Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". • "Gain switching selection" is set to "Switching is enabled by control command from controller (C_CDP) and Input device CDP (Gain switching). (_ _ _ 1)" in [Pr. PB26]. Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. Setting range: 0.00 to 0.30	0.00	○		

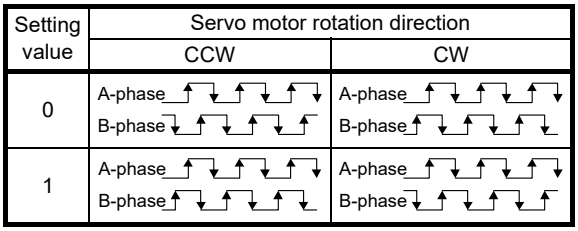
No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PB60 PG1B Model loop gain after gain switching		Set the model loop gain when the gain switching is enabled. When you set a value less than 1.0 rad/s, the value will be the same as [Pr. PB07]. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Gain switching selection" is set to "Switching is enabled by control command from controller (C_CDP) and Input device CDP (Gain switching). (_ _ _ 1)" in [Pr. PB26]. Switching during driving may cause a shock. Be sure to switch them after the servo motor stops. Setting range: 0.0 to 2000.0	0.0 [rad/s]	○	○	

5.2.3 Extension setting parameters ([Pr. PC_ _])

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PC01 STA Acceleration time constant		Set the acceleration time required to reach the rated speed from 0 r/min in response to VC (Analog speed command) and [Pr. PC05 Internal speed command 1] to [Pr. PC11 Internal speed command 7].  For example for the servo motor of 3000 r/min rated speed, set 3000 (3 s) to increase speed from 0 r/min to 1000 r/min in 1 second. Setting range: 0 to 50000	0 [ms]		○	○
PC02 STB Deceleration time constant		Set the deceleration time required to reach 0 r/min from the rated speed in response to VC (Analog speed command) and [Pr. PC05 Internal speed command 1] to [Pr. PC11 Internal speed command 7]. Setting range: 0 to 50000	0 [ms]		○	○

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PC03 STC S-pattern acceleration/ deceleration time constant		Start/stop the servo motor smoothly. Set the time of the arc part for S-pattern acceleration/deceleration. Setting "0" will make it linear acceleration/deceleration.  STA: Acceleration time constant ([Pr. PC01]) STB: Deceleration time constant ([Pr. PC02]) STC: S-pattern acceleration/deceleration time constant ([Pr. PC03]) Long setting of STA (acceleration time constant) or STB (deceleration time constant) may produce an error in the time of the arc part for the setting of the S-pattern acceleration/deceleration time constant. The upper limit value of the actual arc part time is limited by $\frac{2000000}{STA}$ for acceleration or by $\frac{2000000}{STB}$ for deceleration. (Example) At the setting of STA 20000, STB 5000 and STC 200, the actual arc part times are as follows. Acceleration: 100 ms $\frac{2000000}{20000}$ = 100 [ms] < 200 [ms] Therefore, it will be limited to 100 ms. Deceleration: 200 ms $\frac{2000000}{5000}$ = 400 [ms] > 200 [ms] Therefore, it will be 200 ms as you set. Setting range: 0 to 5000	0 [ms]		○	○
PC04 TQC Torque command time constant		Set the constant of a primary delay to the torque command.  TQC: Torque command time constant Setting range: 0 to 50000	0 [ms]			○

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PC05 SC1 Internal speed command 1/internal speed limit 1		Set speed 1 of internal speed commands. If [Pr. PC29] is set to "0 _ _ _" and input device SP1, SP2, and SP3 are turned off, internal speed command 1 is used as the speed command value. Refer to section 3.5 for details. Setting range: 0.00 to instantaneous permissible speed	100.00 [r/min]		○	
		Set speed 1 of internal speed limits. Setting range: 0.00 to instantaneous permissible speed				○
PC06 SC2 Internal speed command 2 Internal speed limit 2		Set speed 2 of internal speed commands. Setting range: 0.00 to instantaneous permissible speed	500.00 [r/min]		○	
		Set speed 2 of internal speed limits. Setting range: 0.00 to instantaneous permissible speed				○
PC07 SC3 Internal speed command 3 Internal speed limit 3		Set speed 3 of internal speed commands. Setting range: 0.00 to instantaneous permissible speed	1000.00 [r/min]		○	
		Set speed 3 of internal speed limits. Setting range: 0.00 to instantaneous permissible speed				○
PC08 SC4 Internal speed command 4 Internal speed limit 4		Set speed 4 of internal speed commands. Setting range: 0.00 to instantaneous permissible speed	200.00 [r/min]		○	
		Set speed 4 of internal speed limits. Setting range: 0.00 to instantaneous permissible speed				○
PC09 SC5 Internal speed command 5 Internal speed limit 5		Set speed 5 of internal speed commands. Setting range: 0.00 to instantaneous permissible speed	300.00 [r/min]		○	
		Set speed 5 of internal speed limits. Setting range: 0.00 to instantaneous permissible speed				○
PC10 SC6 Internal speed command 6 Internal speed limit 6		Set speed 6 of internal speed commands. Setting range: 0.00 to instantaneous permissible speed	500.00 [r/min]		○	
		Set speed 6 of internal speed limits. Setting range: 0.00 to instantaneous permissible speed				○
PC11 SC7 Internal speed command 7 Internal speed limit 7		Set speed 7 of internal speed commands. Setting range: 0.00 to instantaneous permissible speed	800.00 [r/min]		○	
		Set speed 7 of internal speed limits. Setting range: 0.00 to instantaneous permissible speed				○
PC12 VCM Analog speed command - Maximum speed		Set the speed at the maximum input voltage (10 V) of VC (Analog speed command). When "0.00" is set, the analog speed command maximum speed would be the rated speed of the servo motor connected. If a value equal to or larger than the permissible speed is inputted to VC, the value is clamped at the permissible speed. Setting range: 0.00 to 50000.00	0.00 [r/min]		○	

<table>
<tr><th rowspan="2">No./symbol/
name</th><th rowspan="2">Setting
digit</th><th rowspan="2">Function</th><th rowspan="2">Initial
value
[unit]</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>PC13
TLC
Analog torque command maximum output</td><td></td><td>Set the output torque at the analog torque command voltage (TC = ±8 V) of +8 V on the assumption that the maximum torque is 100.0%.
For example, set 50.0.
The maximum torque × $\frac{50.0}{100.0}$ is outputted.
If a value equal to or larger than the maximum torque is inputted to TC, the value is clamped at the maximum torque.
Setting range: 0.0 to 100.0</td><td>100.0
[%]</td><td></td><td></td><td>○</td></tr>
<tr><td>PC16
MBR
Electromagnetic brake sequence output</td><td></td><td>Set the delay time between MBR (Electromagnetic brake interlock) and the base drive circuit is shut-off. For the timing chart of when the servo motor with an electromagnetic brake is used, refer to section 3.10.2.
Setting range: 0 to 1000</td><td>0
[ms]</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>PC17
ZSP
Zero speed</td><td></td><td>Set the output range of ZSP (Zero speed detection).
ZSP (Zero speed detection) has hysteresis of 20 r/min.
Setting range: 0 to 10000</td><td>50
[r/min]</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td rowspan="4">PC18
*BPS
Alarm history clear</td><td>_ _ _ x</td><td>Alarm history clear selection
Used to clear the alarm history.
0: Disabled
1: Enabled
When "Enabled" is set, the alarm history will be cleared at the next power-on. Once the alarm history is cleared, the setting becomes disabled automatically.</td><td>0h</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>_ x _ _</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">PC19
*ENRS
Encoder output pulse selection</td><td>_ _ _ x</td><td>Encoder output pulse phase selection
Select the encoder pulse direction.
0: Increasing A-phase 90° in CCW
1: Increasing A-phase 90° in CW

</td><td>0h</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>_ _ x _</td><td>Encoder output pulse setting selection
0: Output pulse setting
1: Dividing ratio setting
2: The same output pulse setting as the command pulse
3: A-phase/B-phase pulse electronic gear setting
When you select "1", the settings of [Pr. PA16 Encoder output pulses 2] will be disabled.
When you select "2", the settings of [Pr. PA15 Encoder output pulses] and [Pr. PA16 Encoder output pulses 2] will be disabled. When you select the setting, do not change the settings in [Pr. PA06] and [Pr. PA07] after the power-on.</td><td>0h</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td><td></td><td></td></tr>
</table>

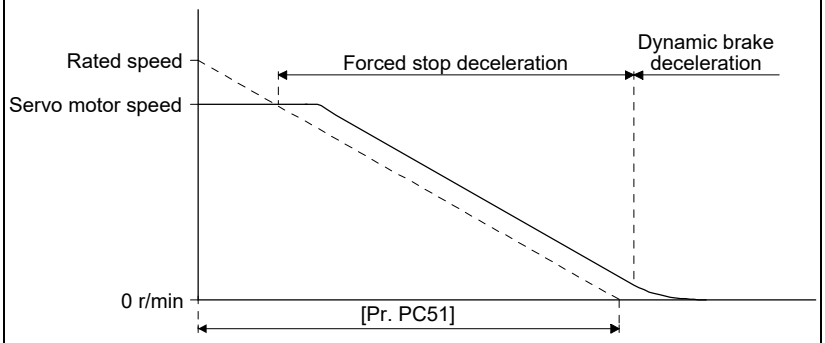
<table>
<tr><th rowspan="2">No./symbol/ name</th><th rowspan="2">Setting digit</th><th rowspan="2">Function</th><th rowspan="2">Initial value [unit]</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td rowspan="4">PC22
*COP1
Function selection C-1</td><td>_ _ _ x</td><td rowspan="3">For manufacturer setting</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>_ _ x _</td><td>2h</td><td></td><td></td><td></td></tr>
<tr><td>_ x _ _</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>x _ _ _</td><td>Encoder cable communication method selection
Select the encoder cable communication method.
0: Two-wire type
1: Four-wire type
If the setting is incorrect, [AL. 16 Encoder initial communication error 1] or [AL. 20 Encoder normal communication error 1] occurs.</td><td>0h</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td rowspan="4">PC23
*COP2
Function selection C-2</td><td>_ _ _ x</td><td>Servo-lock selection at speed control stop
Select the servo-lock selection at speed control stop.
In the speed control mode, the servo motor shaft can be locked to prevent the shaft from being moved by an external force.
0: Enabled (servo-lock)
The operation to maintain the stop position is performed.
1: Disabled (no servo-lock)
The stop position is not maintained.
The control to make the speed 0 r/min is performed.</td><td>0h</td><td></td><td>○</td><td></td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>_ x _ _</td><td>VC voltage averaging selection
Select the VC voltage average.
Set the filtering time when VC (Analog speed command) is imported.
Set "0" to vary the speed to voltage fluctuation in real time. Increase the set value to vary the speed slower to voltage fluctuation.
<table><tr><th>Setting value</th><th>Filtering time [ms]</th></tr><tr><td>0</td><td>0</td></tr><tr><td>1</td><td>0.444</td></tr><tr><td>2</td><td>0.888</td></tr><tr><td>3</td><td>1.777</td></tr><tr><td>4</td><td>3.555</td></tr><tr><td>5</td><td>7.111</td></tr></table></td><td>0h</td><td></td><td>○</td><td>○</td></tr>
<tr><td>x _ _ _</td><td>Speed limit selection at torque control
Select the speed limit selection at torque control.
0: Enabled
1: Disabled
Do not use this function except when configuring an external speed loop.</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">PC24
*COP3
Function selection C-3</td><td>_ _ _ x</td><td>In-position range unit selection
Select a unit of in-position range.
0: Command input pulse unit
1: Servo motor encoder pulse unit</td><td>0h</td><td>○</td><td></td><td></td></tr>
<tr><td>_ _ x _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>_ x _ _</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>x _ _ _</td><td>Error excessive alarm/error excessive warning level unit selection
Select a setting unit for the error excessive alarm detection level set in [Pr. PC43] and for error excessive warning level setting with [Pr. PC73].
0: 1 rev unit
1: 0.1 rev unit
2: 0.01 rev unit
3: 0.001 rev unit</td><td>0h</td><td>○</td><td></td><td></td></tr>
</table>

<table>
<tr><th rowspan="2">No./symbol/ name</th><th rowspan="2">Setting digit</th><th rowspan="2">Function</th><th rowspan="2">Initial value [unit]</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td rowspan="4">PC26
*COP5
Function selection C-5</td><td>_ _ _ x</td><td>[AL. 99 Stroke limit warning] selection
Enable or disable [AL. 99 Stroke limit warning].
0: Enabled
1: Disabled</td><td>0h</td><td>○</td><td>○</td><td></td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>_ x _ _</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">PC27
*COP6
Function selection C-6</td><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>_ _ x _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>_ x _ _</td><td>Undervoltage alarm selection
Select the alarm and warning that occurs when the bus voltage drops to the undervoltage alarm level.
0: [AL. 102] regardless of servo motor speed
1: [AL. E9.1] occurs when the servo motor speed is 50 r/min or less, and [AL. 10.2] occurs when the servo motor speed is over 50 r/min.</td><td>0h</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td rowspan="4">PC29
*COP8
Function selection C-8</td><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>_ _ _ x</td><td rowspan="3">For manufacturer setting</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>_ _ x _</td><td>2h</td><td></td><td></td><td></td></tr>
<tr><td>_ x _ _</td><td>1h</td><td></td><td></td><td></td></tr>
<tr><td>x _ _ _</td><td>Analog input signal selection
Select the analog input signal for the CN3-9 pin. After changing the setting, readjust [Pr. PC37] and [Pr. PC38].
Available analog input signals will differ depending on [Pr. PA01] setting values. Refer to the following table for details.
0: TC/TLA setting
1: VC setting value
<table><tr><th>Setting value</th><th colspan="6">Supported control modes (Note 2)</th></tr><tr><th>[Pr. PC29]</th><th>P</th><th>P/S</th><th>S</th><th>S/T</th><th>T</th><th>T/P</th></tr><tr><td>0 _ _ _
(TC/TLA setting)</td><td>TLA</td><td>TLA/
TLA</td><td>TLA</td><td>TLA/
TC</td><td>TC</td><td>TC/
TLA</td></tr><tr><td>1 _ _ _
(VC setting)</td><td>-</td><td>-/
VC</td><td>VC</td><td colspan="3">- (Note 1)</td></tr></table>Note 1. Setting an unavailable control mode will trigger [AL. 37].
2. P: position control mode, S: speed control mode, T: torque control mode, P/S: position/speed control switching mode, S/T: speed/torque control switching mode, T/P: torque/position control switching mode</td><td>0h</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>PC30
STA2
Acceleration time constant 2</td><td></td><td>To enable the parameter, turn on STAB2 (Speed acceleration/deceleration selection).
Set the acceleration time required to reach the rated speed from 0 r/min in response to VC (Analog speed command) and [Pr. PC05 Internal speed command 1] to [Pr. PC11 Internal speed command 7].

Setting range: 0 to 50000</td><td>0
[ms]</td><td></td><td>○</td><td>○</td></tr>
<tr><td>PC31
STB2
Deceleration time constant 2</td><td></td><td>To enable the parameter, turn on STAB2 (Speed acceleration/deceleration selection).
Set the deceleration time required to reach 0 r/min from the rated speed in response to VC (Analog speed command) and [Pr. PC05 Internal speed command 1] to [Pr. PC11 Internal speed command 7].

Setting range: 0 to 50000</td><td>0
[ms]</td><td></td><td>○</td><td>○</td></tr>
</table>

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PC32 CMX2 Commanded pulse multiplication numerator 2		To enable the parameter, select "Electronic gear (0 _ _ _)" of "Electronic gear selection" in [Pr. PA21]. Setting range: 1 to 16777215	1	○		
PC33 CMX3 Commanded pulse multiplication numerator 3		To enable the parameter, select "Electronic gear (0 _ _ _)" of "Electronic gear selection" in [Pr. PA21]. Setting range: 1 to 16777215	1	○		
PC34 CMX4 Commanded pulse multiplication numerator 4		To enable the parameter, select "Electronic gear (0 _ _ _)" of "Electronic gear selection" in [Pr. PA21]. Setting range: 1 to 16777215	1	○		
PC35 TL2 Internal torque limit 2		Set the rated torque to 100.0 [%]. Set this parameter to "0.0" to generate no torque. Set the parameter referring to section 3.6.1 (5). Setting range: 0.0 to 1000.0	1000.0 [%]	○	○	○
PC37 VCO Analog speed command offset		Set the offset voltage of VC (Analog speed command). For example, if CCW rotation is provided by switching on ST1 (Forward rotation start) with applying 0 V to VC, set a negative value. When automatic VC offset is used, the automatically offset value is set to this parameter. The initial value is provided before shipment by the automatic VC offset function on condition that the voltage between VC and LG is 0 V. Setting range: -9999 to 9999	The value differs depending on the servo amplifiers. [mV]		○	
PC38 TPO Analog torque command offset/Analog torque limit offset		Set the offset voltage of TC (Analog torque command). Setting range: -9999 to 9999	0 [mV]			○
		Set the offset voltage of TLA (Analog torque limit). Setting range: -9999 to 9999			○	
PC43 ERZ Error excessive alarm detection level		Set an error excessive alarm detection level. You can change the setting unit with "Error excessive alarm/error excessive warning level unit selection" in [Pr. PC24]. However, setting "0" will be 3 rev. Setting over 200 rev will be clamped with 200 rev. Setting range: 0 to 1000	0 [rev]	○		

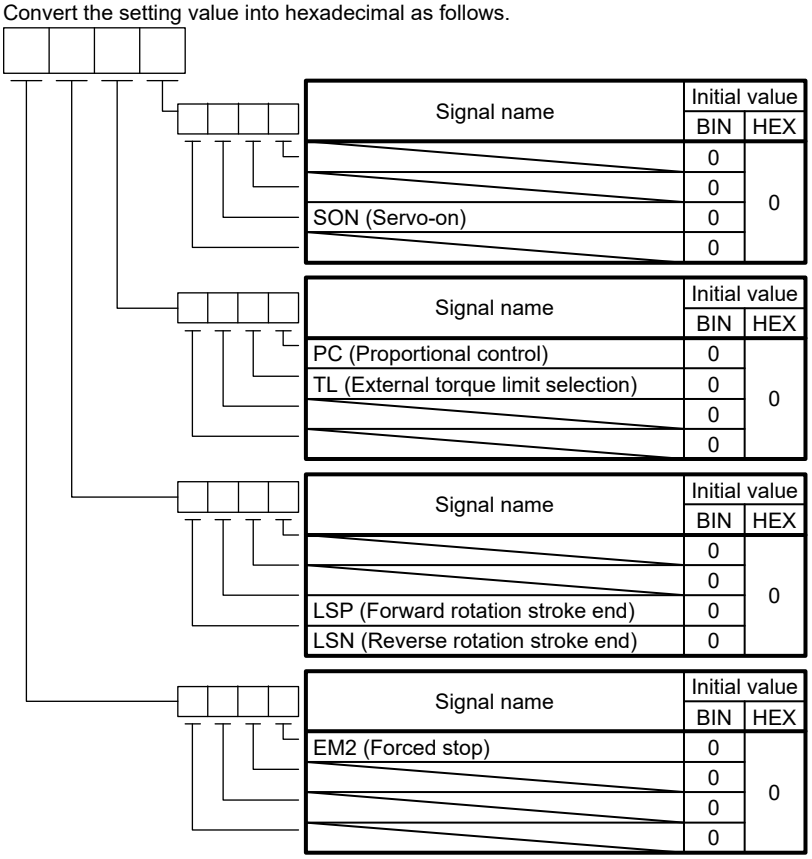
No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PC51 RSBR Forced stop deceleration time constant		Set deceleration time constant when you use the forced stop deceleration function. Set the time per ms from the rated speed to 0 r/min. Setting "0" will be 100 ms.  [Precautions] ▪ If the servo motor torque is saturated at the maximum torque during forced stop deceleration because the set time is too short, the time to stop will be longer than the set time constant. ▪ [AL. 50 Overload alarm 1] or [AL. 51 Overload alarm 2] may occur during forced stop deceleration, depending on the set value. ▪ After an alarm that leads to a forced stop deceleration, if an alarm that does not lead to a forced stop deceleration occurs or if the power supply is cut, dynamic braking will start regardless of the deceleration time constant setting. Setting range: 0 to 20000	100 [ms]	○	○	
PC54 RSUP1 Vertical axis freefall prevention compensation amount		Set the compensation amount of the vertical axis freefall prevention function. Set it per servo motor rotation amount. The function will pull up an shaft per rotation amount to the servo motor rotation direction at the time of inputting forward rotation pulse for a positive value, and at the time of inputting reverse rotation pulse for a negative value. For example, if a positive compensation amount is set when the [Pr. PA14 Rotation direction selection] setting is "1", compensation will be performed to the CW direction. The vertical axis freefall prevention function is performed when all of the following conditions are met. 1) In position control mode, positioning mode or profile position mode (pp). 2) The value of the parameter is other than "0". 3) The forced stop deceleration function is enabled. 4) Alarm has occurred or EM2 has turned off when the servo motor rotates at the zero speed or less. Or, the "Quick stop" command was issued. 5) MBR (Electromagnetic brake interlock) was enabled in [Pr. PD29] to [Pr. PD32], and the base circuit shut-off delay time was set in [Pr. PC16]. Setting range: -25000 to 25000	0 [0.0001 rev]	○		
PC60 *COPD Function selection C-D	_ _ _ x	Motor-less operation selection Select the motor-less operation. 0: Disabled 1: Enabled	0h	○	○	○
	_ _ x _	Test operation selection 0: Disabled 1: Enabled	0h			
	_ x _ _	For manufacturer setting	0h			
	x _ _ _	[AL. 9B Error excessive warning] selection 0: [AL. 9B Error excessive warning] is disabled. 1: [AL. 9B Error excessive warning] is enabled.	0h	○	○	○

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PC73 ERW Error excessive warning level		Set an error excessive warning level. To enable the parameter, select "Enabled (1 _ _ _)" of "[AL. 9B Error excessive warning] selection" in [Pr. PC60]. You can change the setting unit with "Error excessive alarm/error excessive warning level unit selection" in [Pr. PC24]. Set the level in rev unit. When "0" is set, 1 rev will be applied. Setting over 200 rev will be clamped with 200 rev. When an error reaches the set value, [AL. 9B Error excessive warning] will occur. When the error decreases lower than the set value, the warning will be canceled automatically. The minimum pulse width of the warning signal is 100 [ms]. Set as follows: [Pr. PC73 Error excessive warning level] < [Pr. PC43 Error excessive alarm detection level] When you set as [Pr. PC73 Error excessive warning level] ≥ [Pr. PC43 Error excessive alarm detection level], [AL. 52 Error excessive] will occur earlier than the warning. Setting range: 0 to 1000	0 [rev]	○		

5.2.4 I/O setting parameters ([Pr. PD_ _])

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PD01 *DIA1 Input signal automatic on selection 1	Select input devices to turn on automatically.					
	_ _ _ x (HEX)	_ _ _ x (BIN): For manufacturer setting	0h			
		_ _ x _ (BIN): For manufacturer setting				
		_ x _ _ (BIN): SON (Servo-on) Selecting "1" in profile mode will trigger [AL. 37 Parameter error]. 0: Disabled (Use for an external input signal.) 1: Enabled (automatic on)		○	○	○
		x _ _ _ (BIN): For manufacturer setting				
	_ _ x _ (HEX)	_ _ _ x (BIN): PC (Proportional control) 0: Disabled (Use for an external input signal.) 1: Enabled (automatic on)	0h	○	○	
		_ _ x _ (BIN): TL (External torque limit selection) 0: Disabled (Use for an external input signal.) 1: Enabled (automatic on)		○	○	
		_ x _ _ (BIN): For manufacturer setting				
		x _ _ _ (BIN): For manufacturer setting				
	_ x _ _ (HEX)	_ _ _ x (BIN): For manufacturer setting	0h			
		_ _ x _ (BIN): For manufacturer setting				
		_ x _ _ (BIN): LSP (Forward rotation stroke end) 0: Disabled (Use for an external input signal.) 1: Enabled (automatic on)		○	○	
		x _ _ _ (BIN): LSN (Reverse rotation stroke end) 0: Disabled (Use for an external input signal.) 1: Enabled (automatic on)		○	○	
	x _ _ _ (HEX)	_ _ _ x (BIN): EM2 (Forced stop) 0: Disabled (Use for an external input signal.) 1: Enabled (automatic on)	0h	○	○	○
		_ _ x _ (BIN): For manufacturer setting				
		_ x _ _ (BIN): For manufacturer setting				
		x _ _ _ (BIN): For manufacturer setting				

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PD01 *DIA1 Input signal automatic on selection 1		Convert the setting value into hexadecimal as follows.				



Signal name	Initial value BIN	Initial value HEX
	0	0
	0	
SON (Servo-on)	0	
	0	

Signal name	Initial value BIN	Initial value HEX
PC (Proportional control)	0	0
TL (External torque limit selection)	0	
	0	
	0	

Signal name	Initial value BIN	Initial value HEX
	0	0
	0	
LSP (Forward rotation stroke end)	0	
LSN (Reverse rotation stroke end)	0	

Signal name	Initial value BIN	Initial value HEX
EM2 (Forced stop)	0	0
	0	
	0	
	0	

BIN 0: Use for an external input signal.
BIN 1: Automatic on

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode P	S	T
PD05 *DI1L Input device selection 1L	Any input device can be assigned to the CN3-2 pin.					
	_ _ x x	Position control mode - Device selection Refer to table 5.8 for settings.	02h	○		
	x x _ _	Speed control mode - Device selection Refer to table 5.8 for settings.	02h		○	

Table 5.8 Selectable input devices

Setting value	Input device (Note 1) P	S	T
02	SON	SON	SON
03	RES	RES	RES
04	PC	PC	
05	TL	TL	
06	CR		
07		ST1	RS2
08		ST2	RS1
09	TL1	TL1	
0A	LSP	LSP	
0B	LSN	LSN	
0D	CDP	CDP	
20		SP1	SP1
21		SP2	SP2
22		SP3	SP3
23	LOP (Note 2)	LOP (Note 2)	LOP (Note 2)
24	CM1		
25	CM2		
26		STAB2	STAB2

Note 1. P: position control mode, S: speed control mode, T: torque control mode
The diagonal lines indicate manufacturer settings. Never change the setting.
2. When assigning LOP (Control switching), assign it to the same pin in all control modes.

PD06 *DI1M Input device selection 1M	Any input device can be assigned to the CN3-2 pin.					
	_ _ x x	Torque control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	02h			○
	_ x _ _	For manufacturer setting	2h			
	x _ _ _		0h			
PD08 *DI2L Input device selection 2L	Any input device can be assigned to the CN3-3 pin.					
	_ _ x x	Position control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	0Ah	○		
	x x _ _	Speed control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	0Ah		○	
PD09 *DI2M Input device selection 2M	Any input device can be assigned to the CN3-3 pin.					
	_ _ x x	Torque control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	00h			○
	_ x _ _	For manufacturer setting	7h			
	x _ _ _		0h			
PD11 *DI3L Input device selection 3L	Any input device can be assigned to the CN3-4 pin.					
	_ _ x x	Position control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	0Bh	○		
	x x _ _	Speed control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	0Bh		○	

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PD12 *DI3M Input device Selection 3M	Any input device can be assigned to the CN3-4 pin.					
	_ _ x x	Torque control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	00h			○
	_ x _ _	For manufacturer setting	8h			
	x _ _ _		0h			
PD14 *DI4L Input device selection 4L	Any input device can be assigned to the CN3-8 pin.					
	_ _ x x	Position control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	03h	○		
	x x _ _	Speed control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	07h		○	
PD15 *DI4M Input device selection 4M	Any input device can be assigned to the CN3-8 pin.					
	_ _ x x	Torque control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	07h			○
	_ x _ _	For manufacturer setting	8h			
	x _ _ _		3h			
PD17 *DI5L Input device selection 5L	Any input device can be assigned to the CN3-21 pin.					
	_ _ x x	Position control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	06h	○		
	x x _ _	Speed control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	08h		○	
PD18 *DI5M Input device selection 5M	Any input device can be assigned to the CN3-21 pin.					
	_ _ x x	Torque control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	08h			○
	_ x _ _	For manufacturer setting	0h			
	x _ _ _		2h			
PD23 *DI7L Input device selection 7L	Any input device can be assigned to the CN3-6 pin.					
	_ _ x x	Position control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	00h	○		
	x x _ _	Speed control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	00h		○	
PD24 *DI7M Input device selection 7M	Any input device can be assigned to the CN3-6 pin.					
	_ _ x x	Torque control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	00h			○
	_ x _ _	For manufacturer setting	0h			
	x _ _ _		0h			
PD26 *DI8L Input device selection 8L	Any input device can be assigned to the CN3-19 pin.					
	_ _ x x	Position control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	00h	○		
	x x _ _	Speed control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	00h		○	
PD27 *DI8M Input device selection 8M	Any input device can be assigned to the CN3-19 pin.					
	_ _ x x	Torque control mode - Device selection Refer to table 5.8 in [Pr. PD05] for settings.	00h			○
	_ x _ _	For manufacturer setting	0h			
	x _ _ _		0h			

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PD29 *DO1 Output device selection 1	_ _ x x	Device selection Any output device can be assigned to the CN3-14 pin. If "CN3-14 (1 _ _ _)" is selected in "OP signal assignment selection" of [Pr. PD38], this digit will be disabled, and OP (Encoder Z-phase pulse (open collector)) will be assigned to the CN3-14 pin. Refer to table 5.9 for settings.	02h	○	○	○
	_ x _ _	For manufacturer setting	0h			
	x _ _ _		0h			

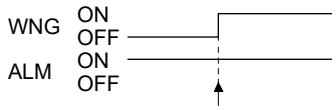
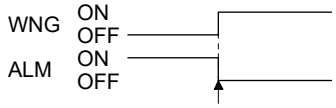
Table 5.9 Selectable output devices

Setting value	Output device (Note)		
	P	S	T
_ _ 0 0	Always off	Always off	Always off
_ _ 0 2	RD	RD	RD
_ _ 0 3	ALM	ALM	ALM
_ _ 0 4	INP	SA	Always off
_ _ 0 5	MBR	MBR	MBR
_ _ 0 7	TLC	TLC	VLC
_ _ 0 8	WNG	WNG	WNG
_ _ 0 A	Always off	SA	Always off
_ _ 0 B	Always off	Always off	VLC
_ _ 0 C	ZSP	ZSP	ZSP
_ _ 0 D	MTTR	MTTR	MTTR
_ _ 0 F	CDPS	Always off	Always off
_ _ 1 1	ABSV	Always off	Always off

Note. P: position control mode, S: speed control mode, T: torque control mode

PD30 *DO2 Output device selection 2	_ _ x x	Device selection Any output device can be assigned to the CN3-15 pin. If "CN3-15 (2 _ _ _)" is selected in "OP signal assignment selection" of [Pr. PD38], this digit will be disabled, and OP (Encoder Z-phase pulse (open collector)) will be assigned to the CN3-15 pin. Refer to table 5.9 in [Pr. PD29] for settings.	03h	○	○	○
	_ x _ _	For manufacturer setting	0h			
	x _ _ _		0h			
PD31 *DO3 Output device selection 3	_ _ x x	Device selection Any output device can be assigned to the CN3-16 pin. This parameter cannot be used to assign output devices since the OP signal is assigned to the CN3-16 pin with "OP signal assignment selection" of [Pr. PD38] in the initial setting. To assign output devices, select a value other than "CN3-16 (3 _ _ _)" in "OP signal assignment selection" of [Pr. PD38] Refer to table 5.9 in [Pr. PD29] for settings.	00h	○	○	○
	_ x _ _	For manufacturer setting	0h			
	x _ _ _		0h			
PD32 *DO4 Output device selection 4	_ _ x x	Device selection Any output device can be assigned to the CN3-22 pin. If "CN3-22 (4 _ _ _)" is selected in "OP signal assignment selection" of [Pr. PD38], this digit will be disabled, and OP (Encoder Z-phase pulse (open collector)) will be assigned to the CN3-22 pin. Refer to table 5.9 in [Pr. PD29] for settings.	04h	○	○	○
	_ x _ _	For manufacturer setting	0h			
	x _ _ _		0h			

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PD34 *DIF Input filter setting	Select a filter for the input signal.					
	_ _ _ x	Input signal filter selection If external input signal causes chattering due to noise, etc., input filter is used to suppress it. 0: None 1: 0.888 [ms] 2: 1.777 [ms] 3: 2.666 [ms] 4: 3.555 [ms]	4h	○	○	○
	_ _ x _	RES (Reset) dedicated filter selection 0: Disabled 1: Enabled (50 [ms])	0h	○	○	○
	_ x _ _	CR (Clear) dedicated filter selection 0: Disabled 1: Enabled (50 [ms])	0h	○	○	○
	x _ _ _	For manufacturer setting	0h			
PD35 *DOP1 Function selection D-1	_ _ _ x	Stop method selection for LSP (Forward rotation stroke end) off and LSN (Reverse rotation stroke end) off Select a stop method for LSP (Forward rotation stroke end) off and LSN (Reverse rotation stroke end) off. 0: Quick stop 1: Slow stop	1h	○	○	
	_ _ x _	Base circuit status selection for RES (Reset) on 0: Base circuit shut-off 1: No base circuit shut-off	0h	○	○	○
	_ x _ _	For manufacturer setting	1h			
	x _ _ _		0h			
PD37 *DOP3 Function selection D-3	_ _ _ x	CR (Clear) selection Set CR (Clear). 0: Deletes droop pulses by turning on the device 1: Always deletes droop pulses during the device on 2: Disabled	0h	○		
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _		0h			
PD38 *DOP4 Function selection D-4	_ _ _ x	For manufacturer setting	0h			
	_ _ x _		0h			
	_ x _ _	Rotation direction selection for enabling torque limit Select a rotation direction which enables the internal torque limit 2 and the external torque limit. Refer to section 3.6.1 (5) for details. 0: Enabled in both CCW or positive direction and CW or negative direction 1: Enabled in CCW or positive direction 2: Enabled in CW or negative direction	0h	○	○	○
	x _ _ _	OP signal assignment selection Select the pin to assign the OP (Encoder Z-phase pulse (open collector)) to. For example, if OP is assigned to the CN3-14 pin, OP is outputted regardless of the setting in [Pr. PD29]. 0: Not assigned 1: CN3-14 ([Pr. PD29] disabled) 2: CN3-15 ([Pr. PD30] disabled) 3: CN3-16 ([Pr. PD31] disabled) 4: CN3-22 ([Pr. PD32] disabled)	3h	○	○	○

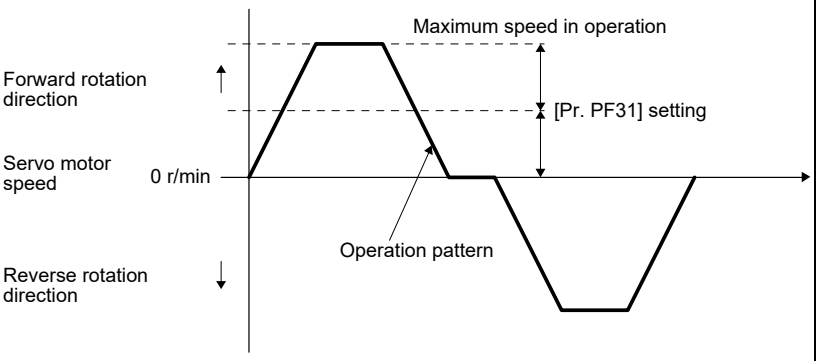
<table>
<tr><th rowspan="2">No./symbol/
name</th><th rowspan="2">Setting
digit</th><th rowspan="2">Function</th><th rowspan="2">Initial
value
[unit]</th><th colspan="3">Control mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td rowspan="4">PD39
*DOP5
Function
selection D-5</td><td>_ _ _ x</td><td>Alarm code output
Select an alarm code output.
When an alarm occurs, the alarm code is outputted to CN3-14, CN3-16, and CN3-22 pins.
0: Disabled
1: Enabled
For details of the alarm codes, refer to chapter 8.
When you select alarm code output while MBR or ALM is assigned to the CN3-14, CN3-16, or CN3-22 pin, [AL. 37 Parameter error] will occur.</td><td>0h</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>_ _ x _</td><td>Selection of output device at warning occurrence
Select ALM (Malfunction) output status for a warning occurrence.
<table><tr><th>Setting value</th><th>Device status</th></tr><tr><td>0</td><td>
</td></tr><tr><td>1</td><td>
</td></tr></table></td><td>0h</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td><td></td><td></td><td></td></tr>
<tr><td>x _ _ _</td><td>0h</td><td></td><td></td><td></td></tr>
</table>

5.2.5 Extension setting 2 parameters ([Pr. PE_ _])

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PE41 EOP3 Function selection E-3	_ _ _ x	Robust filter selection 0: Disabled 1: Enabled When you select "Enabled" of this digit, the machine resonance suppression filter 5 set in [Pr. PB51] is not available.	0h	○	○	○
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _		0h			
PE44 LMCP Lost motion compensation positive-side compensation value selection		Set the lost motion compensation for when reverse rotation (CW) switches to forward rotation (CCW) in increments of 0.01% assuming the rated torque as 100%. Setting range: 0 to 30000	0 [0.01%]	○		
PE45 LMCN Lost motion compensation negative-side compensation value selection		Set the lost motion compensation for when forward rotation (CCW) switches to reverse rotation (CW) in increments of 0.01% assuming the rated torque as 100%. Setting range: 0 to 30000	0 [0.01%]	○		
PE46 LMFLT Lost motion filter setting		Set the time constant of the lost motion compensation filter in increments of 0.1 ms. If the time constant is set to "0", the torque is compensated with the value set in [Pr. PE44] and [Pr. PE45]. If the time constant is set to other than "0", the torque is compensated with the high-pass filter output value of the set time constant, and the lost motion compensation will continue. Setting range: 0 to 30000	0 [0.1 ms]	○		
PE47 TOF Torque offset		Set this when canceling unbalanced torque of vertical axis. Set this assuming the rated torque of the servo motor as 100%. The torque offset does not need to be set for a machine not generating unbalanced torque. The torque offset set with this parameter will be enabled in the position control mode, speed control mode, and torque control mode. Input commands assuming torque offset for the torque control mode. Setting range: -10000 to 10000	0 [0.01%]	○	○	○
PE48 *LMOP Lost motion compensation function selection	_ _ _ x	Lost motion compensation selection 0: disabled 1: enabled	0h	○		
	_ _ x _	Unit setting of lost motion compensation non-sensitive band 0: 1 pulse unit 1: 1 kpulse unit	0h	○		
	_ x _ _	For manufacturer setting	0h			
	x _ _ _		0h			
PE49 LMCD Lost motion compensation timing		Set the lost motion compensation timing in increments of 0.1 ms. You can delay the timing to perform the lost motion compensation for the set time. Setting range: 0 to 30000	0 [0.1 ms]	○		
PE50 LMCT Lost motion compensation non-sensitive band		Set the lost motion compensation non-sensitive band. When the fluctuation of droop pulses equals to or less than the setting value, the speed will be "0".The setting unit can be changed in [Pr. PE48].Set this parameter per encoder. Setting range: 0 to 65535	0 [pulse]/ [kpulse]	○		

5.2.6 Extension setting 3 parameters ([Pr. PF_ _])

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PF09 *FOP5 Function selection F-5	_ _ _ x	Electronic dynamic brake selection 0: Disabled 3: Automatic (enabled only for specified servo motors) Refer to the following table for the specified servo motors. Series: HG-KN — Servo motor: HG-KN053/HG-KN13/HG-KN23/HG-KN43 Series: HG-SN — Servo motor: HG-SN52	3h	○	○	○
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _		0h			
PF15 DBT Electronic dynamic brake operating time		Set an operating time for the electronic dynamic brake. Setting range: 0 to 10000	2000 [ms]	○	○	○
PF21 DRT Drive recorder switching time setting		Set a drive recorder switching time. When a USB communication is cut during using a graph function or a graph function is terminated, the function will be changed to the drive recorder function after the setting time of this parameter. When a value from "1" to "32767" is set, it will switch after the setting value. When "0" is set, it will switch after 600 s. When "-1" is set, the drive recorder function is disabled. Setting range: -1 to 32767	0 [s]	○	○	○
PF23 OSCL1 Vibration tough drive - Oscillation detection level		Set a filter readjustment sensitivity of [Pr. PB13 Machine resonance suppression filter 1] and [Pr. PB15 Machine resonance suppression filter 2] while the vibration tough drive is enabled. However, setting "0" will be 50%. Example: When you set "50" to the parameter, the filter will be readjusted at the time of 50% or more oscillation level. Setting range: 0 to 100	50 [%]	○	○	
PF24 *OSCL2 Vibration tough drive function selection	_ _ _ x	Oscillation detection alarm selection Select alarm or warning when an oscillation continues at a filter readjustment sensitivity level of [Pr. PF23]. The digit is continuously enabled regardless of the vibration tough drive in [Pr. PA20]. 0: [AL. 54 Oscillation detection] will occur at oscillation detection. 1: [AL. F3.1 Oscillation detection warning] will occur at oscillation detection. 2: Oscillation detection function disabled	0h	○	○	
	_ _ x _	For manufacturer setting	0h			
	_ x _ _		0h			
	x _ _ _		0h			
PF25 CVAT instantaneous power failure tough drive - detection time		Set the time of the [AL. 10.1 Voltage drop in the power] occurrence. To disable the parameter, select "Disabled (_ 0 _ _)" of "Instantaneous power failure tough drive selection" in [Pr. PA20]. When "Enabled (_ 1 _ _)" is selected of "Instantaneous power failure tough drive selection" in [Pr. PA20], the power should be off for the setting value of this parameter + 1.5 s or more before cycling the power to enable a parameter whose symbol is preceded by "*". Setting range: 30 to 2000	200 [ms]	○	○	○

No./symbol/ name	Setting digit	Function	Initial value [unit]	Control mode		
				P	S	T
PF31 FRIC Machine diagnosis function - Friction judgment speed		Set a servo motor speed to divide a friction estimation area into high and low for the friction estimation process of the machine diagnosis. However, setting "0" will be the value half of the rated speed. When your operation pattern is under rated speed, we recommend that you set half value to the maximum speed with this.  Setting range: 0 to permissible speed	0 [r/min]	○	○	○

6. NORMAL GAIN ADJUSTMENT

POINT

- In the torque control mode, you do not need to make gain adjustment.
- Before making gain adjustment, check that your machine is not being operated at maximum torque of the servo motor. If operated over maximum torque, the machine may vibrate and may operate unexpectedly. In addition, make gain adjustment with a safety margin considering characteristic differences of each machine. It is recommended that generated torque during operation is under 90% of the maximum torque of the servo motor.
- For the vibration suppression control tuning mode, the setting range of [Pr. PB07] is limited. For the vibration suppression control tuning mode, the setting range of [Pr. PB07] is limited. Refer to section 7.1.5 (4) for details.

6.1 Different adjustment methods

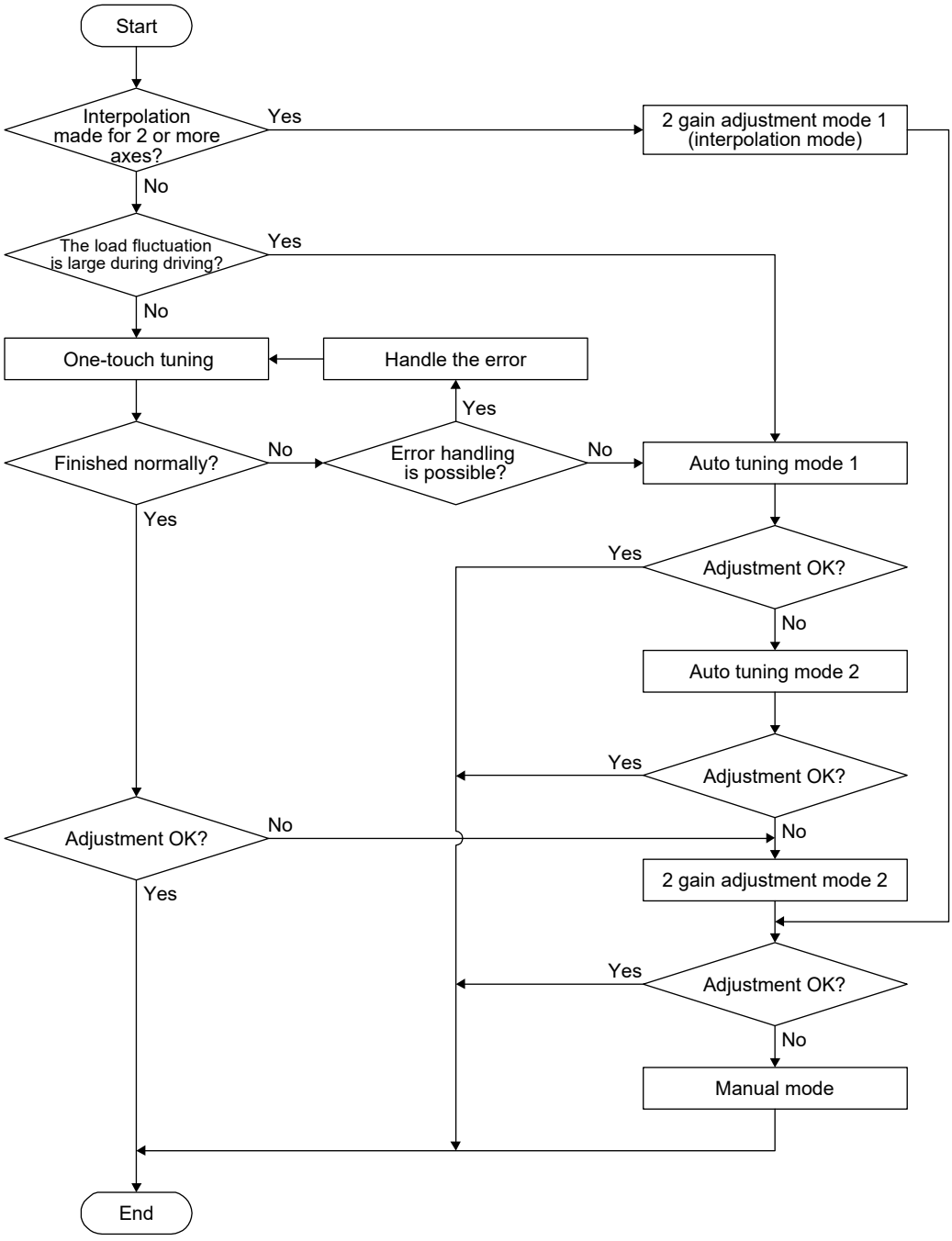
6.1.1 Adjustment on a single servo amplifier

The following table shows the gain adjustment modes that can be set on a single servo amplifier. For gain adjustment, first execute "Auto tuning mode 1". If you are not satisfied with the result of the adjustment, execute "Auto tuning mode 2" and "Manual mode" in this order.

(1) Gain adjustment mode explanation

Gain adjustment mode	[Pr. PA08] setting	Estimation of load to motor inertia ratio	Automatically set parameters	Manually set parameters
Auto tuning mode 1 (initial value)	_ _ _ 1	Always estimated	GD2 ([Pr. PB06]) PG1 ([Pr. PB07]) PG2 ([Pr. PB08]) VG2 ([Pr. PB09]) VIC ([Pr. PB10])	RSP ([Pr. PA09])
Auto tuning mode 2	_ _ _ 2	Fixed to [Pr. PB06] value	PG1 ([Pr. PB07]) PG2 ([Pr. PB08]) VG2 ([Pr. PB09]) VIC ([Pr. PB10])	GD2 ([Pr. PB06]) RSP ([Pr. PA09])
Manual mode	_ _ _ 3			GD2 ([Pr. PB06]) PG1 ([Pr. PB07]) PG2 ([Pr. PB08]) VG2 ([Pr. PB09]) VIC ([Pr. PB10])
2 gain adjustment mode 1 (interpolation mode)	_ _ _ 0	Always estimated	GD2 ([Pr. PB06]) PG2 ([Pr. PB08]) VG2 ([Pr. PB09]) VIC ([Pr. PB10])	PG1 ([Pr. PB07]) RSP ([Pr. PA09])
2 gain adjustment mode 2	_ _ _ 4	Fixed to [Pr. PB06] value	PG2 ([Pr. PB08]) VG2 ([Pr. PB09]) VIC ([Pr. PB10])	GD2 ([Pr. PB06]) PG1 ([Pr. PB07]) RSP ([Pr. PA09])

(2) Adjustment sequence and mode usage



6.1.2 Adjustment using MR Configurator2

This section explains the functions and adjustment using the servo amplifier with MR Configurator2.

Function	Description	Adjustment
Machine analyzer	With the machine and servo motor coupled, the characteristic of the mechanical system can be measured by giving a random vibration command from a personal computer to the servo and measuring the machine response.	You can grasp the machine resonance frequency and determine the notch frequency of the machine resonance suppression filter.

6.2 One-touch tuning

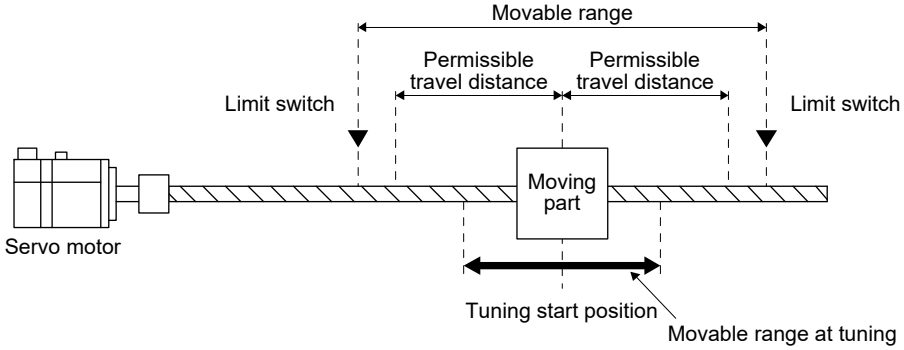
POINT

- After the one-touch tuning is completed, "Gain adjustment mode selection" in [Pr. PA08] will be set to "2 gain adjustment mode 2 (_ _ _ 4)". To estimate [Pr. PB06 Load to motor inertia ratio], set "Gain adjustment mode selection" in [Pr. PA08] to "Auto tuning mode 1 (_ _ _ 1)".
- When executing the one-touch tuning, check the [Pr. PA21 One-touch tuning function selection] is "_ _ _1" (initial value).
- For one-touch tuning via a network, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".
- At start of the one-touch tuning, only when "Auto tuning mode 1 (_ _ _ 1)" or "2 gain adjustment mode 1 (interpolation mode) (_ _ _ 0)" of "Gain adjustment mode selection" is selected in [Pr. PA08], [Pr. PB06 Load to motor inertia ratio] will be estimated.
- When executing the one-touch tuning from the controller, do so when the controller and servo amplifier are connected.
- When the one-touch tuning is executed in the amplifier command method, MR Configurator2 is required.

The one-touch tuning includes two methods: the user command method and the amplifier command method.

(1) User command method
Connect MR Configurator2 and open the one-touch tuning window, and you can use the function. The user command method performs one-touch tuning by inputting commands from outside the servo amplifier.

(2) Amplifier command method
Connect MR Configurator2 and open the one-touch tuning window, and you can use the function. In the amplifier command method, when you simply input a travel distance (permissible travel distance) that collision against the equipment does not occur during servo motor driving, a command for the optimum tuning will be generated inside the servo amplifier to perform one-touch tuning.



The following parameters are set automatically with one-touch tuning. Also, "Gain adjustment mode selection" in [Pr. PA08] will be "2 gain adjustment mode 2 (_ _ _ 4)" automatically. Other parameters will be set to an optimum value depending on the setting of [Pr. PA09 Auto tuning response].

Table 6.1 List of parameters automatically set with one-touch tuning

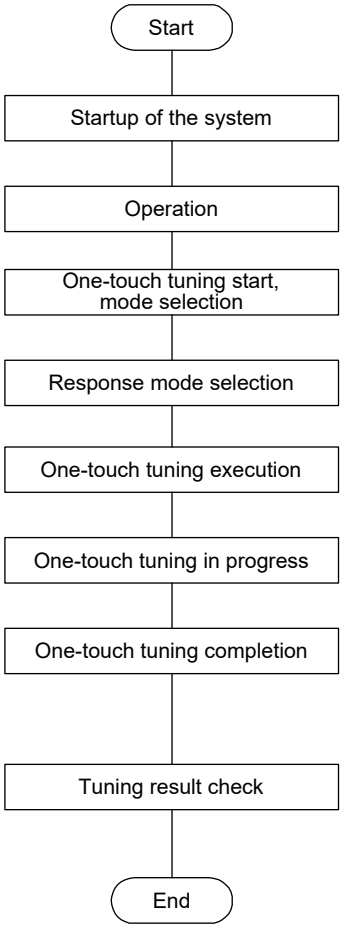
Parameter	Symbol	Name
PA08	ATU	Auto tuning mode
PA09	RSP	Auto tuning response
PB01	FILT	Adaptive tuning mode (adaptive filter II)
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control II)
PB03	PST	Position command acceleration/ deceleration time constant (position smoothing)
PB06	GD2	Load to motor inertia ratio
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation
PB12	OVA	Overshoot amount compensation
PB13	NH1	Machine resonance suppression filter 1
PB14	NHQ1	Notch shape selection 1

Parameter	Symbol	Name
PB15	NH2	Machine resonance suppression filter 2
PB16	NHQ2	Notch shape selection 2
PB17	NHF	Shaft resonance suppression filter
PB18	LPF	Low-pass filter setting
PB19	VRF11	Vibration suppression control 1 - Vibration frequency
PB20	VRF12	Vibration suppression control 1 - Resonance frequency
PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping
PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping
PB23	VFBF	Low-pass filter selection
PB46	NH3	Machine resonance suppression filter 3
PB47	NHQ3	Notch shape selection 3
PB48	NH4	Machine resonance suppression filter 4
PB49	NHQ4	Notch shape selection 4
PB51	NHQ5	Notch shape selection 5
PE41	EOP3	Function selection E-3

6.2.1 One-touch tuning flowchart

(1) User command method

Make one-touch tuning as follows.



Start a system referring to chapter 4.

Rotate the servo motor by a controller. (In the user command method, the one-touch tuning cannot be executed if the servo motor is not operating.)

Start one-touch tuning of MR Configurator2, and select "User command method".

Select a response mode (High mode, Basic mode, and Low mode) in the one-touch tuning window of MR Configurator2.

Press "Start" during servo motor driving to execute one-touch tuning.

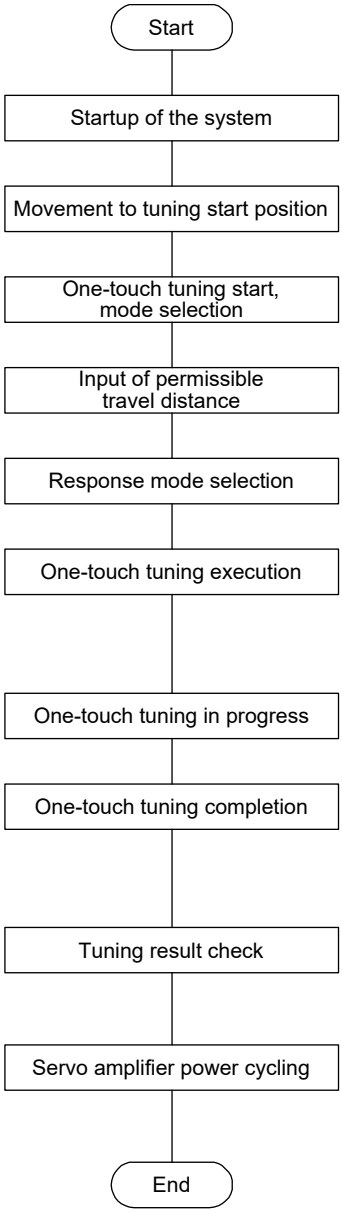
Gains and filters will be adjusted automatically. During processing of tuning, the tuning progress will be displayed in % in MR Configurator2.

When one-touch tuning is completed normally, the parameters described in table 6.1 will be set automatically.
When the tuning is not completed normally, the tuning error will be displayed. (Refer to section 6.2.2 (1) (e).)

Check the tuning result.
When the tuning result is not satisfactory, you can return the parameter to the value before the one-touch tuning or the initial value. (Refer to section 6.2.2 (1) (h).)

(2) Amplifier command method

Make one-touch tuning as follows.



Start a system referring to chapter 4.

Move the moving part to the center of a movable range.

Start one-touch tuning of MR Configurator2, and select "Amplifier command method".

In the one-touch tuning window of MR Configurator2, input a maximum travel distance to move the moving part at one-touch tuning.

Select a response mode (High mode, Basic mode, and Low mode) in the one-touch tuning window of MR Configurator2.

While the servo motor is stopped, press "Start" to start one-touch tuning. After the tuning is started, the servo motor will reciprocate automatically. Executing one-touch tuning during servo motor rotation will cause an error. After one-touch tuning is executed using the amplifier command method, control will not be performed by commands from the controller.

Gains and filters will be adjusted automatically. During processing of tuning, the tuning progress will be displayed in % in MR Configurator2.

One-touch tuning will be completed automatically after the tuning. When one-touch tuning is completed normally, the parameters described in table 6.1 will be updated automatically.
When the tuning is not completed normally, the tuning error will be displayed. (Refer to section 6.2.2 (1) (e).)

Check the tuning result.
When the tuning result is not satisfactory, you can return the parameter to the value before the one-touch tuning or the initial value. (Refer to section 6.2.2 (1) (h).)

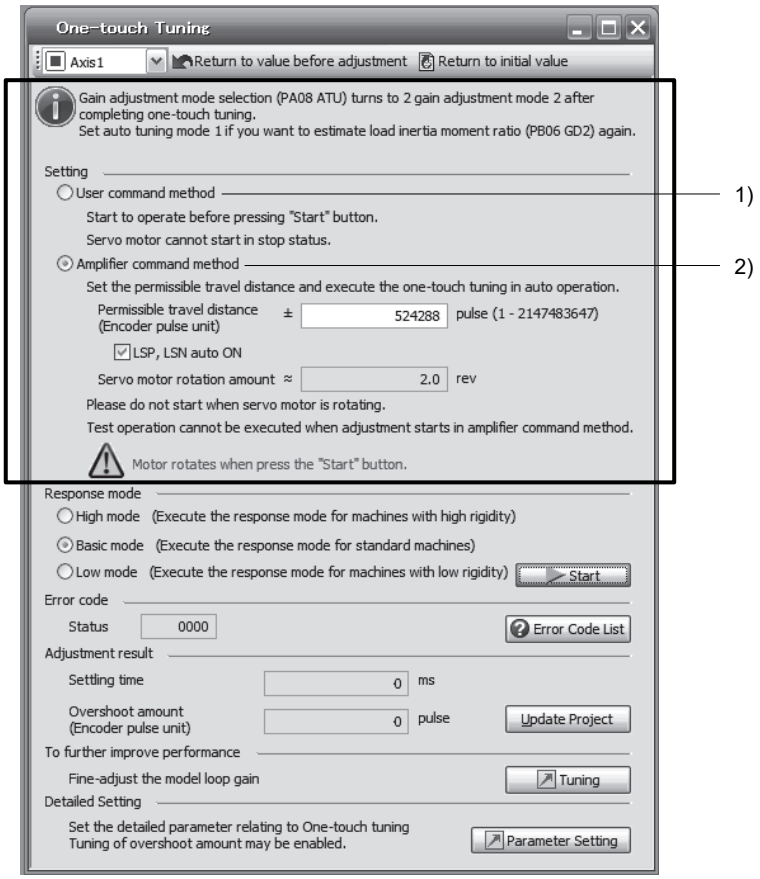
After executing the one-touch tuning, cycling the power of the servo amplifier returns to the state in which control is performed from the controller.

6.2.2 Display transition and operation procedure of one-touch tuning

(1) When you use MR Configurator2

(a) Command method selection

Select a command method from two methods in the one-touch tuning window of MR Configurator2.



1) User command method

It is recommended to input commands meeting the following conditions to the servo amplifier. If one-touch tuning is executed while commands which do not meet the conditions are inputted to the servo amplifier, the one-touch tuning error may occur.

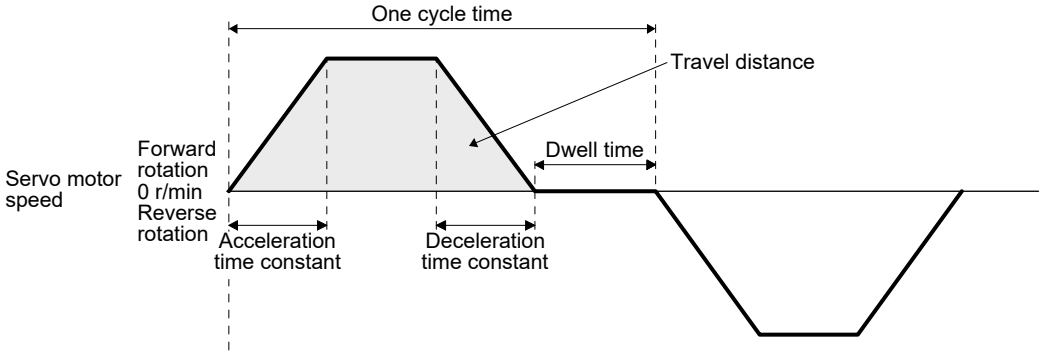


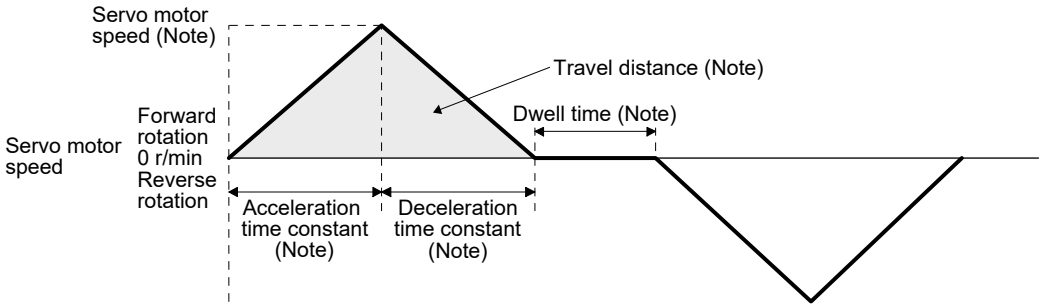
Fig. 6.1 Recommended command for one-touch tuning in the user command method

Item	Description
Travel distance	Set 100 pulses or more in encoder unit. Setting less than 100 pulses will cause the one-touch tuning error "C004".
Servo motor speed	Set 150 r/min or higher. Setting less than 150 r/min may cause the one-touch tuning error "C005".
Acceleration time constant Deceleration time constant	Set the time to reach 2000 r/min to 5 s or less. Set an acceleration time constant/deceleration time constant so that the acceleration/deceleration torque is 10% or more of the rated torque. The estimation accuracy of the load to motor inertia ratio is more improved as the acceleration/deceleration torque is larger, and the one-touch tuning result will be closer to the optimum value.
Dwell time	Set 200 ms or more. Setting a smaller value may cause the one-touch tuning error "C004".
One cycle time	Set 30 s or less. Setting over 30 s will cause the one-touch tuning error "C004".

2) Amplifier command method

Input a permissible travel distance. Input it in the servo motor-side resolution unit. In the amplifier command method, the servo motor will be operated in a range between "current value ± permissible travel distance". Input the permissible travel distance as large as possible within a range that the movable part does not collide against the machine. Inputting a small permissible travel distance decreases the possibility that the moving part will collide against the machine. However, the estimation accuracy of the load to motor inertia ratio may be lower, resulting in improper tuning.

Also, executing the one-touch tuning in the amplifier command method will generate a command for the following optimum tuning inside the servo amplifier to start the tuning.



Note. It will be automatically generated in the servo amplifier.

Fig. 6.2 Command generated by one-touch tuning in the amplifier command method

Item	Description
Travel distance	An optimum travel distance will be automatically set in the range not exceeding the user-inputted permissible travel distance with MR Configurator2.
Servo motor speed	A speed not exceeding 1/2 of the rated speed will be automatically set.
Acceleration time constant Deceleration time constant	An acceleration time constant/deceleration time constant will be automatically set so as not to exceed 60% of the rated torque and the torque limit value set at the start of one-touch tuning in the amplifier command method.
Dwell time	A dwell time in which the one-touch tuning error "C004" does not occur will be automatically set.

(b) Response mode selection

Select a response mode from 3 modes in the one-touch tuning window of MR Configurator2.

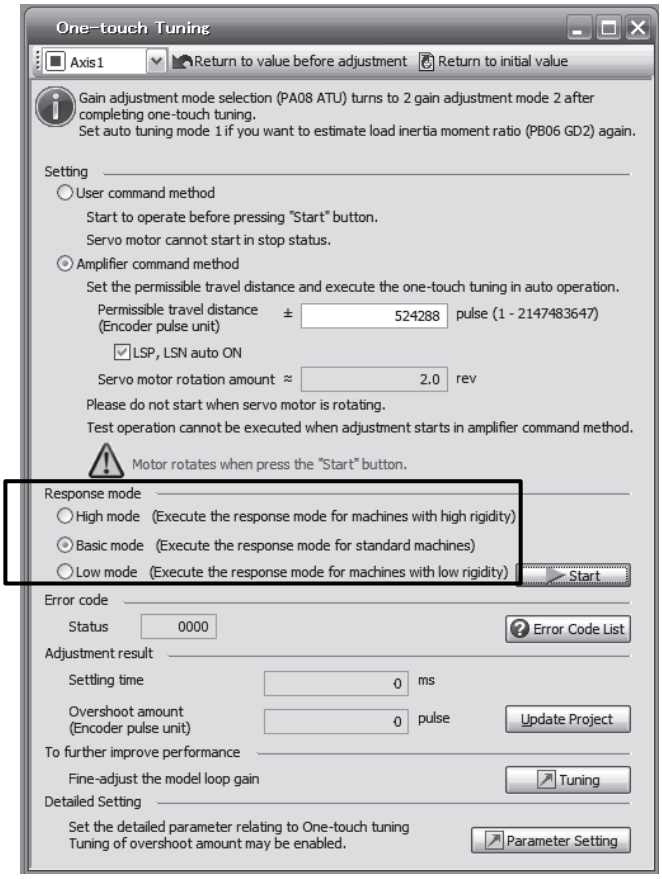


Table 6.2 Response mode explanations

Response mode	Explanation
High mode	This mode is for high-rigid system.
Basic mode	This mode is for standard system.
Low mode	This mode is for low-rigid system.

Refer to the following table for selecting a response mode.

Table 6.3 Guideline for response mode

Response mode			Response	Machine characteristic
Low mode	Basic mode	High mode		Guideline of corresponding machine
↕	↕	↕	Low response ↕ High response	Arm robot General machine tool conveyor Precision working machine Inserter Mounter Bonder

(c) One-touch tuning execution

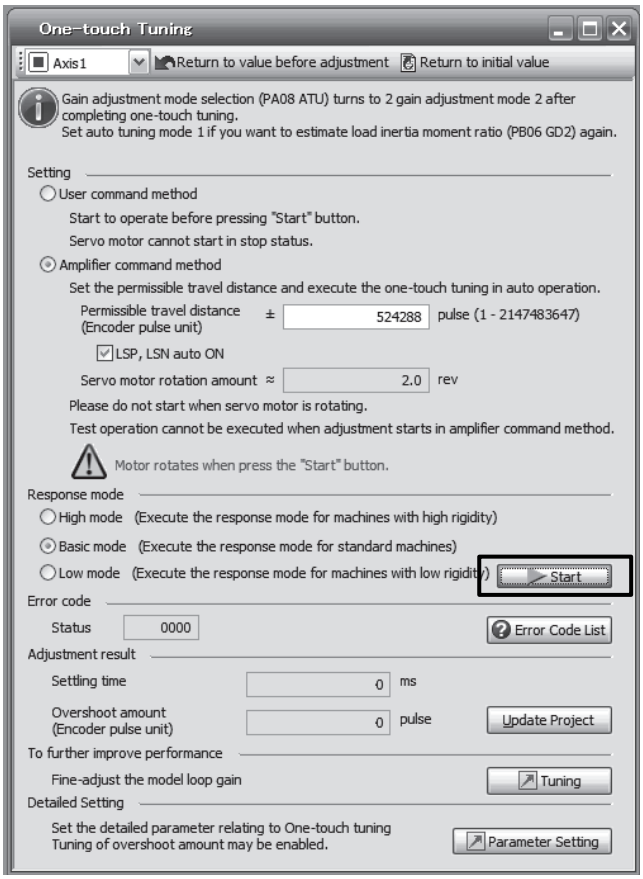
POINT

- For equipment in which overshoot during one-touch tuning is in the permissible level of the in-position range, changing the value of [Pr. PA25 One-touch tuning overshoot permissible level] will shorten the settling time and improve the response.
- When executing one-touch tuning in the amplifier command method, turn on EM2, LSP, and LSN. When EM2, LSP, and LSN are turned off during one-touch tuning, "C008" will be displayed at status in error code, and the one-touch tuning will be canceled. When setting LSP and LSN to automatic on, enable the check box "LSP, LSN auto ON" in the one-touch tuning window of MR Configurator2.

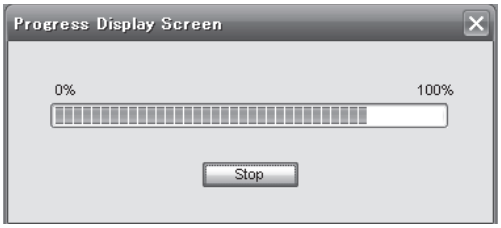
After the response mode is selected in (1) (b) in this section, clicking "Start" will start one-touch tuning. If "Start" is clicked while the servo motor stops, "C002" or "C004" will be displayed at status in error code. (Refer to (1) (e) in this section for error codes.)

Click "Start" with the amplifier command method selected in the servo-off, the servo-on will be automatically enabled, and the one-touch tuning will start. In the one-touch tuning by the amplifier command method, an optimum tuning command will be generated in the servo amplifier after servo-on. Then, the servo motor will reciprocate, and the one-touch tuning will be executed. After the tuning is completed or canceled, the servo amplifier will be the servo-off status. When the servo-on command is inputted from outside, the amplifier will be the servo-on status.

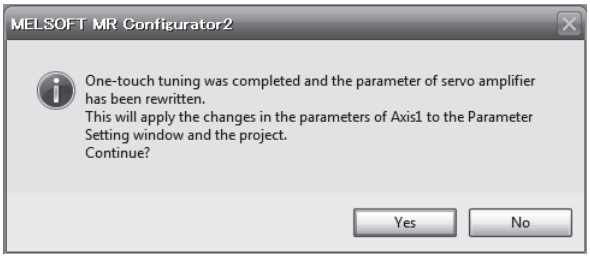
After one-touch tuning is executed using the amplifier command method, control will not be performed by commands from the controller. To return to the state in which control is performed from the controller, cycle the power.



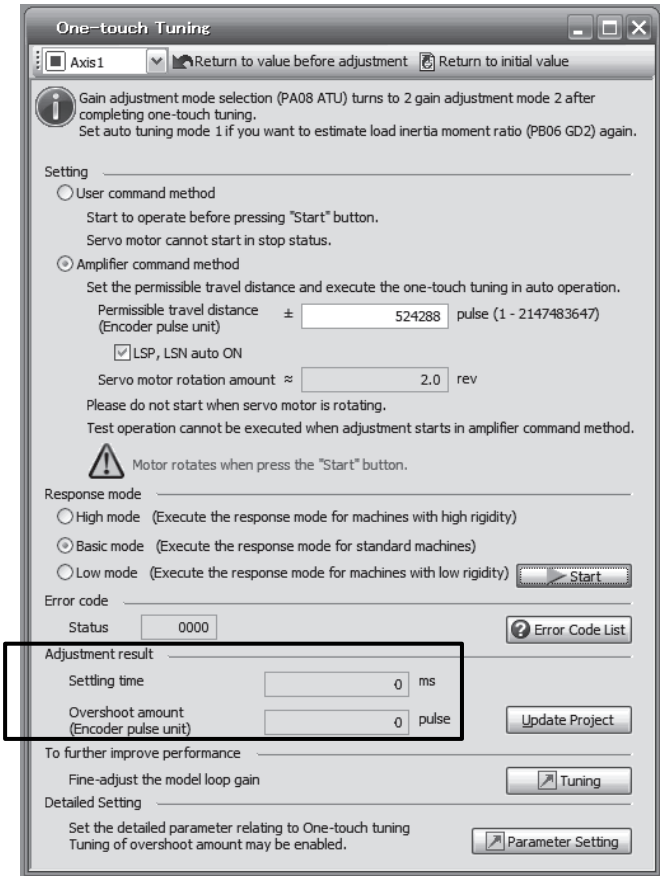
During processing of one-touch tuning, the progress will be displayed as follows. Tuning will be completed at 100%.



Completing the one-touch tuning will start writing tuning parameters to the servo amplifier, and the following window will be displayed. Select whether or not to reflect the tuning result in the project.



After the one-touch tuning is completed, "0000" will be displayed at status in error code. In addition, settling time and overshoot amount will be displayed in "Adjustment result".



(d) Stop of one-touch tuning

During one-touch tuning, clicking the stop button stops one-touch tuning. At this time, "C000" is displayed at status in error code. After the one-touch tuning is stopped, parameters will return to the values at the start of the one-touch tuning. When executing one-touch tuning again, stop the servo motor once. In addition, after returning the moving part to the tuning start position, execute it.

(e) If an error occurs

If a tuning error occurs during tuning, one-touch tuning will be stopped. With that, the following error code will be displayed in status. Check the cause of tuning error. When executing one-touch tuning again, stop the servo motor once. In addition, after returning the moving part to the tuning start position, execute it.

Display	Name	Error detail	Corrective action example
C000	Tuning canceled	The stop button was clicked during one-touch tuning.	
C001	Overshoot exceeded	Overshoot amount is a value larger than the one set in [Pr. PA10 In-position range] and [Pr. PA25 One-touch tuning - Overshoot permissible level].	Increase the in-position range or overshoot permissible level.
C002	Servo-off during tuning	The one-touch tuning was attempted in the user command method during servo-off. The servo amplifier will be servo-off status during one-touch tuning.	When executing one-touch tuning in the user command method, turn to servo-on, and then execute it. Prevent the servo amplifier from being the servo-off status during one-touch tuning.
C003	Control mode error	1. The one-touch tuning was attempted while the torque control mode was selected in the control modes.	Select the position control mode or speed control mode for the control mode, and then execute one-touch tuning. Do not change the control mode during the one-touch tuning.
		2. During one-touch tuning, the control mode was attempted to change from the position control mode to the speed control mode.	
C004	Time-out	1. One cycle time during the operation has been over 30 s.	Set one cycle time during the operation (time from the command start to the next command start) to 30 s or less.
		2. The command speed is slow.	Set the servo motor speed to 100 r/min or higher. Error is less likely to occur as the setting speed is higher. When one-touch tuning by the amplifier command is used, set a permissible travel distance so that the servo motor speed is 100 r/min or higher. Set a permissible travel distance to two or more revolutions as a guide value to set the servo motor speed to 100 r/min.
		3. The operation interval of the continuous operation is short.	Set the stop interval during operation to 200 ms or more. Error is less likely to occur as the setting time is longer.
C005	Load to motor inertia ratio misestimated	1. The estimation of the load to motor inertia ratio at one-touch tuning was a failure.	Drive the motor with meeting conditions as follows. ・The acceleration time constant/deceleration time constant to reach 2000 r/min is 5 s or less. ・Speed is 150 r/min or higher. ・The load to motor inertia ratio is 100 times or less. ・The acceleration/deceleration torque is 10% or more of the rated torque.
		2. The load to motor inertia ratio was not estimated due to an oscillation or other influences.	Set to the auto tuning mode that does not estimate the load to motor inertia ratio as follows, and then execute the one-touch tuning. ・Select "Auto tuning mode 2 (_ _ _ 2)", "Manual mode (_ _ _ 3)", or "2 gain adjustment mode 2 (_ _ _ 4)" of "Gain adjustment mode selection" in [Pr. PA08]. ・Manually set [Pr. PB06 Load to motor inertia ratio] properly.

Display	Name	Error detail	Corrective action example
C006	Amplifier command start error	One-touch tuning was attempted to start in the amplifier command method under the following speed condition. Servo motor speed: 20 r/min or higher	Execute the one-touch tuning in the amplifier command method while the servo motor is stopped.
C007	Amplifier command generation error	1. One-touch tuning was executed in the amplifier command method when the permissible travel distance is set to 100 pulses or less in the encoder pulse unit, or the distance is set not to increase the servo motor speed to 150 r/min or higher at the time of load to motor inertia ratio estimation.	Set a permissible travel distance to 100 pulses or more in the encoder pulse unit, or a distance so as to increase the servo motor speed to 150 r/min or higher at the time of load to motor inertia ratio estimation, and then execute the one-touch tuning. Set a permissible travel distance to four or more revolutions as a guide value. Load to motor inertia ratio will be estimated when "0000" or "0001" is set in [Pr. PA08 Auto tuning mode] at the start of one-touch tuning. If the permissible travel distance is short and the servo motor speed cannot be increased to 150 r/min or higher, select "Auto tuning mode 2 (_ _ _ 2)", "Manual mode (_ _ _ 3)", or "2 gain adjustment mode 2 (_ _ _ 4)" of "Gain adjustment mode selection" in [Pr. PA08].
		2. The torque limit has been set to 0.	Set the torque limit value to greater than 0.
C008	Stop signal	EM2, LSP, and LSN were turned off during one-touch tuning in the amplifier command method.	Review the one-touch tuning start position and permissible travel distance for the amplifier command method. After ensuring safety, turn on EM2, LSP, and LSN.
C009	Parameter	Parameters for manufacturer setting have been changed.	Return the parameters for manufacturer setting to the initial values.
C00A	Alarm	One-touch tuning was attempted to start in the amplifier command method during alarm or warning. Alarm or warning occurred during one-touch tuning by the amplifier command method.	Start one-touch tuning when no alarm or warning occurs. Prevent alarm or warning from occurring during one-touch tuning.
C00F	One-touch tuning disabled	"One-touch tuning function selection" in [Pr. PA21] is "Disabled (_ _ _ 0)".	Select "Enabled (_ _ _ 1)".

(f) If an alarm occurs

If an alarm occurs during the one-touch tuning, the tuning will be forcibly terminated. Remove the cause of the alarm and execute one-touch tuning again. When executing one-touch tuning in the amplifier command method again, return the moving part to the tuning start position.

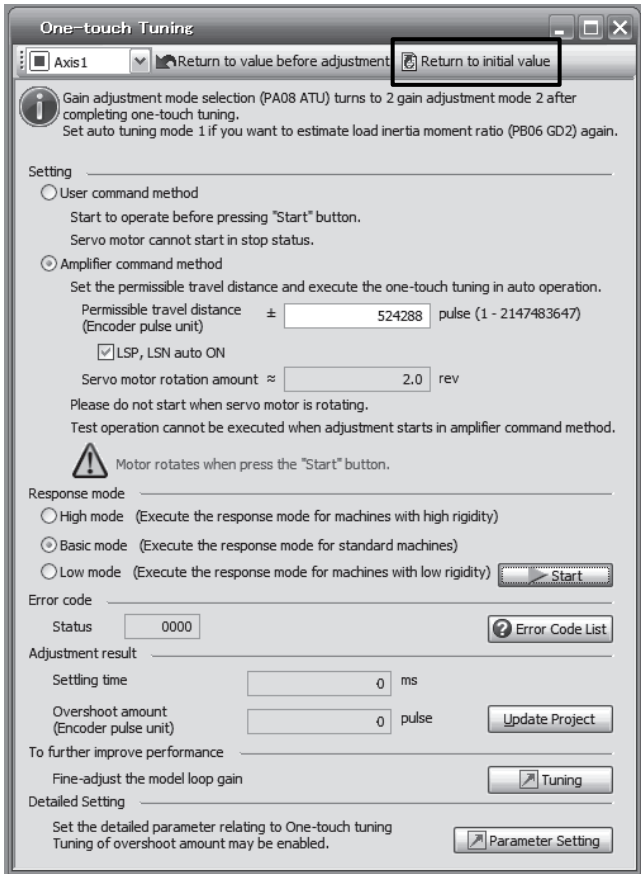
(g) If a warning occurs

If a warning which continues the motor driving occurs during one-touch tuning by the user command method, the tuning will be continued. If a warning which does not continue the motor driving occurs during the tuning, one-touch tuning will be stopped.

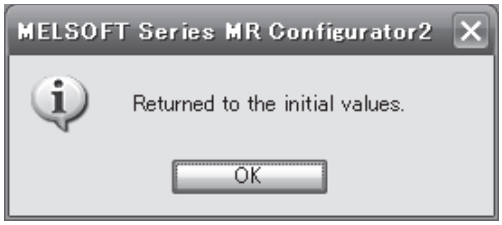
One-touch tuning will be stopped when warning occurs during one-touch tuning by the amplifier command method regardless of the warning type. Remove the cause of the warning, and return the moving part to the tuning start position. Then, execute the tuning again.

(h) Initializing one-touch tuning

Clicking "Return to initial value" in the one-touch tuning window of MR Configurator2 enables to return the parameter to the initial value. Refer to table 6.1 for the parameters which you can initialize. Clicking "Return to value before adjustment" in the one-touch tuning window of MR Configurator2 enables to return the parameter to the value before clicking "Start".



When the initialization of one-touch tuning is completed, the following window will be displayed. (returning to initial value)



6.2.3 Caution for one-touch tuning

(1) Caution common for user command method and amplifier command method

(a) The tuning is not available in the torque control mode.

(b) The one-touch tuning cannot be executed while an alarm or warning which does not continue the motor driving is occurring.

(c) You can execute the one-touch tuning during the following test operation modes marked by "○".

How to one-touch tuning	Test operation mode					
	Output signal (DO) forced output	JOG operation	Positioning operation	Motor-less operation	Program operation	Single-step feed
MR Configurator2		○	○		○	

(d) If one-touch tuning is performed when the gain switching function is enabled, vibration and/or unusual noise may occur during the tuning.

(2) Caution for amplifier command method

(a) Starting one-touch tuning while the servo motor is rotating displays "C006" at status in error code, and the one-touch tuning cannot be executed.

(b) One-touch tuning is not available during the test operation mode. The following test operation modes cannot be executed during one-touch tuning.

1) Positioning operation

2) JOG operation

3) Program operation

4) Machine analyzer operation

5) Single-step feed

(c) After one-touch tuning is executed, control will not be performed by commands from the controller. To return to the state in which control is performed from the controller, reset the controller or cycle the power of the servo amplifier.

(d) During one-touch tuning, the permissible travel distance may be exceeded due to overshoot, set a value sufficient to prevent machine collision.

(e) When Auto tuning mode 2, Manual mode, or 2 gain adjustment mode 2 is selected in [Pr. PA08 Auto tuning mode], the load to motor inertia ratio will not be estimated. An optimum acceleration/deceleration command will be generated by [Pr. PB06 Load to motor inertia ratio] at the start of one-touch tuning. When the load to motor inertia ratio is incorrect, the optimum acceleration/deceleration command may not be generated, causing the tuning to fail.

(f) When one-touch tuning is started by using communication, if the communication is interrupted during the tuning, the servo motor will stop, and the tuning will also stop. The parameter will return to the one at the start of the one-touch tuning.

(g) When one-touch tuning is started during the speed control mode, the mode will be switched to the position control mode automatically. The tuning result may differ from the one obtained by executing tuning by using the speed command.

6.3 Auto tuning

6.3.1 Auto tuning mode

The servo amplifier has a real-time auto tuning function which estimates the machine characteristic (load to motor inertia ratio) in real time and automatically sets the optimum gains according to that value. This function permits ease of gain adjustment of the servo amplifier.

(1) Auto tuning mode 1

The servo amplifier is factory-set to the auto tuning mode 1.

In this mode, the load to motor inertia ratio of a machine is always estimated to set the optimum gains automatically.

The following parameters are automatically adjusted in the auto tuning mode 1.

Parameter	Symbol	Name
PB06	GD2	Load to motor inertia ratio
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

POINT

●The auto tuning mode 1 may not be performed properly if all of the following conditions are not satisfied.

- Time to reach 2000 r/min is the acceleration/deceleration time constant of 5 s or less.
- Speed is 150 r/min or higher.
- The load to motor inertia ratio is 100 times or less.
- The acceleration/deceleration torque is 10% or more of the rated torque.

●Under operating conditions which will impose sudden disturbance torque during acceleration/deceleration or on a machine which is extremely loose, auto tuning may not function properly, either. In such cases, use the auto tuning mode 2 or manual mode to make gain adjustment.

(2) Auto tuning mode 2

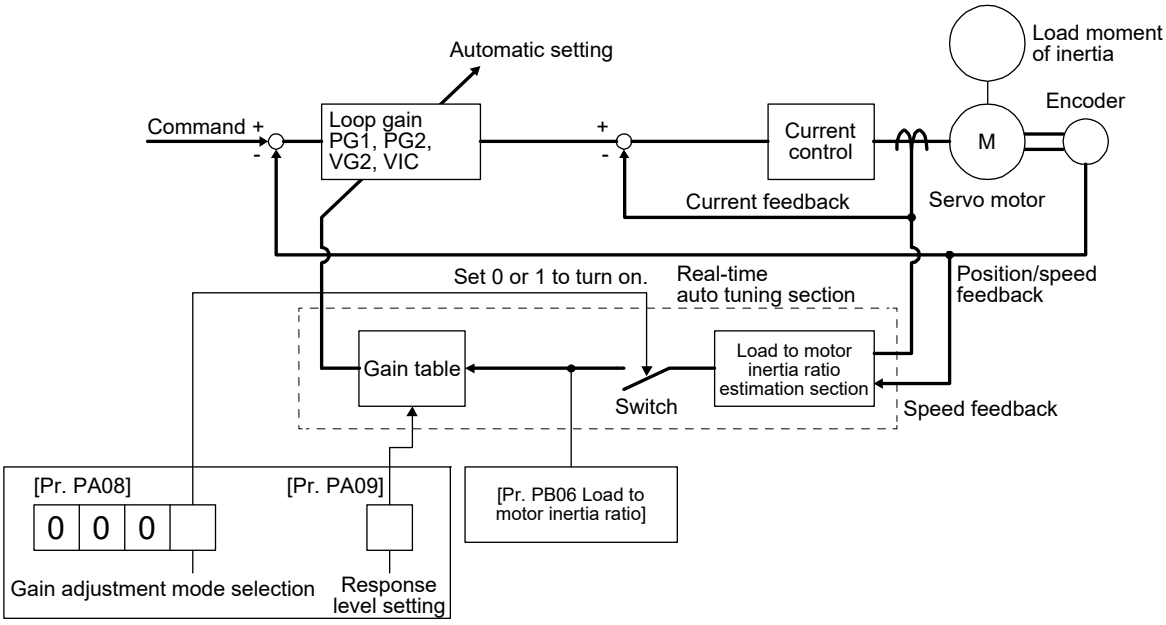
Use the auto tuning mode 2 when proper gain adjustment cannot be made by auto tuning mode 1. Since the load to motor inertia ratio is not estimated in this mode, set the value of a correct load to motor inertia ratio in [Pr. PB06].

The following parameters are automatically adjusted in the auto tuning mode 2.

Parameter	Symbol	Name
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

6.3.2 Auto tuning mode basis

The block diagram of real-time auto tuning is shown below.



When a servo motor is accelerated/decelerated, the load to motor inertia ratio estimation section always estimates the load to motor inertia ratio from the current and speed of the servo motor. The results of estimation are written to [Pr. PB06 Load to motor inertia ratio]. These results can be confirmed on the status display screen of the MR Configurator2.

If you have already known the value of the load to motor inertia ratio or failed to estimate, set "Gain adjustment mode selection" to "Auto tuning mode 2 (_ _ _ 2)" in [Pr. PA08] to stop the estimation (turning off the switch in above diagram), and set the load to motor inertia ratio ([Pr. PB06]) manually.

From the preset load to motor inertia ratio ([Pr. PB06]) value and response ([Pr. PA09]), the optimum loop gains are automatically set on the basis of the internal gain table.

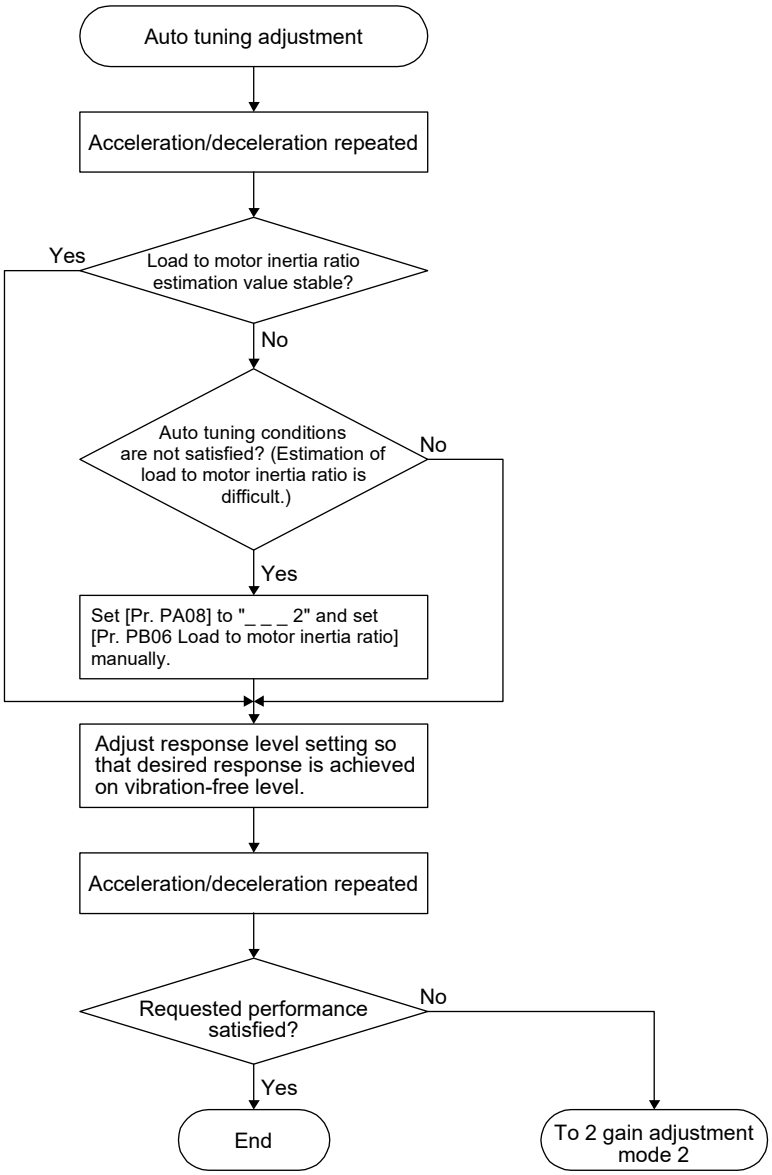
The auto tuning results are saved in the EEP-ROM of the servo amplifier every 60 minutes since power-on. At power-on, auto tuning is performed with the value of each loop gain saved in the EEP-ROM being used as an initial value.

POINT

- If sudden disturbance torque is imposed during operation, the load to motor inertia ratio may be misestimated temporarily. In such a case, set "Gain adjustment mode selection" to "Auto tuning mode 2 (_ _ _ 2)" in [Pr. PA08] and then set the correct load to motor inertia ratio in [Pr. PB06].
- When any of the auto tuning mode 1 and auto tuning mode settings is changed to the manual mode 2 setting, the current loop gains and load to motor inertia ratio estimation value are saved in the EEP-ROM.

6.3.3 Adjustment procedure by auto tuning

Since auto tuning is enabled before shipment from the factory, simply running the servo motor automatically sets the optimum gains that match the machine. Merely changing the response level setting value as required completes the adjustment. The adjustment procedure is as follows.



6.3.4 Response level setting in auto tuning mode

Set the response of the whole servo system by [Pr. PA09]. As the response level setting is increased, the trackability to a command improves and settling time decreases, but setting the response level too high will generate vibration. Set a value to obtain the desired response level within the vibration-free range.
If the response level setting cannot be increased up to the desired response because of machine resonance beyond 100 Hz, filter tuning mode selection in [Pr. PB01] or machine resonance suppression filter in [Pr. PB13] to [Pr. PB16], and [Pr. PB46] to [Pr. PB51] may be used to suppress machine resonance.
Suppressing machine resonance may allow the response level setting to increase. Refer to section 7.1.1 and 7.1.2 for settings of the adaptive tuning mode and machine resonance suppression filter.

[Pr. PA09]

Setting value	Machine characteristic	
	Response	Guideline for machine resonance frequency [Hz]
1	Low response	2.7
2	↑	3.6
3		4.9
4		6.6
5		10.0
6		11.3
7		12.7
8		14.3
9		16.1
10		18.1
11		20.4
12		23.0
13		25.9
14		29.2
15		32.9
16		37.0
17		41.7
18		47.0
19	↓	52.9
20	Middle response	59.6

Setting value	Machine characteristic	
	Response	Guideline for machine resonance frequency [Hz]
21	Middle response	67.1
22	↑	75.6
23		85.2
24		95.9
25		108.0
26		121.7
27		137.1
28		154.4
29		173.9
30		195.9
31		220.6
32		248.5
33		279.9
34		315.3
35		355.1
36		400.0
37		446.6
38		501.2
39	↓	571.5
40	High response	642.7

6.4 Manual mode

If you are not satisfied with the adjustment of auto tuning, you can adjust all gains manually.

> POINT
>
> ●If machine resonance occurs, filter tuning mode selection in [Pr. PB01] or machine resonance suppression filter in [Pr. PB13] to [Pr. PB16] and [Pr. PB46] to [Pr. PB51] may be used to suppress machine resonance. (Section 7.1.1, 7.1.2)

(1) For speed control

(a) Parameter

The following parameters are used for gain adjustment.

Parameter	Symbol	Name
PB06	GD2	Load to motor inertia ratio
PB07	PG1	Model loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 6.3.3.	
2	Change the setting of auto tuning to the manual mode ([Pr. PA08]: _ _ _ 3).	
3	Set an estimated value to the load to motor inertia ratio. (If the estimate value with auto tuning is correct, setting change is not required.)	
4	Set a small value to the model loop gain. Set a large value to the speed integral compensation.	
5	Increase the speed loop gain within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the speed integral compensation within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the model loop gain, and return slightly if overshoot takes place.	Increase the model loop gain.
8	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with the adaptive tuning mode or machine resonance suppression filter and then executing steps 3 to 7.	Suppression of machine resonance Refer to section 7.1.1 and 7.1.2.
9	While checking the motor status, fine-adjust each gain.	Fine adjustment

(c) Parameter adjustment

1) [Pr. PB09 Speed loop gain]

This parameter determines the response level of the speed control loop. Increasing the setting increases the response level, but the mechanical system is liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

$$\text{Speed loop response frequency [Hz]} = \frac{\text{Speed loop gain}}{(1 + \text{Load to motor inertia ratio}) \times 2\pi}$$

2) [Pr. PB10 Speed integral compensation]

To eliminate stationary deviation against a command, the speed control loop is under proportional integral control. For the speed integral compensation, set the time constant of this integral control. Increasing the setting lowers the response level. However, if the load to motor inertia ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

$$\text{Speed integral compensation setting [ms]} \geq \frac{2000 \text{ to } 3000}{\text{Speed loop gain}/(1 + \text{Load to motor inertia ratio})}$$

3) [Pr. PB07 Model loop gain]

This parameter determines the response level to a speed command. Increasing the value improves trackability to a speed command, but a too high value will make overshoot liable to occur at settling.

$$\text{Estimated model loop gain} \leq \frac{\text{Speed loop gain}}{(1 + \text{Load to motor inertia ratio})} \times \left(\frac{1}{4} \text{ to } \frac{1}{8}\right)$$

(2) For position control

(a) Parameter

The following parameters are used for gain adjustment.

Parameter	Symbol	Name
PB06	GD2	Load to motor inertia ratio
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 6.3.3.	
2	Change the setting of auto tuning to the manual mode ([Pr. PA08]: _ _ _ 3).	
3	Set an estimated value to the load to motor inertia ratio. (If the estimate value with auto tuning is correct, setting change is not required.)	
4	Set a small value to the model loop gain and the position loop gain. Set a large value to the speed integral compensation.	
5	Increase the speed loop gain within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the speed integral compensation within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the position loop gain, and return slightly if vibration takes place.	Increase the position loop gain.
8	Increase the model loop gain, and return slightly if overshoot takes place.	Increase the model loop gain.
9	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with the adaptive tuning mode or machine resonance suppression filter and then executing steps 3 to 8.	Suppression of machine resonance Section 7.1.1 and 7.1.2
10	While checking the settling characteristic and motor status, fine-adjust each gain.	Fine adjustment

(c) Parameter adjustment

1) [Pr. PB09 Speed loop gain]

This parameter determines the response level of the speed control loop. Increasing the setting increases the response level, but the mechanical system is liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

$$\text{Speed loop response frequency [Hz]} = \frac{\text{Speed loop gain}}{(1 + \text{Load to motor inertia ratio}) \times 2\pi}$$

2) [Pr. PB10 Speed integral compensation]

To eliminate stationary deviation against a command, the speed control loop is under proportional integral control. For the speed integral compensation, set the time constant of this integral control. Increasing the setting lowers the response level. However, if the load to motor inertia ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

$$\text{Speed integral compensation setting [ms]} \geq \frac{2000 \text{ to } 3000}{\text{Speed loop gain}/(1 + \text{Load to motor inertia ratio})}$$

3) [Pr. PB08 Position loop gain]
This parameter determines the response level to a disturbance to the position control loop. Increasing the position loop gain increases the response level to a disturbance, but the mechanical system is liable to vibrate.

$$\text{Position loop gain guideline} \leq \frac{\text{Speed loop gain}}{(1 + \text{Load to motor inertia ratio})} \times \left(\frac{1}{4} \text{ to } \frac{1}{8}\right)$$

4) [Pr. PB07 Model loop gain]
This parameter determines the response level to a position command. Increasing the value improves trackability to a position command, but a too high value will make overshoot liable to occur at settling.

$$\text{Estimated model loop gain} \leq \frac{\text{Speed loop gain}}{(1 + \text{Load to motor inertia ratio})} \times \left(\frac{1}{4} \text{ to } \frac{1}{8}\right)$$

6.5 2 gain adjustment mode

Use the 2 gain adjustment mode to match the position loop gains of the axes when performing the interpolation operation of servo motors of two or more axes for an X-Y table or the like. In this mode, manually set the model loop gain that determines command trackability. Other parameters for gain adjustment are set automatically.

(1) 2 gain adjustment mode 1

For the 2 gain adjustment mode 1, manually set the model loop gain that determines command trackability. The mode constantly estimates the load to motor inertia ratio, and automatically set other parameters for gain adjustment to optimum gains using auto tuning response.
The following parameters are used for 2 gain adjustment mode 1.

(a) Automatically adjusted parameter

The following parameters are automatically adjusted by auto tuning.

Parameter	Symbol	Name
PB06	GD2	Load to motor inertia ratio
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Manually adjusted parameter

The following parameters are adjustable manually.

Parameter	Symbol	Name
PA09	RSP	Auto tuning response
PB07	PG1	Model loop gain

(2) 2 gain adjustment mode 2

Use 2 gain adjustment mode 2 when proper gain adjustment cannot be made with 2 gain adjustment mode 1. Since the load to motor inertia ratio is not estimated in this mode, set the value of a proper load to motor inertia ratio in [Pr. PB06].
The following parameters are used for 2 gain adjustment mode 2.

(a) Automatically adjusted parameter

The following parameters are automatically adjusted by auto tuning.

Parameter	Symbol	Name
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Manually adjusted parameter

The following parameters are adjustable manually.

Parameter	Symbol	Name
PA09	RSP	Auto tuning response
PB06	GD2	Load to motor inertia ratio
PB07	PG1	Model loop gain

(3) Adjustment procedure of 2 gain adjustment mode

POINT
●Set the same value in [Pr. PB07 Model loop gain] for the axis used in 2 gain adjustment mode.

Step	Operation	Description
1	Set to the auto tuning mode.	Select the auto tuning mode 1.
2	During operation, increase the response level setting value in [Pr. PA09], and return the setting if vibration occurs.	Adjustment in auto tuning mode 1
3	Check value of the model loop gain and the load to motor inertia ratio in advance.	Check the upper setting limits.
4	Set the 2 gain adjustment mode 1 ([Pr. PA08]: _ _ _ 0).	Select the 2 gain adjustment mode 1 (interpolation mode).
5	When the load to motor inertia ratio is different from the design value, select the 2 gain adjustment mode 2 ([Pr. PA08]: _ _ _ 4) and then set the load to motor inertia ratio manually in [Pr. PB06].	Check the load to motor inertia ratio.
6	Set the model loop gain of all the axes to be interpolated to the same value. At that time, adjust to the setting value of the axis, which has the smallest model loop gain.	Set model loop gain.
7	Considering the interpolation characteristic and motor status, fine-adjust the model loop gain and response level setting.	Fine adjustment

(4) Parameter adjustment

[Pr. PB07 Model loop gain]

This parameter determines the response level of the position control loop. Increasing the value improves trackability to a position command, but a too high value will make overshoot liable to occur at settling. Number of droop pulses is determined by the following expression.

$$\text{Number of droop pulses [pulse]} = \frac{\text{Position command frequency [pulse/s]}}{\text{Model loop gain setting}}$$

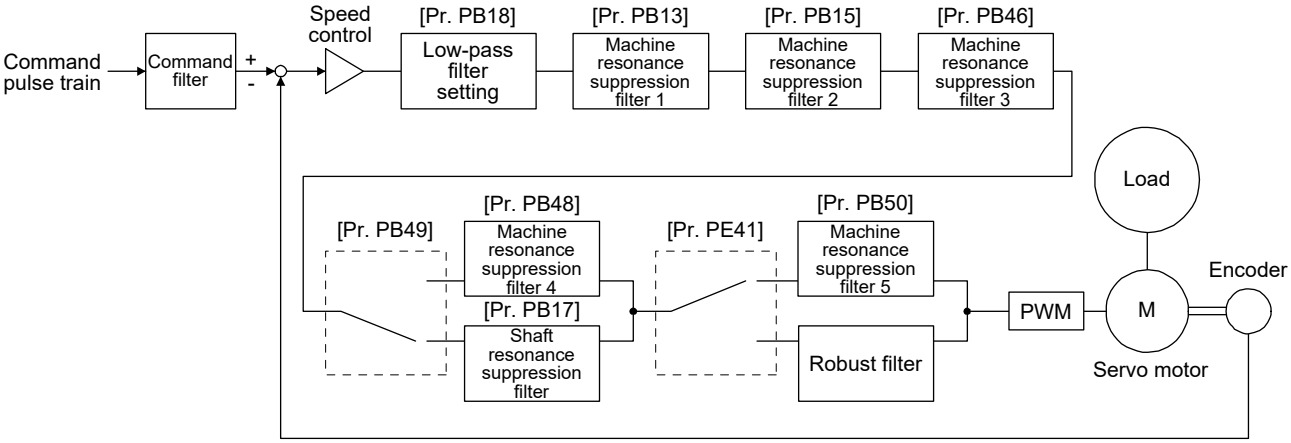
$$\text{Position command frequency} = \frac{\text{Speed [r/min]}}{60} \times \text{Encoder resolution (number of pulses per servo motor revolution)}$$

7. SPECIAL ADJUSTMENT FUNCTIONS

POINT
●The functions given in this chapter need not be used normally. Use them if you are not satisfied with the machine status after making adjustment in the methods in chapter 6.

7.1 Filter setting

The following filters are available with MR-JE servo amplifiers.



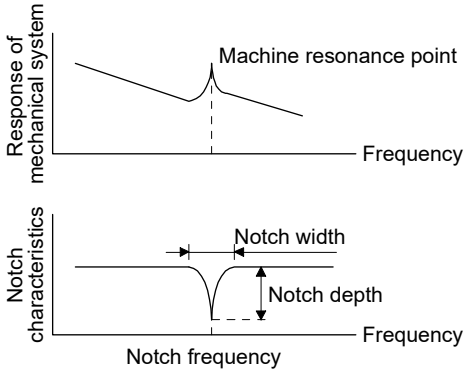
7.1.1 Machine resonance suppression filter

POINT
●The machine resonance suppression filter is a delay factor for the servo system. Therefore, vibration may increase if you set an incorrect resonance frequency or set notch characteristics too deep or too wide. ●If the frequency of machine resonance is unknown, decrease the notch frequency from higher to lower ones in order. The optimum notch frequency is set at the point where vibration is minimal. ●A deeper notch has a higher effect on machine resonance suppression but increases a phase delay and may increase vibration. ●A wider notch has a higher effect on machine resonance suppression but increases a phase delay and may increase vibration. ●The machine characteristic can be grasped beforehand by the machine analyzer on MR Configurator2. This allows the required notch frequency and notch characteristics to be determined.

If a mechanical system has a unique resonance point, increasing the servo system response level may cause resonance (vibration or unusual noise) in the mechanical system at that resonance frequency. Using the machine resonance suppression filter and adaptive tuning can suppress the resonance of the mechanical system. The setting range is 10 Hz to 4500 Hz.

(1) Function

The machine resonance suppression filter is a filter function (notch filter) which decreases the gain of the specific frequency to suppress the resonance of the mechanical system. You can set the gain decreasing frequency (notch frequency), gain decreasing depth and width.



You can set five machine resonance suppression filters at most.

Filter	Setting parameter	Precaution	Parameter that is reset with vibration tough drive function	Parameter automatically adjusted with one-touch tuning
Machine resonance suppression filter 1	PB01/PB13/PB14	The filter can be set automatically with "Filter tuning mode selection" in [Pr. PB01].	PB13	PB01/PB13/PB14
Machine resonance suppression filter 2	PB15/PB16		PB15	PB15/PB16
Machine resonance suppression filter 3	PB46/PB47			PB46/PB47
Machine resonance suppression filter 4	PB48/PB49	Enabling the machine resonance suppression filter 4 disables the shaft resonance suppression filter. Using the shaft resonance suppression filter is recommended because it is adjusted properly depending on the usage situation. The shaft resonance suppression filter is enabled for the initial setting.		PB48/PB49
Machine resonance suppression filter 5	PB50/PB51	Enabling the robust filter disables the machine resonance suppression filter 5. The robust filter is disabled for the initial setting.		PB51

(2) Parameter

(a) Machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14])

Set the notch frequency, notch depth and notch width of the machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14])

When you select "Manual setting (_ _ _ 2)" of "Filter tuning mode selection" in [Pr. PB01], the setting of the machine resonance suppression filter 1 is enabled.

(b) Machine resonance suppression filter 2 ([Pr. PB15] and [Pr. PB16])

To use this filter, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 2 selection" in [Pr. PB16].

How to set the machine resonance suppression filter 2 ([Pr. PB15] and [Pr. PB16]) is the same as for the machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14]).

(c) Machine resonance suppression filter 3 ([Pr. PB46] and [Pr. PB47])

To use this filter, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 3 selection" in [Pr. PB47].

How to set the machine resonance suppression filter 3 ([Pr. PB46] and [Pr. PB47]) is the same as for the machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14]).

(d) Machine resonance suppression filter 4 ([Pr. PB48] and [Pr. PB49])

To use this filter, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 4 selection" in [Pr. PB49]. However, enabling the machine resonance suppression filter 4 disables the shaft resonance suppression filter.

How to set the machine resonance suppression filter 4 ([Pr. PB48] and [Pr. PB49]) is the same as for the machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14]).

(e) Machine resonance suppression filter 5 ([Pr. PB50] and [Pr. PB51])

To use this filter, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 5 selection" in [Pr. PB51]. However, enabling the robust filter ([Pr. PE41: _ _ _ 1]) disables the machine resonance suppression filter 5.

How to set the machine resonance suppression filter 5 ([Pr. PB50] and [Pr. PB51]) is the same as for the machine resonance suppression filter 1 ([Pr. PB13] and [Pr. PB14]).

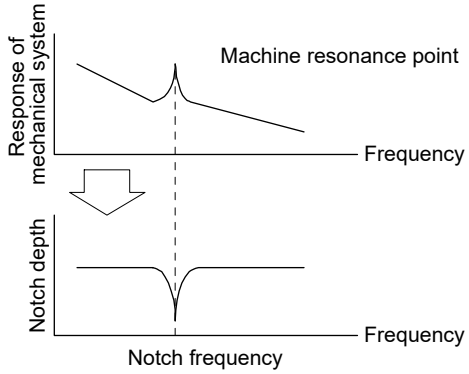
7.1.2 Adaptive filter II

POINT

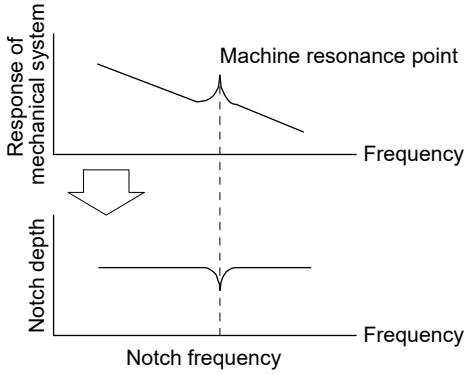
- The machine resonance frequency which adaptive filter II (adaptive tuning) can respond to is about 100 Hz to 2.25 kHz. As for the resonance frequency out of the range, set manually.
- When adaptive tuning is executed, vibration sound increases as an excitation signal is forcibly applied for several seconds.
- When adaptive tuning is executed, machine resonance is detected for a maximum of 10 s and a filter is generated. After filter generation, the adaptive tuning mode automatically shifts to the manual setting.
- Adaptive tuning generates the optimum filter with the currently set control gains. If vibration occurs when the response setting is increased, execute adaptive tuning again.
- During adaptive tuning, a filter having the best notch depth at the set control gain is generated. To allow a filter margin against machine resonance, increase the notch depth in the manual setting.
- Adaptive vibration suppression control may provide no effect on a mechanical system which has complex resonance characteristics.
- The frequency is estimated more accurately in the high accuracy mode's adaptive tuning compared to the standard mode. However, the tuning sound may be larger in the high accuracy mode.

(1) Function

Adaptive filter II (adaptive tuning) is a function in which the servo amplifier detects machine vibration for a predetermined period of time and sets the filter characteristics automatically to suppress mechanical system vibration. Since the filter characteristics (frequency, depth) are set automatically, you need not be conscious of the resonance frequency of a mechanical system.



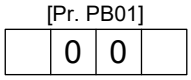
When machine resonance is large and frequency is low



When machine resonance is small and frequency is high

(2) Parameter

Select how to set the filter tuning in [Pr. PB01 Adaptive tuning mode (adaptive filter II)].

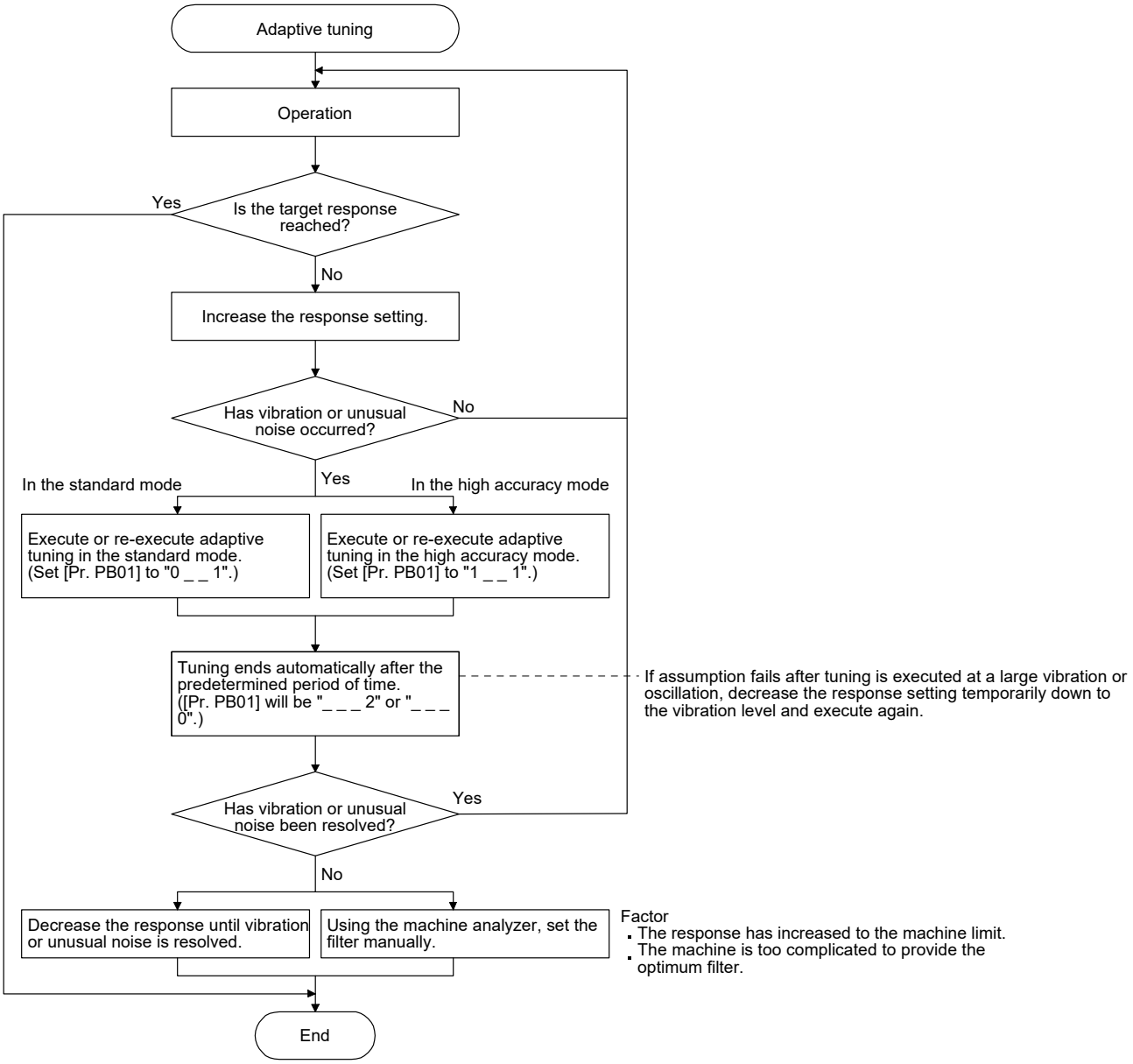


Filter tuning mode selection

Setting value	Filter tuning mode selection	Automatically set parameter
0	Disabled	
1	Automatic setting	PB13/PB14
2	Manual setting	

Tuning accuracy selection
0: Standard
1: High accuracy

(3) Adaptive tuning mode procedure



7.1.3 Shaft resonance suppression filter

> POINT
>
> ●This filter is set properly by default according to servo motor you use and load moment of inertia. It is recommended that [Pr. PB23] be set to "_ _ _ 0" (automatic setting) because changing "Shaft resonance suppression filter selection" in [Pr. PB23] or [Pr. PB17 Shaft resonance suppression filter] may lower the performance.

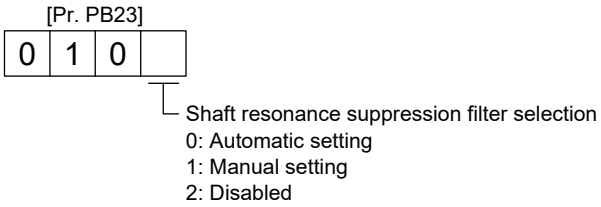
(1) Function

When a load is mounted to the servo motor shaft, resonance by shaft torsion during driving may generate a mechanical vibration at high frequency. The shaft resonance suppression filter suppresses the vibration.

When you select "Automatic setting", the filter will be set automatically on the basis of the servo motor you use and the load to motor inertia ratio. The disabled setting increases the response of the servo amplifier for high resonance frequency.

(2) Parameter

Set "Shaft resonance suppression filter selection" in [Pr. PB23].



To set [Pr. PB17 Shaft resonance suppression filter] automatically, select "Automatic setting".

To set [Pr. PB17 Shaft resonance suppression filter] manually, select "Manual setting". The setting values are as follows.

Shaft resonance suppression filter setting frequency selection

Setting value	Frequency [Hz]
_ _ 0 0	Disabled
_ _ 0 1	Disabled
_ _ 0 2	4500
_ _ 0 3	3000
_ _ 0 4	2250
_ _ 0 5	1800
_ _ 0 6	1500
_ _ 0 7	1285
_ _ 0 8	1125
_ _ 0 9	1000
_ _ 0 A	900
_ _ 0 B	818
_ _ 0 C	750
_ _ 0 D	692
_ _ 0 E	642
_ _ 0 F	600

Setting value	Frequency [Hz]
_ _ 1 0	562
_ _ 1 1	529
_ _ 1 2	500
_ _ 1 3	473
_ _ 1 4	450
_ _ 1 5	428
_ _ 1 6	409
_ _ 1 7	391
_ _ 1 8	375
_ _ 1 9	360
_ _ 1 A	346
_ _ 1 B	333
_ _ 1 C	321
_ _ 1 D	310
_ _ 1 E	300
_ _ 1 F	290

7.1.4 Low-pass filter

(1) Function

When a ball screw or the like is used, resonance of high frequency may occur as the response level of the servo system is increased. To prevent this, the low-pass filter is enabled for a torque command as the initial value. The filter frequency of the low-pass filter is automatically adjusted to the value in the following equation.

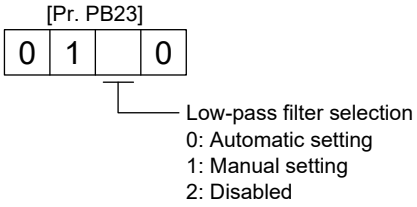
$$\text{Filter frequency ([rad/s])} = \frac{VG2}{1 + GD2} \times 8$$

However, when an automatically adjusted value is smaller than VG2, the filter frequency will be the VG2 value.

To set [Pr. PB18] manually, select "Manual setting (_ _ 1 _)" of "Low-pass filter selection" in [Pr. PB23].

(2) Parameter

Set "Low-pass filter selection" in [Pr. PB23].



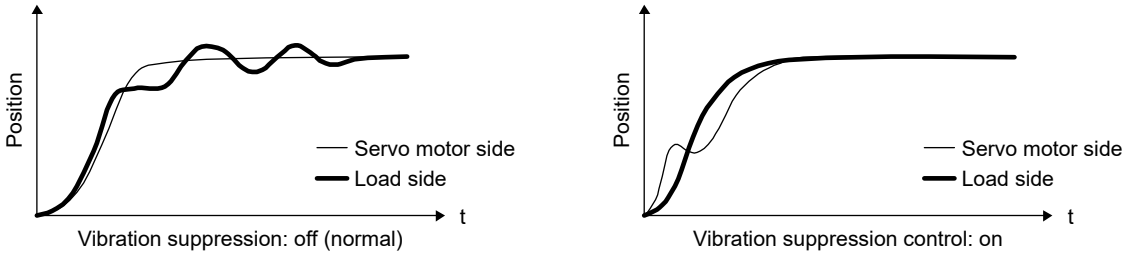
7.1.5 Advanced vibration suppression control II

POINT

- The function is enabled when "Gain adjustment mode selection" in [Pr. PA08] is "Auto tuning mode 2 (_ _ _ 2)", "Manual mode (_ _ _ 3)", or "2 gain adjustment mode 2 (_ _ _ 4)".
- The machine resonance frequency supported in the vibration suppression control tuning mode is 1.0 Hz to 100.0 Hz. As for the vibration out of the range, set manually.
- Stop the servo motor before changing the vibration suppression control-related parameters. Otherwise, it may cause an unexpected operation.
- For positioning operation during execution of vibration suppression control tuning, provide a stop time to ensure a stop after vibration damping.
- Vibration suppression control tuning may not make normal estimation if the residual vibration at the servo motor side is small.
- Vibration suppression control tuning sets the optimum parameter with the currently set control gains. When the response setting is increased, set vibration suppression control tuning again.
- When using the vibration suppression control 2, set "_ _ _ 1" in [Pr. PA24].

(1) Function

Use the vibration suppression control to further suppress load-side vibration, such as work-side vibration and base shake. The servo motor-side operation is adjusted for positioning so that the machine does not vibrate.



When the advanced vibration suppression control II ([Pr. PB02 Vibration suppression control tuning mode]) is executed, the vibration frequency at load side is automatically estimated to suppress machine side vibration two times at most.

In the vibration suppression control tuning mode, this mode shifts to the manual setting after the positioning operation is performed the predetermined number of times. For manual setting, adjust the vibration suppression control 1 with [Pr. PB19] to [Pr. PB22] and vibration suppression control 2 with [Pr. PB52] to [Pr. PB55].

(2) Parameter

Set [Pr. PB02 Vibration suppression control tuning mode (advanced vibration suppression control II)]. When you use a vibration suppression control, set "Vibration suppression control 1 tuning mode selection". When you use two vibration suppression controls, set "Vibration suppression control 2 tuning mode selection" in addition.

[Pr. PB02]

0	0		

Vibration suppression control 1 tuning mode

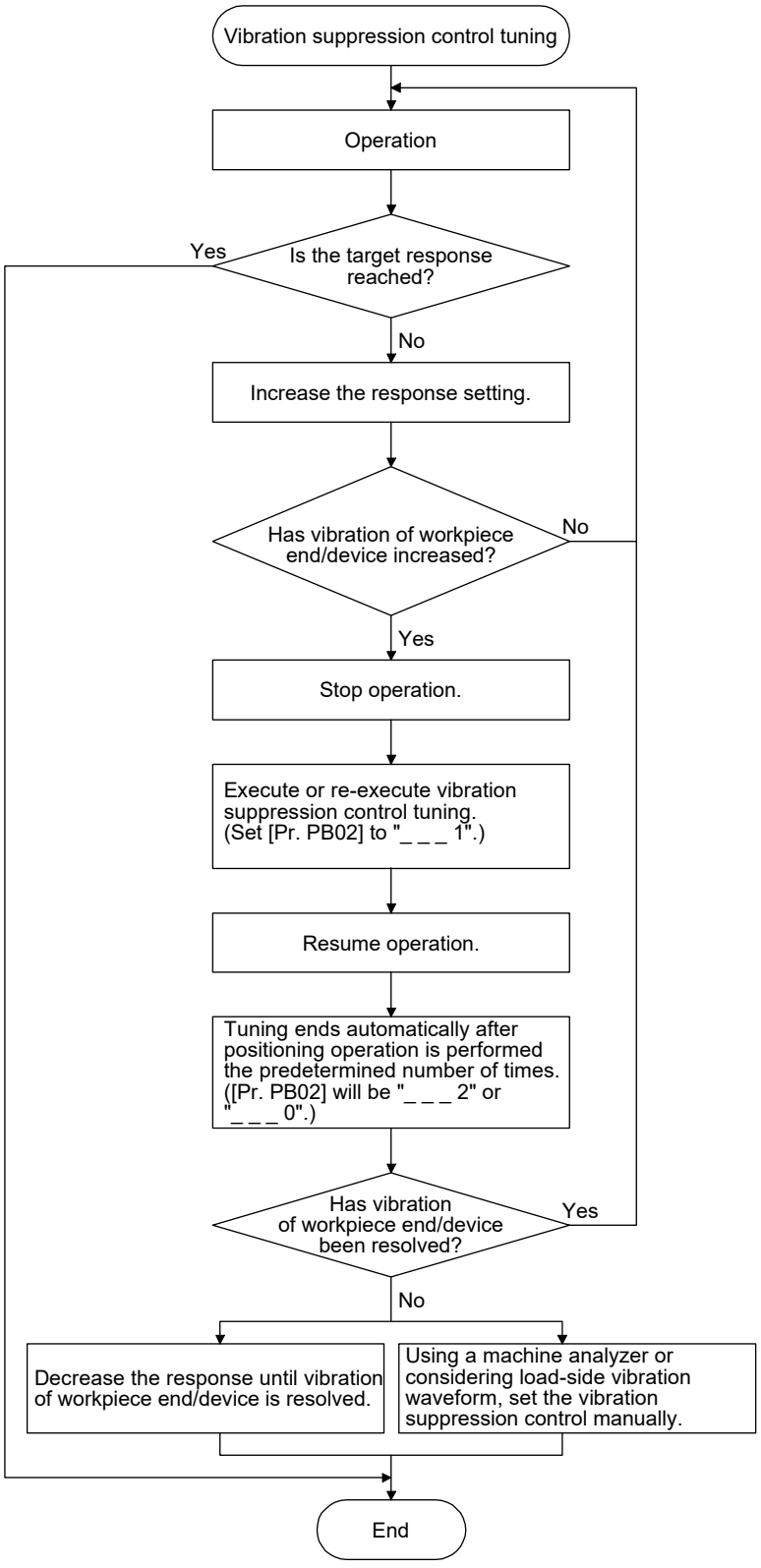
Setting value	Vibration suppression control 1 tuning mode selection	Automatically set parameter
_ _ _ 0	Disabled	
_ _ _ 1	Automatic setting	PB19/PB20/PB21/PB22
_ _ _ 2	Manual setting	

Vibration suppression control 2 tuning mode

Setting value	Vibration suppression control 2 tuning mode selection	Automatically set parameter
_ _ 0 _	Disabled	
_ _ 1 _	Automatic setting	PB52/PB53/PB54/PB55
_ _ 2 _	Manual setting	

(3) Vibration suppression control tuning procedure

The following flow chart is for the vibration suppression control 1. For the vibration suppression control 2, set "_ _ 1 _" in [Pr. PB02] to execute the vibration suppression control tuning.



Factor

- Estimation cannot be made as load-side vibration has not been transmitted to the servo motor side.
- The response of the model loop gain has increased to the load-side vibration frequency (vibration suppression control limit).

(4) Vibration suppression control manual mode

POINT

- When load-side vibration does not show up in servo motor-side vibration, the setting of the servo motor-side vibration frequency does not produce an effect.
- When the anti-resonance frequency and resonance frequency can be confirmed using the machine analyzer or external equipment, do not set the same value but set different values to improve the vibration suppression performance.
- The setting range of [Pr. PB19], [Pr. PB20], [Pr. PB52], and [Pr. PB53] varies, depending on the value in [Pr. PB07]. If a value out of the range is set, the vibration suppression control will be disabled.

Measure work-side vibration and device shake with the machine analyzer or external measuring instrument, and set the following parameters to adjust vibration suppression control manually.

Setting item	Vibration suppression control 1	Vibration suppression control 2
Vibration suppression control - Vibration frequency	[Pr. PB19]	[Pr. PB52]
Vibration suppression control - Resonance frequency	[Pr. PB20]	[Pr. PB53]
Vibration suppression control - Vibration frequency damping	[Pr. PB21]	[Pr. PB54]
Vibration suppression control - Resonance frequency damping	[Pr. PB22]	[Pr. PB55]

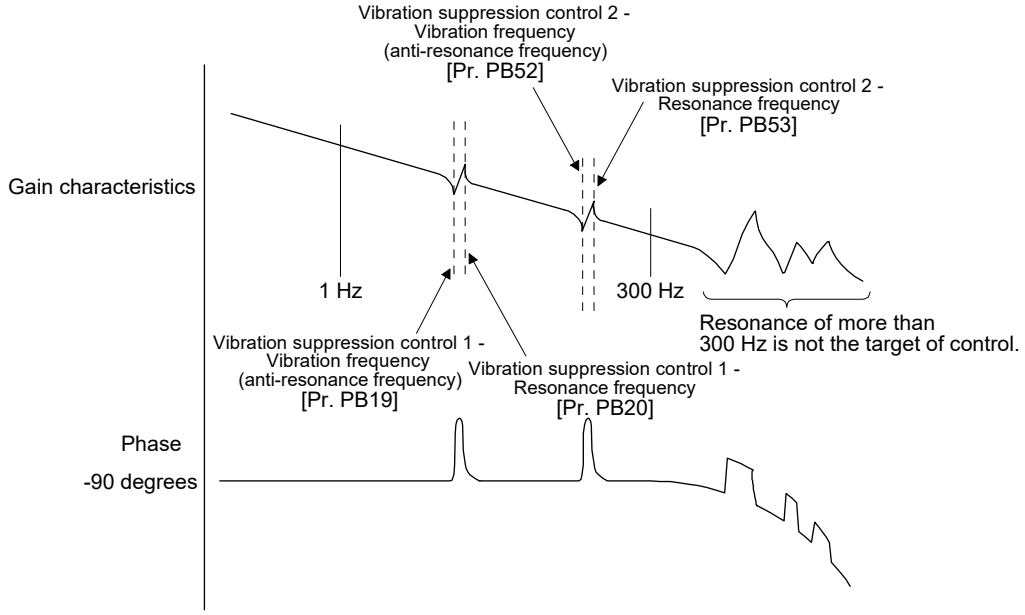
Step 1. Select "Manual setting (_ _ _ 2)" of "Vibration suppression control 1 tuning mode selection" or "Manual setting (_ _ 2 _)" of "Vibration suppression control 2 tuning mode selection" in [Pr. PB02].

Step 2. Set "Vibration suppression control - Vibration frequency" and "Vibration suppression control - Resonance frequency" as follows.

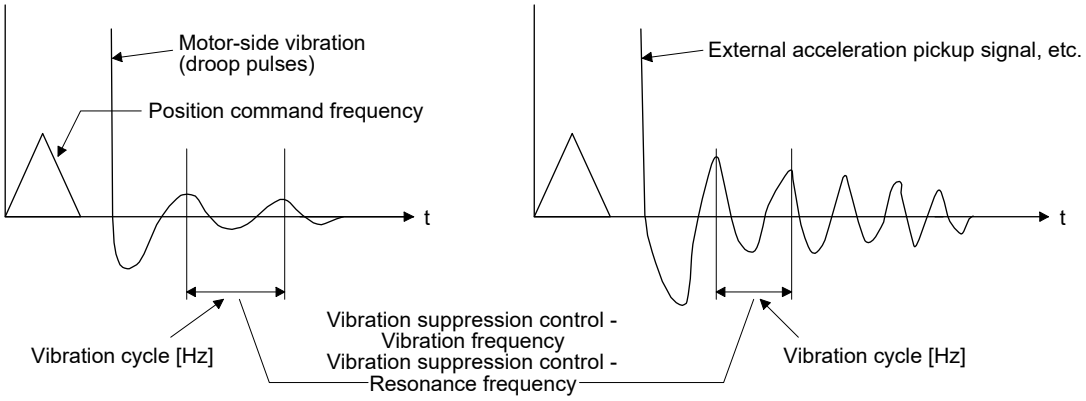
However, the value of [Pr. PB07 Model loop gain], vibration frequency, and resonance frequency have the following usable range and recommended range.

Vibration suppression control	Usable range	Recommended setting range
Vibration suppression control 1	[Pr. PB19] > 1/2π × (0.9 × [Pr. PB07]) [Pr. PB20] > 1/2π × (0.9 × [Pr. PB07])	[Pr. PB19] > 1/2π × (1.5 × [Pr. PB07]) [Pr. PB20] > 1/2π × (1.5 × [Pr. PB07])
Vibration suppression control 2	When [Pr. PB19] < [Pr. PB52], [Pr. PB52] > (5.0 + 0.1 × [Pr. PB07]) [Pr. PB53] > (5.0 + 0.1 × [Pr. PB07]) 1.1 < [Pr. PB52]/[Pr. PB19] < 5.5 [Pr. PB07] < 2π (0.3 × [Pr. PB19] + 1/8 × [Pr. PB52])	When [Pr. PB19] < [Pr. PB52], [Pr. PB52], [Pr. PB53] > 6.25 Hz 1.1 < [Pr. PB52]/[Pr. PB19] < 4 [Pr. PB07] < 1/3 × (4 × [Pr. PB19] + 2 × [Pr. PB52])

(a) When a vibration peak can be confirmed with machine analyzer using MR Configurator2, or external equipment.



(b) When vibration can be confirmed using monitor signal or external sensor



Set the same value.

Step 3. Fine-adjust "Vibration suppression control - Vibration frequency damping" and "Vibration suppression control - Resonance frequency damping".

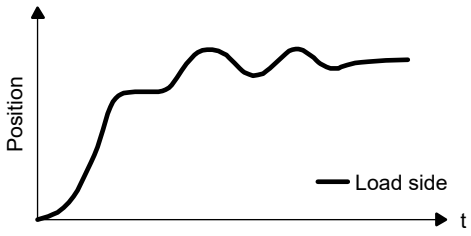
7.1.6 Command notch filter

POINT

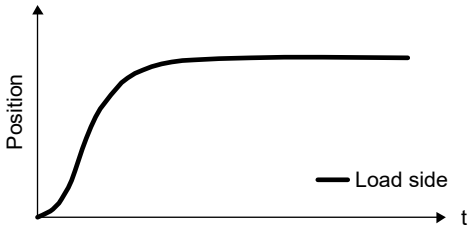
- By using the advanced vibration suppression control II and the command notch filter, the load-side vibration of three frequencies can be suppressed.
- The frequency range of machine vibration, which can be supported by the command notch filter, is between 4.5 Hz and 2250 Hz. Set a frequency close to the machine vibration frequency and within the range.
- When [Pr. PB45 Command notch filter] is changed during the positioning operation, the changed setting is not reflected. The setting is reflected approximately 150 ms after the servo motor stops (after servo-lock).

(1) Function

Command notch filter has a function that lowers the gain of the specified frequency contained in a position command. By lowering the gain, load-side vibration, such as work-side vibration and base shake, can be suppressed. Which frequency to lower the gain and how deep to lower the gain can be set.



Command notch filter: disabled

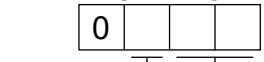


Command notch filter: enabled

(2) Parameter

Set [Pr. PB45 Command notch filter] as shown below. For the command notch filter setting frequency, set the closest value to the vibration frequency [Hz] at the load side.

[Pr. PB45]



Setting value	Depth [dB]
0	-40.0
1	-24.1
2	-18.1
3	-14.5
4	-12.0
5	-10.1
6	-8.5
7	-7.2
8	-6.0
9	-5.0
A	-4.1
B	-3.3
C	-2.5
D	-1.8
E	-1.2
F	-0.6

Setting value	Frequency [Hz]	Setting value	Frequency [Hz]	Setting value	Frequency [Hz]
00	Disabled	20	70	40	17.6
01	2250	21	66	41	16.5
02	1125	22	62	42	15.6
03	750	23	59	43	14.8
04	562	24	56	44	14.1
05	450	25	53	45	13.4
06	375	26	51	46	12.8
07	321	27	48	47	12.2
08	281	28	46	48	11.7
09	250	29	45	49	11.3
0A	225	2A	43	4A	10.8
0B	204	2B	41	4B	10.4
0C	187	2C	40	4C	10.0
0D	173	2D	38	4D	9.7
0E	160	2E	37	4E	9.4
0F	150	2F	36	4F	9.1
10	140	30	35.2	50	8.8
11	132	31	33.1	51	8.3
12	125	32	31.3	52	7.8
13	118	33	29.6	53	7.4
14	112	34	28.1	54	7.0
15	107	35	26.8	55	6.7
16	102	36	25.6	56	6.4
17	97	37	24.5	57	6.1
18	93	38	23.4	58	5.9
19	90	39	22.5	59	5.6
1A	86	3A	21.6	5A	5.4
1B	83	3B	20.8	5B	5.2
1C	80	3C	20.1	5C	5.0
1D	77	3D	19.4	5D	4.9
1E	75	3E	18.8	5E	4.7
1F	72	3F	18.2	5F	4.5

7.2 Gain switching function

You can switch gains with the function. You can switch gains during rotation and during stop, and can use an input device to switch gains during operation.

7.2.1 Applications

The following shows when you use the function.

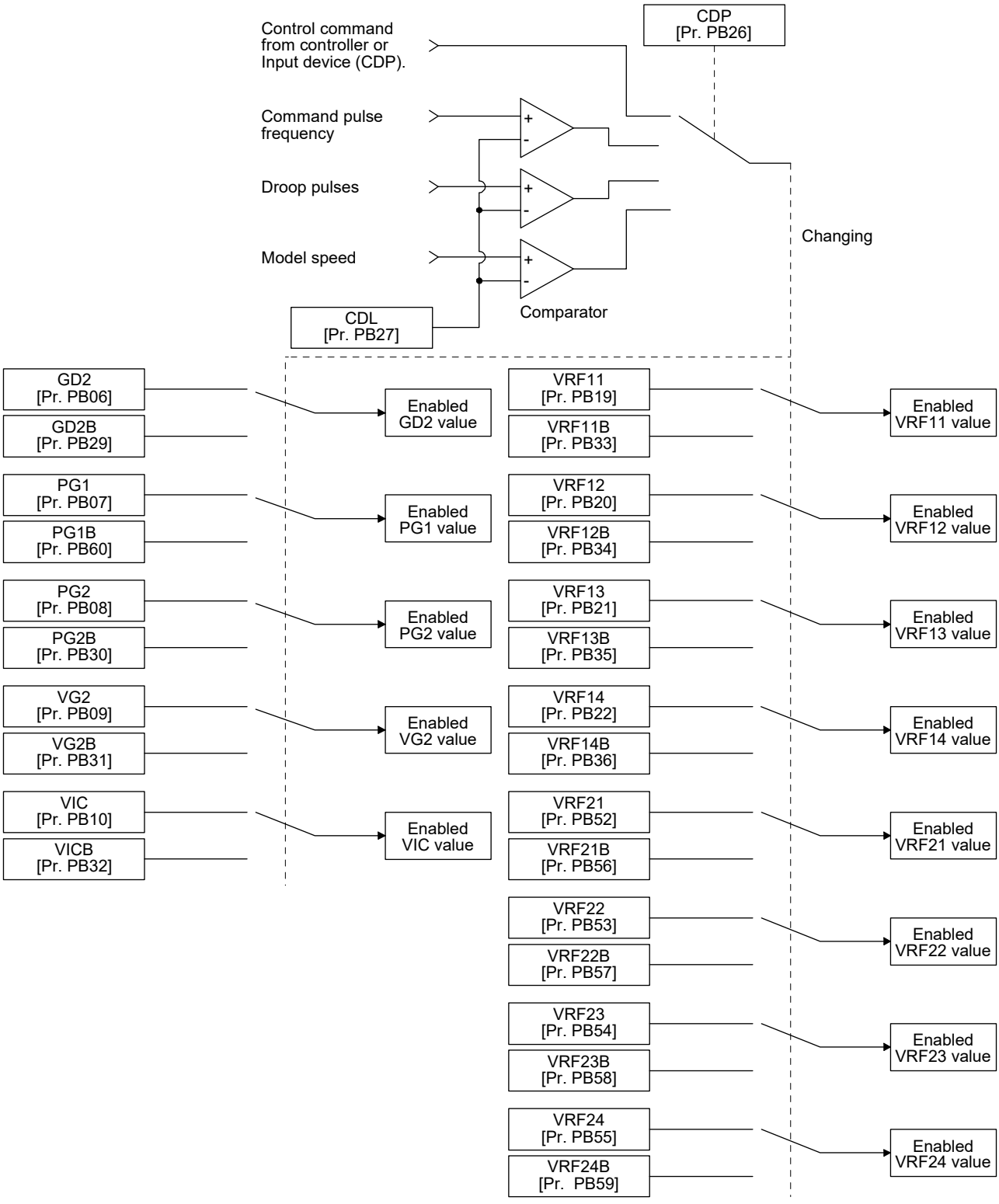
(1) You want to increase the gains during servo-lock but decrease the gains to reduce noise during rotation.

(2) You want to increase the gains during settling to shorten the stop settling time.

(3) You want to change the gains using an input device to ensure stability of the servo system since the load to motor inertia ratio varies greatly during a stop (e.g. a large load is mounted on a carrier).

7.2.2 Function block diagram

The control gains, load to motor inertia ratio, and vibration suppression control settings are changed according to the conditions selected by [Pr. PB26 Gain switching function] and [Pr. PB27 Gain switching condition].



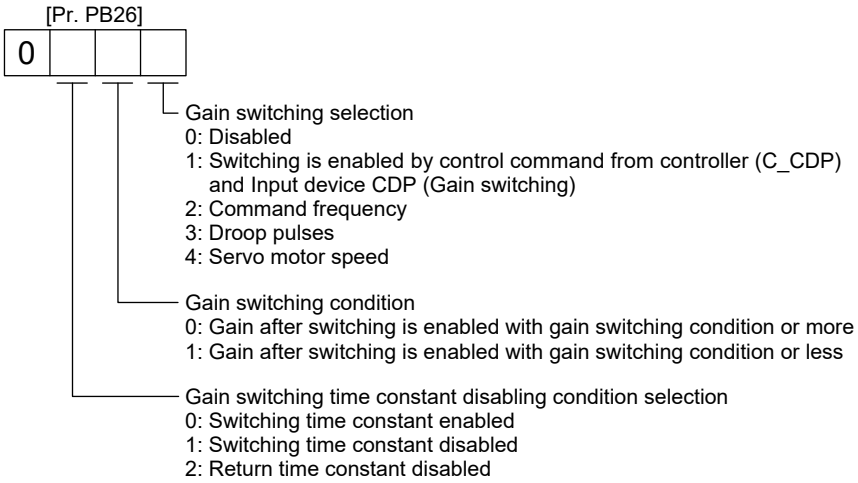
7.2.3 Parameter

When using the gain switching function, always select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08 Auto tuning mode]. The gain switching function cannot be used in the auto tuning mode.

(1) Parameter for setting gain switching condition

Parameter	Symbol	Name	Unit	Description
PB26	CDP	Gain switching function		Select the changing condition.
PB27	CDL	Gain switching condition	[kpulse/s] /[pulse] /[r/min]	Set the changing condition values.
PB28	CDT	Gain switching time constant	[ms]	Set the filter time constant for a gain change at changing.

(a) [Pr. PB26 Gain switching function]
Set the gain switching condition. Select the switching condition in the first to third digits.



(b) [Pr. PB27 Gain switching condition]
Set a level to switch gains with [Pr. PB27] after you select "Command frequency", "Droop pulses", or "Servo motor speed" in the gain switching selection of [Pr. PB26 Gain switching function].
The setting unit is as follows.

Gain switching condition	Unit
Command frequency	[kpulse/s]
Droop pulses	[pulse]
Servo motor speed	[r/min]

(c) [Pr. PB28 Gain switching time constant]
You can set the primary delay filter to each gain at gain switching. Use this parameter to suppress shock given to the machine if the gain difference is large at gain switching, for example.

(2) Switchable gain parameter

Loop gain	Before switching			After switching		
	Parameter	Symbol	Name	Parameter	Symbol	Name
Load to motor inertia ratio	PB06	GD2	Load to motor inertia ratio	PB29	GD2B	Load to motor inertia ratio after gain switching
Model loop gain	PB07	PG1	Model loop gain	PB60	PG1B	Gain switching Model loop gain
Position loop gain	PB08	PG2	Position loop gain	PB30	PG2B	Position loop gain after gain switching
Speed loop gain	PB09	VG2	Speed loop gain	PB31	VG2B	Speed loop gain after gain switching
Speed integral compensation	PB10	VIC	Speed integral compensation	PB32	VICB	Gain switching Speed integral compensation
Vibration suppression control 1 Used to set the value of the after-changing vibration suppression control vibration frequency setting.	PB19	VRF11	Vibration suppression control 1 Used to set the value of the after-changing vibration suppression control vibration frequency setting.	PB33	VRF11B	Vibration suppression control 1 - Vibration frequency after gain switching
Vibration suppression control 1 - Resonance frequency	PB20	VRF12	Vibration suppression control 1 - Resonance frequency	PB34	VRF12B	Vibration suppression control 1 - Resonance frequency after gain switching
Vibration suppression control 1 - Vibration frequency damping	PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping	PB35	VRF13B	Vibration suppression control 1 - Vibration frequency damping after gain switching
Vibration suppression control 1 - Resonance frequency damping	PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping	PB36	VRF14B	Vibration suppression control 1 - Resonance frequency damping after gain switching
Vibration suppression control 2 - Vibration frequency	PB52	VRF21	Vibration suppression control 2 - Vibration frequency	PB56	VRF21B	Vibration suppression control 2 - Vibration frequency after gain switching
Vibration suppression control 2 - Resonance frequency	PB53	VRF22	Vibration suppression control 2 - Resonance frequency	PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching
Vibration suppression control 2 - Vibration frequency damping	PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping	PB58	VRF23B	Vibration suppression control 2 - Vibration frequency damping after gain switching
Vibration suppression control 2 - Resonance frequency damping	PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping	PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching

(a) [Pr. PB06] to [Pr. PB10]

These parameters are the same as in ordinary manual adjustment. Gain switching allows the values of load to motor inertia ratio, position loop gain, model loop gain, speed loop gain, and speed integral compensation to be switched.

(b) [Pr. PB19] to [Pr. PB22]/[Pr. PB52] to [Pr. PB55]

These parameters are the same as in ordinary manual adjustment. You can switch the vibration frequency, resonance frequency, vibration frequency damping, and resonance frequency damping by switching gain during motor stop.

(c) [Pr. PB29 Load to motor inertia ratio after gain switching]
Set the load to motor inertia ratio after gain switching. If the load to motor inertia ratio does not change, set it to the same value as [Pr. PB06 Load to motor inertia ratio].

(d) [Pr. PB30 Position loop gain after gain switching], [Pr. PB31 Speed loop gain after gain switching], and [Pr. PB32 Speed integral compensation after gain switching]
Set the values of after switching position loop gain, speed loop gain and speed integral compensation.

(e) Vibration suppression control after gain switching ([Pr. PB33] to [Pr. PB36]/[Pr. PB56] to [Pr. PB59])/[Pr. PB60 Model loop gain after gain switching]
The vibration suppression control after gain switching and model loop gain after gain switching are used only with the control command from the controller, or with input device (CDP) on/off.
You can switch the vibration frequency, resonance frequency, vibration frequency damping, resonance frequency damping, and model loop gain of the vibration suppression control 1 and vibration suppression control 2.

7.2.4 Gain switching procedure

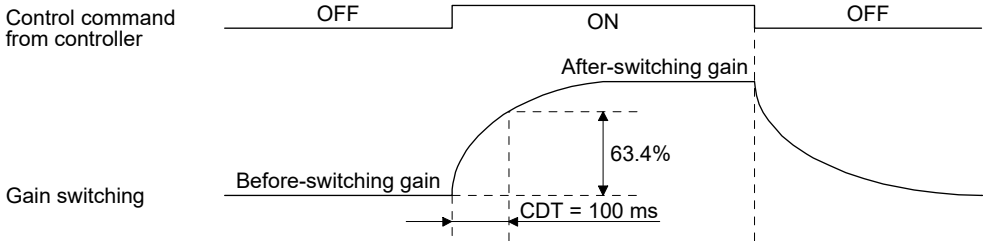
This operation will be described by way of setting examples.

(1) When choosing to switch by control command from the controller, or input device (CDP)
(a) Setting

Parameter	Symbol	Name	Setting value	Unit
PB06	GD2	Load to motor inertia ratio	4.00	[Multiplier]
PB07	PG1	Model loop gain	100	[rad/s]
PB08	PG2	Position loop gain	120	[rad/s]
PB09	VG2	Speed loop gain	3000	[rad/s]
PB10	VIC	Speed integral compensation	20	[ms]
PB19	VRF11	Vibration suppression control 1 - Vibration frequency	50	[Hz]
PB20	VRF12	Vibration suppression control 1 - Resonance frequency	50	[Hz]
PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping	0.20	
PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping	0.20	
PB52	VRF21	Vibration suppression control 2 - Vibration frequency	20	[Hz]
PB53	VRF22	Vibration suppression control 2 - Resonance frequency	20	[Hz]
PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping	0.10	
PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping	0.10	
PB29	GD2B	Load to motor inertia ratio after gain switching	10.00	[Multiplier]
PB60	PG1B	Model loop gain after gain switching	50	[rad/s]
PB30	PG2B	Position loop gain after gain switching	84	[rad/s]
PB31	VG2B	Speed loop gain after gain switching	4000	[rad/s]
PB32	VICB	Speed integral compensation after gain switching	50	[ms]
PB26	CDP	Gain switching function	0001 (Switched by the control command from the controller, or input device (CDP) on/off.)	

Parameter	Symbol	Name	Setting value	Unit
PB28	CDT	Gain switching time constant	100	[ms]
PB33	VRF11B	Vibration suppression control 1 - Vibration frequency after gain switching	60	[Hz]
PB34	VRF12B	Vibration suppression control 1 - Resonance frequency after gain switching	60	[Hz]
PB35	VRF13B	Vibration suppression control 1 - Vibration frequency damping after gain switching	0.15	
PB36	VRF14B	Vibration suppression control 1 - Resonance frequency damping after gain switching	0.15	
PB56	VRF21B	Vibration suppression control 2 - Vibration frequency after gain switching	30	[Hz]
PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching	30	[Hz]
PB58	VRF23B	Vibration suppression control 2 - Vibration frequency damping after gain switching	0.05	
PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching	0.05	

(b) Switching timing chart



Model loop gain	100	→	50	→	100
Load to motor inertia ratio	4.00	→	10.00	→	4.00
Position loop gain	120	→	84	→	120
Speed loop gain	3000	→	4000	→	3000
Speed integral compensation	20	→	50	→	20
Vibration suppression control 1 - Vibration frequency	50	→	60	→	50
Vibration suppression control 1 - Resonance frequency	50	→	60	→	50
Vibration suppression control 1 - Vibration frequency damping	0.20	→	0.15	→	0.20
Vibration suppression control 1 - Resonance frequency damping	0.20	→	0.15	→	0.20
Vibration suppression control 2 - Vibration frequency	20	→	30	→	20
Vibration suppression control 2 - Resonance frequency	20	→	30	→	20
Vibration suppression control 2 - Vibration frequency damping	0.10	→	0.05	→	0.10
Vibration suppression control 2 - Resonance frequency damping	0.10	→	0.05	→	0.10

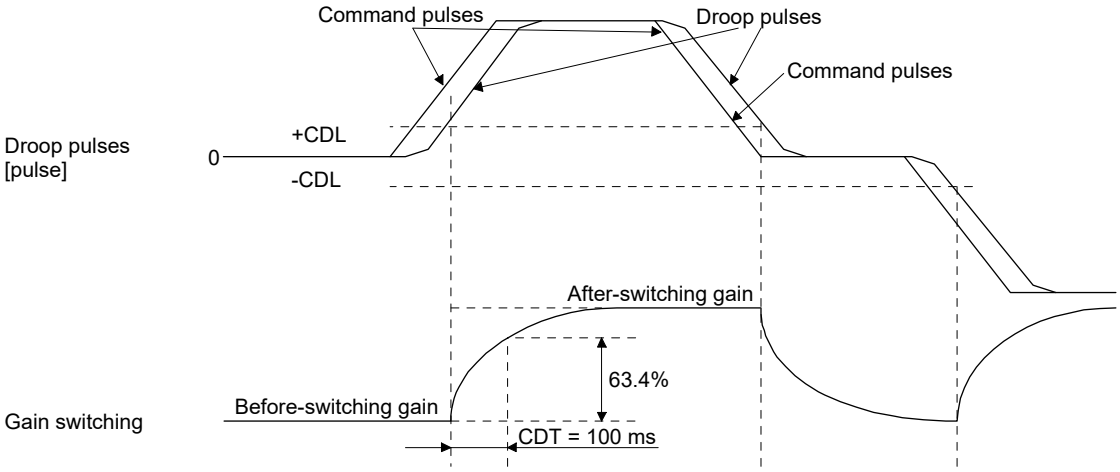
(2) When you choose switching by droop pulses

The vibration suppression control after gain switching and model loop gain after gain switching cannot be used.

(a) Setting

Parameter	Symbol	Name	Setting value	Unit
PB06	GD2	Load to motor inertia ratio	4.00	[Multiplier]
PB08	PG2	Position loop gain	120	[rad/s]
PB09	VG2	Speed loop gain	3000	[rad/s]
PB10	VIC	Speed integral compensation	20	[ms]
PB29	GD2B	Load to motor inertia ratio after gain switching	10.00	[Multiplier]
PB30	PG2B	Position loop gain after gain switching	84	[rad/s]
PB31	VG2B	Speed loop gain after gain switching	4000	[rad/s]
PB32	VICB	Speed integral compensation after gain switching	50	[ms]
PB26	CDP	Gain switching function	0003 (switching by droop pulses)	
PB27	CDL	Gain switching condition	50	[pulse]
PB28	CDT	Gain switching time constant	100	[ms]

(b) Switching timing chart



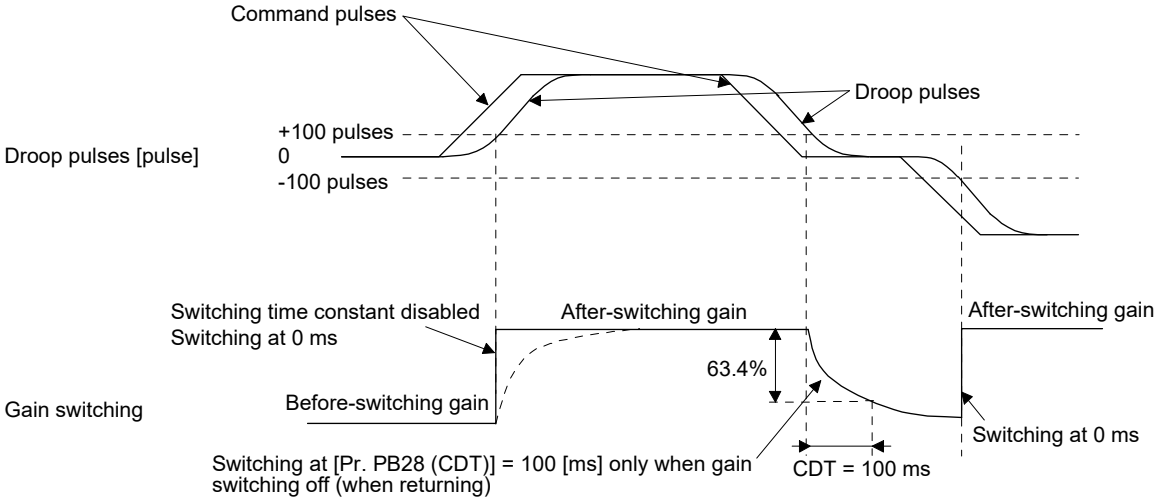
Load to motor inertia ratio	4.00	→	10.00	→	4.00	→	10.00
Position loop gain	120	→	84	→	120	→	84
Speed loop gain	3000	→	4000	→	3000	→	4000
Speed integral compensation	20	→	50	→	20	→	50

(3) When the gain switching time constant is disabled

(a) Switching time constant disabled was selected.

The gain switching time constant is disabled. The time constant is enabled at gain return.

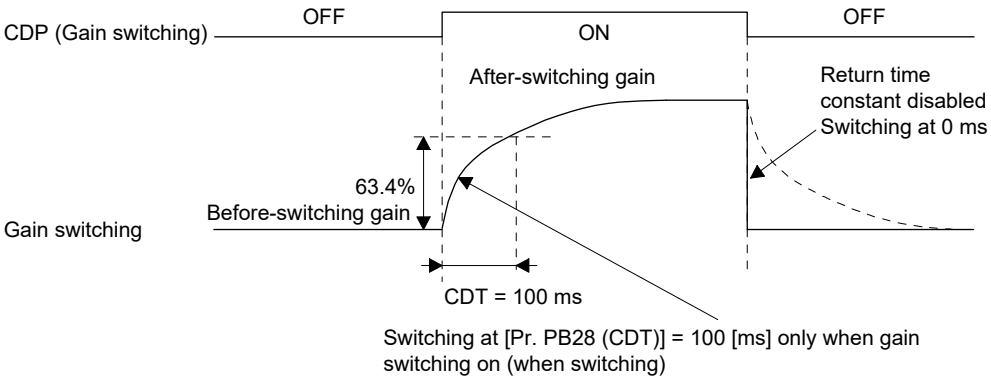
The following example shows for [Pr. PB26 (CDP)] = 0103, [Pr. PB27 (CDL)] = 100 [pulse], and [Pr. PB28 (CDT)] = 100 [ms].



(b) Return time constant disabled was selected.

The gain switching time constant is enabled. The time constant is disabled at gain return.

The following example shows for [Pr. PB26 (CDP)] = 0201, [Pr. PB27 (CDL)] = 0, and [Pr. PB28 (CDT)] = 100 [ms].



7.3 Tough drive function

POINT
●Set enable/disable of the tough drive function with [Pr. PA20 Tough drive setting]. (Refer to section 5.2.1.)

This function makes the equipment continue operating even under the condition that an alarm occurs. The tough drive functions are the vibration tough drive and the instantaneous power failure tough drive.

7.3.1 Vibration tough drive function

This function prevents vibration by resetting a filter instantaneously when machine resonance occurs due to varied vibration frequency caused by machine aging.
To reset the machine resonance suppression filters with the function, [Pr. PB13 Machine resonance suppression filter 1] and [Pr. PB15 Machine resonance suppression filter 2] should be set in advance.
Set [Pr. PB13] and [Pr. PB15] as follows.

(1) One-touch tuning execution (section 6.2)

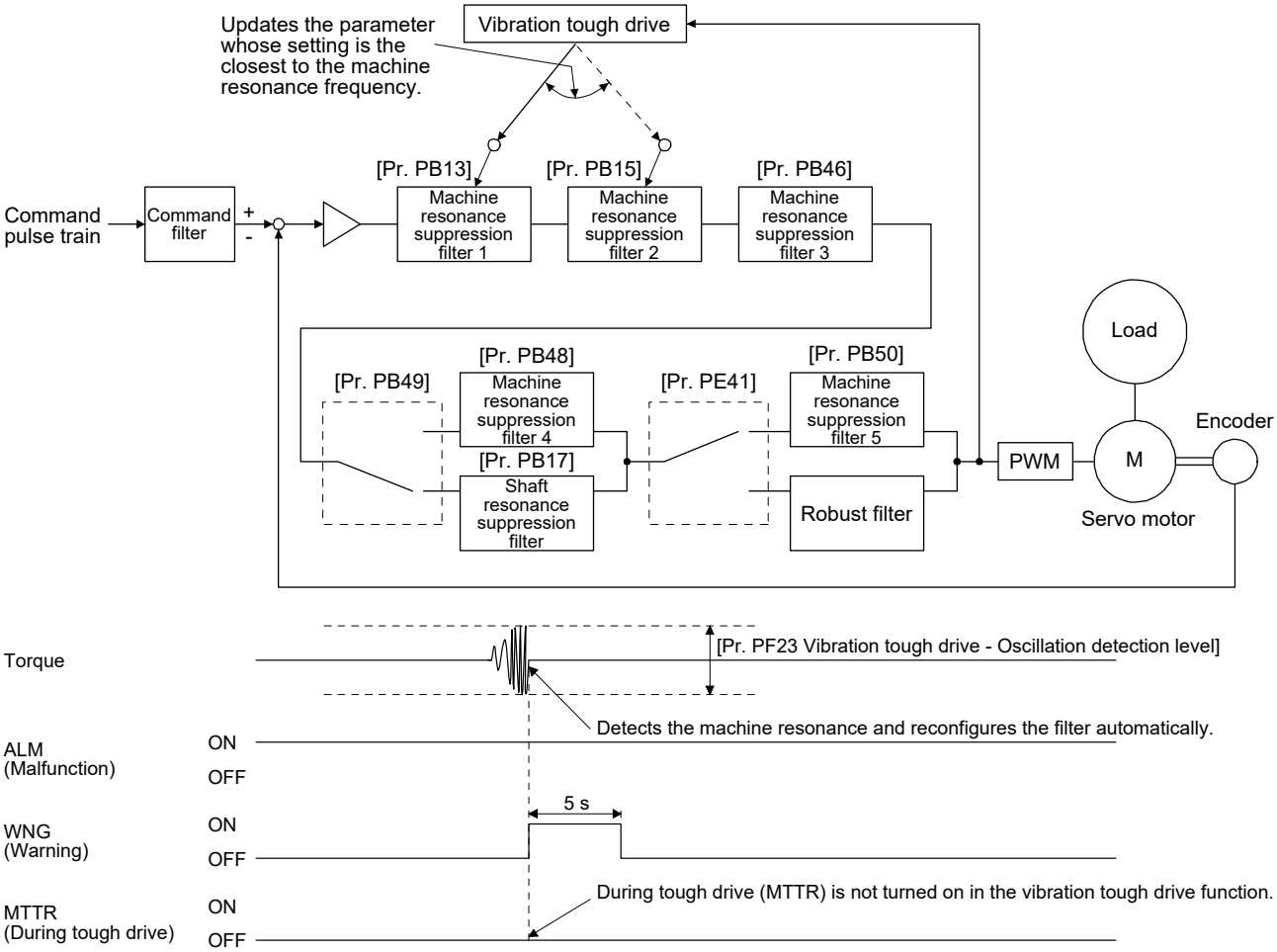
(2) Manual setting (section 5.2.2)

The vibration tough drive function operates when a detected machine resonance frequency is within ±30% for a value set in [Pr. PB13 Machine resonance suppression filter 1] or [Pr. PB15 Machine resonance suppression filter 2].
To set a detection level of the function, set sensitivity in [Pr. PF23 Vibration tough drive - Oscillation detection level].

POINT
●Resetting [Pr. PB13] and [Pr. PB15] by the vibration tough drive function is performed constantly. However, the number of write times to the EEPROM is limited to once per hour. ●The vibration tough drive function does not reset [Pr. PB46 Machine resonance suppression filter 3], [Pr. PB48 Machine resonance suppression filter 4], and [Pr. PB50 Machine resonance suppression filter 5]. ●The vibration tough drive function does not detect a vibration of 100 Hz or less.

The following shows the function block diagram of the vibration tough drive function.
The function detects machine resonance frequency and compare it with [Pr. PB13] and [Pr. PB15], and reset a machine resonance frequency of a parameter whose set value is closer.

Filter	Setting parameter	Precaution	Parameter that is reset with vibration tough drive function
Machine resonance suppression filter 1	PB01/PB13/PB14	The filter can be set automatically with "Filter tuning mode selection" in [Pr. PB01].	PB13
Machine resonance suppression filter 2	PB15/PB16		PB15
Machine resonance suppression filter 3	PB46/PB47		
Machine resonance suppression filter 4	PB48/PB49	Enabling the machine resonance suppression filter 4 disables the shaft resonance suppression filter. Using the shaft resonance suppression filter is recommended because it is adjusted properly depending on the usage situation. The shaft resonance suppression filter is enabled for the initial setting.	
Machine resonance suppression filter 5	PB50/PB51	Enabling the robust filter disables the machine resonance suppression filter 5. The robust filter is disabled for the initial setting.	



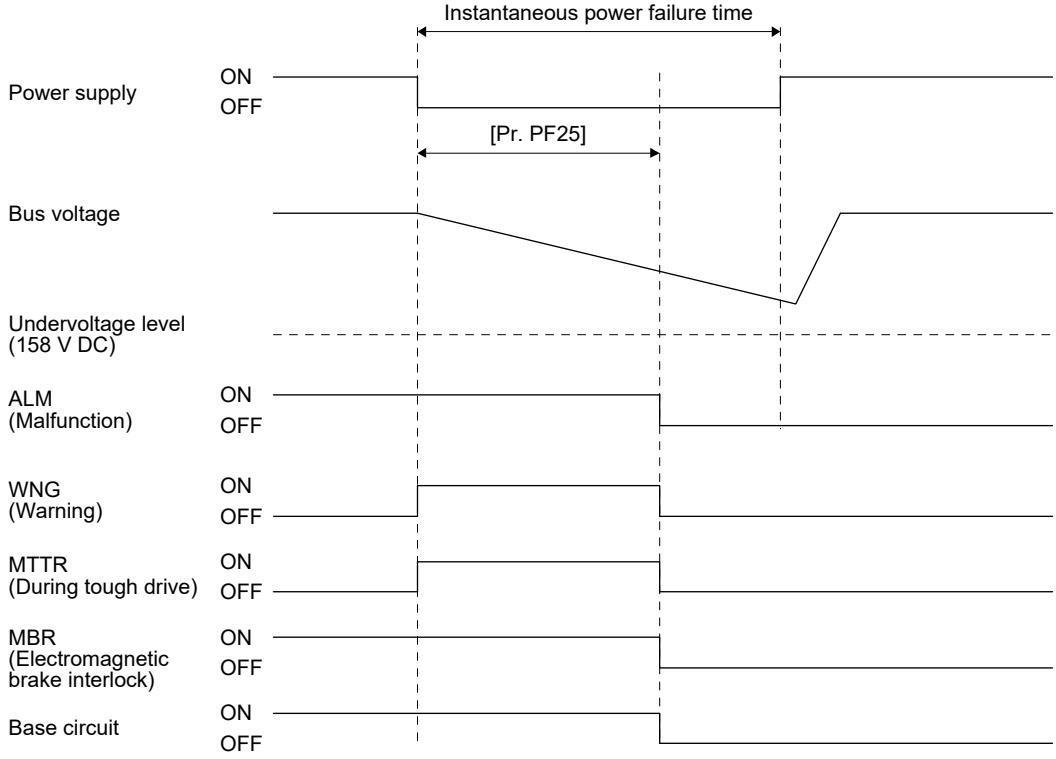
7.3.2 Instantaneous power failure tough drive function

The instantaneous power failure tough drive function avoids [AL. 10 Undervoltage] even when an instantaneous power failure occurs during operation. When the instantaneous power failure tough drive activates, the function will increase the tolerance against instantaneous power failure using the electrical energy charged in the capacitor in the servo amplifier and will change an alarm level of [AL. 10 Undervoltage] simultaneously. The [AL. 10.1 Voltage drop in the power] detection time for the power supply can be changed by [Pr. PF25 Instantaneous power failure tough drive - detection time]. In addition, [AL. 10.2 Bus voltage drop] detection level for the bus voltage is changed automatically.

POINT

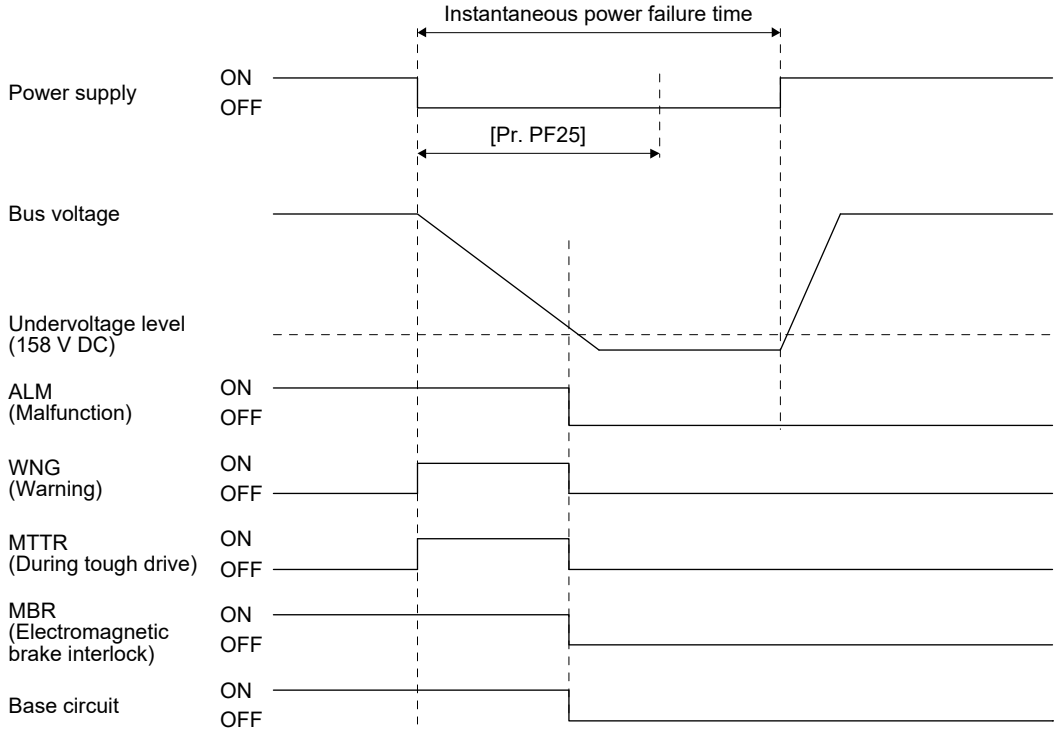
- MBR (Electromagnetic brake interlock) will not turn off during the instantaneous power failure tough drive.
- Selecting "Enabled (_ _ _ 1)" for "Torque limit function selection at instantaneous power failure" in [Pr. PA26] will limit torques to save electric energy when an instantaneous power failure occurs during operation and will make [AL. 10 Undervoltage] less likely to occur.
- When the load of instantaneous power failure is large, [AL. 10.2] caused by the bus voltage drop may occur regardless of the set value of [Pr. PF25 Instantaneous power failure tough drive - Detection time].

(1) Instantaneous power failure time > [Pr. PF25 Instantaneous power failure tough drive - detection time]
The alarm occurs when the instantaneous power failure time exceeds [Pr. PF25 Instantaneous power failure tough drive - detection time].
MTTR (During tough drive) turns on after the instantaneous power failure is detected.
MBR (Electromagnetic brake interlock) turns off when the alarm occurs.



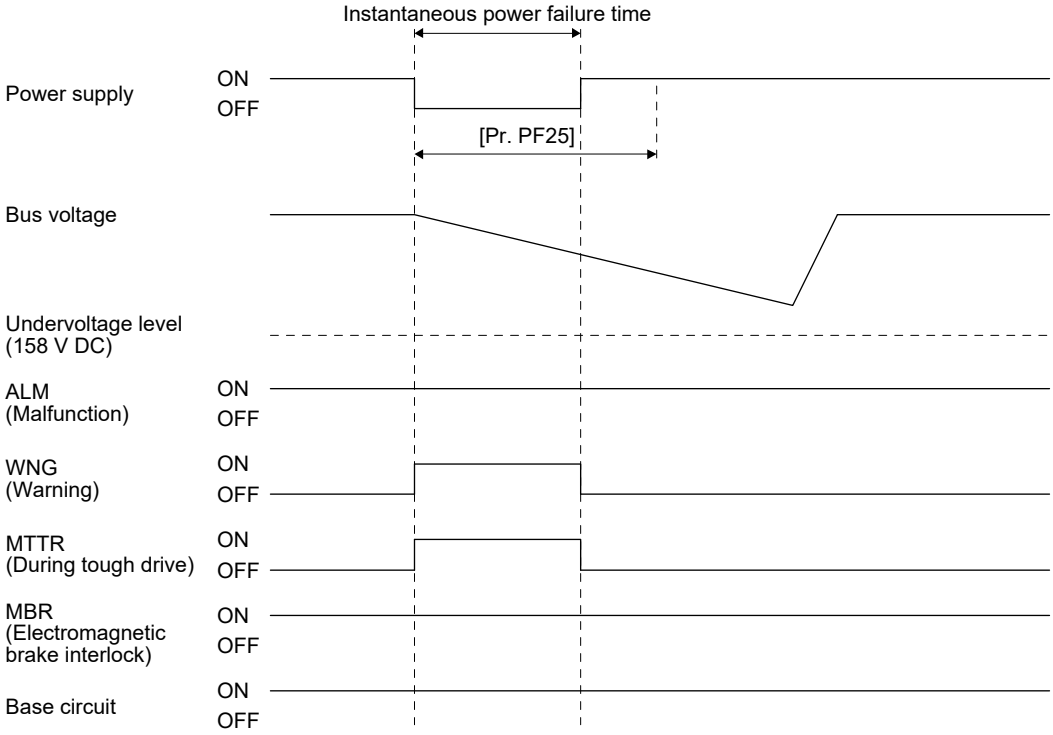
(2) Instantaneous power failure time < [Pr. PF25 Instantaneous power failure tough drive - detection time]
Operation status differs depending on how bus voltage decrease.

(a) When the bus voltage decreases lower than 158 V DC within the instantaneous power failure time [AL. 10 Undervoltage] occurs when the bus voltage decrease lower than 158 V DC regardless of the enabled instantaneous power failure tough drive.



(b) When the bus voltage does not decrease lower than 158 V DC within the instantaneous power failure time

The operation continues without alarming.



7.4 Model adaptive control disabled

POINT
●Change the parameters while the servo motor stops. ●When setting auto tuning response ([Pr. PA09]), change the setting value one by one to adjust it while checking operation status of the servo motor.

(1) Summary

The servo amplifier has a model adaptive control. The servo amplifier has a virtual motor model and drives the servo motor following the output of the motor model in the model adaptive control. At model adaptive control disabled, the servo amplifier drives the motor with PID control without using the model adaptive control.

The following shows the available parameters at model adaptive control disabled.

Parameter	Symbol	Name
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(2) Parameter setting

Set [Pr. PB25] to "_ _ _ 2".

(3) Restrictions

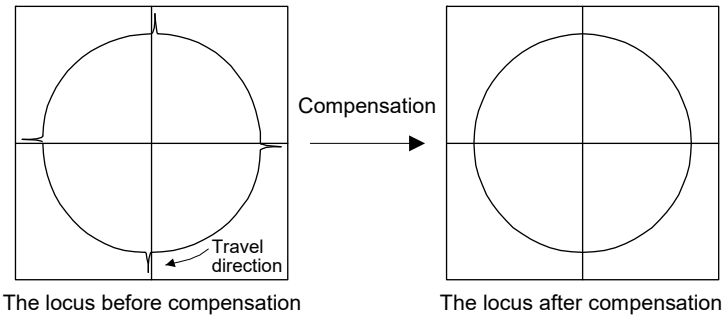
The following functions are not available at model adaptive control disabled.

Function	Explanation
Forced stop deceleration function ([Pr. PA04])	Disabling the model adaptive control while the forced stop deceleration function is enabled, [AL. 37] will occur. The forced stop deceleration function is enabled at factory setting. Set [Pr. PA04] to "0 _ _ _" (Forced stop deceleration function disabled).
Vibration suppression control 1 ([Pr. PB02]/[Pr. PB19]/[Pr. PB20]) Vibration suppression control 2 ([Pr. PB02]/[Pr. PB52]/[Pr. PB53])	The vibration suppression control uses the model adaptive control. Disabling the model adaptive control will also disable the vibration suppression control.
Overshoot amount compensation ([Pr. PB12])	The overshoot amount compensation uses data used by the model adaptive control. Disabling the model adaptive control will also disable the overshoot amount compensation.

7.5 Lost motion compensation function

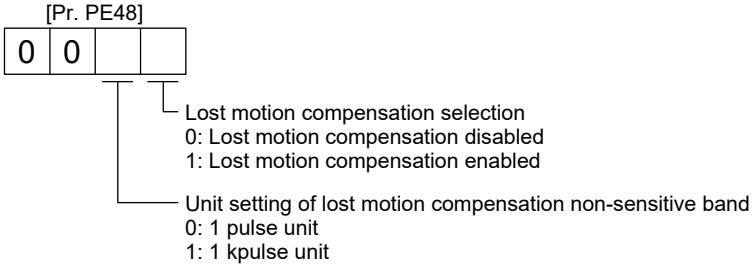
POINT
●The lost motion compensation function is enabled only in the position control mode.

The lost motion compensation function corrects response delays (caused by a non-sensitive band due to friction, twist, expansion, and backlash) caused when the machine travel direction is reversed. This function contributes to improvement for protrusions that occur at a quadrant change and streaks that occur at a quadrant change during circular cutting.
This function is effective when a high follow-up performance is required such as drawing an arc with an X-Y table.



(1) Parameter setting
Setting [Pr. PE44] to [Pr. PE50] enables the lost motion compensation function.

(a) Lost motion compensation function selection ([Pr. PE48])
Select the lost motion compensation function.



(b) Lost motion compensation ([Pr. PE44]/[Pr. PE45])
Set the same value for the lost motion compensation for each of when the forward rotation switches to the reverse rotation and when the reverse rotation switches to the forward rotation. When the heights of protrusions differ depending on the travel direction, set the different compensation for each travel direction. Set a value twice the usual friction torque and adjust the value while checking protrusions.

(c) Torque offset ([Pr. PE47])
For a vertical axis, unbalanced torque occurs due to the gravity. Although setting the torque offset is usually unnecessary, setting unbalanced torque of a machine as a torque offset cancels the unbalanced torque. The torque offset does not need to be set for a machine not generating unbalanced torque.

(d) Lost motion compensation timing ([Pr. PE49])
You can set the delay time of the lost motion compensation start timing with this parameter. When a protrusion occurs belatedly, set the lost motion compensation timing corresponding to the protrusion occurrence timing.

(e) Lost motion compensation non-sensitive band ([Pr. PE50])
When the travel direction reverses frequently around the zero speed, unnecessary lost motion compensation is triggered by the travel direction switching. By setting the lost motion compensation non-sensitive band, the speed is recognized as 0 when the fluctuation of the droop pulses is the setting value or less. This prevents unnecessary lost motion compensation.
When the value of this parameter is changed, the compensation timing is changed. Adjust the value of Lost motion compensation timing ([Pr. PE49]).

(f) Lost motion filter setting ([Pr. PE46])
Changing the value of this parameter is usually unnecessary. When a value other than 0.0 ms is set in this parameter, the high-pass filter output value of the set time constant is applied to the compensation and lost motion compensation continues.

(2) Adjustment procedure of the lost motion compensation function

(a) Measuring the load current
Measure the load currents during the forward direction feed and reverse direction feed with MR Configurator2.

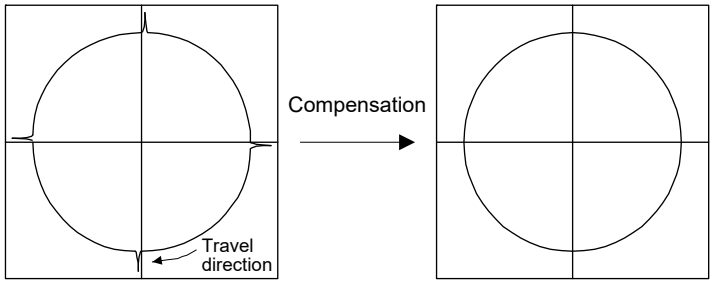
(b) Setting the lost motion compensation
Calculate the friction torque from the measurement result of (2) (a) in this section and set a value twice the friction torque in [Pr. PE44] and [Pr. PE45] as lost motion compensation.

$$\text{Friction torque [\%]} = \frac{\left|(\text{load current during feed in the forward rotation direction [\%]}) - (\text{load current during feed in the reverse rotation direction [\%]})\right|}{2}$$

(c) Checking protrusions
Drive the servo motor and check that the protrusions are corrected.

(d) Adjusting the lost motion compensation

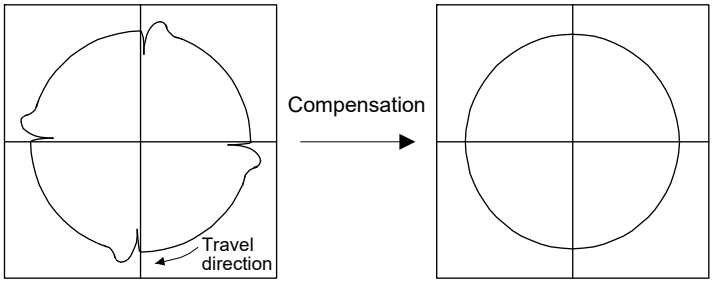
When protrusions still occur, the compensation is insufficient. Increase the lost motion compensation by approximately 0.5% until the protrusions are eliminated. When notches occur, the compensation is excessive. Decrease the lost motion compensation by approximately 0.5% until the notches are eliminated. Different values can be set as the compensation for each of when the forward rotation (CCW) switches to the reverse rotation (CW) and when the reverse rotation (CW) switches to the forward rotation (CCW).



The locus before compensation　　The locus after compensation

(e) Adjusting the lost motion compensation timing

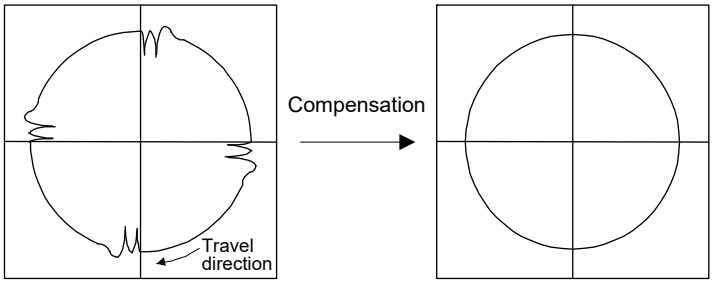
When the machine has low rigidity, the speed loop gain is set lower than the standard setting value, or the servo motor is rotating at high speed, quadrant projections may occur behind the quadrant change points. In this case, you can suppress the quadrant projections by delaying the lost motion compensation timing with [Pr. PE49 Lost motion compensation timing]. Increase the setting value of [Pr. PE49] from 0 ms (initial value) by approximately 0.5 ms to adjust the compensation timing.



Before timing delay compensation　　After timing delay compensation

(f) Adjusting the lost motion compensation non-sensitive band

When the lost motion is compensated twice around a quadrant change point, set [Pr. PE50 Lost motion compensation non-sensitive band]. Increase the setting value so that the lost motion is not compensated twice. Setting [Pr. PE50] may change the compensation timing. Adjust the lost motion compensation timing of (2) (e) in this section.



Before timing delay compensation　　After timing delay compensation

8. TROUBLESHOOTING

POINT
●Refer to "MELSERVO-JE Servo Amplifier Instruction Manual (Troubleshooting)" for details of alarms and warnings. ●As soon as an alarm occurs, turn SON (Servo-on) off and interrupt the power. ●[AL. 37 Parameter error] and warnings (except [AL. F0 Tough drive warning]) are not recorded in the alarm history.

When an error occurs during operation, the corresponding alarm or warning is displayed. When an alarm or warning is displayed, refer to "MELSERVO-JE Servo Amplifier Instruction Manual (Troubleshooting)" to remove the failure. When an alarm occurs, ALM (Malfunction) will turn off.

8.1 Explanation for the lists

(1) No./Name/Detail No./Detail name
Indicates the No./name/detail No./detail name of alarms or warnings.

(2) Stop method
For the alarms and warnings in which "SD" is written in the stop method column, the servo motor stops with the dynamic brake after forced stop deceleration. For the alarms and warnings in which "DB" or "EDB" is written in the stop method column, the servo motor stops with the dynamic brake without forced stop deceleration.

(3) Alarm deactivation
After the cause of the alarm has been removed, the alarm can be deactivated by any of the methods marked ○ in the alarm deactivation column. Warnings are automatically canceled after the cause of occurrence is removed. Alarms are deactivated by alarm reset or power cycling.

Alarm deactivation	Explanation
Alarm reset	1. Turn on RES (Reset) with an input device. 2. Error reset command from the controller 3. Click the "Occurred Alarm Reset" in the "Alarm Display" window of MR Configurator2.
Power cycling	Turn off the power, check that the 3-digit, 7-segment LED display is off, and then turn on the power.

(4) Alarm code
To output alarm codes, set [Pr. PD39] to "_ _ _ 1". Alarm codes are outputted by turning on/off bit 0 to bit 2. Warnings ([AL. 90] to [AL. F3]) do not have alarm codes. The alarm codes in the following table will be outputted when they occur. The alarm codes will not be outputted in normal condition.

8.2 Alarm list

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation			Alarm code (Note 5)		
						Alarm reset	CPU reset	Power cycling	ACD2 (Bit 2)	ACD1 (Bit 1)	ACD0 (Bit 0)
Alarm	10	Undervoltage	10.1	Voltage drop in the power	EDB	○	○	○	0	1	0
			10.2	Bus voltage drop	SD	○	○	○			
	11	Switch setting error	11.1	Rotary switch setting error	DB			○	1	1	0
	12	Memory error 1 (RAM)	12.1	RAM error 1	DB			○	0	0	0
			12.2	RAM error 2	DB			○			
			12.3	RAM error 3	DB			○			
			12.4	RAM error 4	DB			○			
			12.5	RAM error 5	DB			○			
			12.6	RAM error 6	DB			○			
	13	Clock error	13.1	Clock error 1	DB			○	0	0	0
			13.2	Clock error 2	DB			○			
			13.3	Clock error 3	DB			○			
	14	Control process error	14.1	Control process error 1	DB			○	0	0	0
			14.2	Control process error 2	DB			○			
			14.3	Control process error 3	DB			○			
			14.4	Control process error 4	DB			○			
			14.5	Control process error 5	DB			○			
			14.6	Control process error 6	DB			○			
			14.7	Control process error 7	DB			○			
			14.8	Control process error 8	DB			○			
			14.9	Control process error 9	DB			○			
			14.A	Control process error 10	DB			○			
			14.C	Control process error 12	DB			○			
			14.D	Control process error 13	DB			○			
	15	Memory error 2 (EEP-ROM)	15.1	EEP-ROM error at power on	DB			○	0	0	0
			15.2	EEP-ROM error during operation	DB			○			
			15.4	Home position information read error	DB			○			
	16	Encoder initial communication error 1	16.1	Encoder initial communication - Receive data error 1	DB			○	1	1	0
			16.2	Encoder initial communication - Receive data error 2	DB			○			
			16.3	Encoder initial communication - Receive data error 3	DB			○			
			16.5	Encoder initial communication - Transmission data error 1	DB			○			
			16.6	Encoder initial communication - Transmission data error 2	DB			○			
			16.7	Encoder initial communication - Transmission data error 3	DB			○			
			16.A	Encoder initial communication - Process error 1	DB			○			
			16.B	Encoder initial communication - Process error 2	DB			○			
			16.C	Encoder initial communication - Process error 3	DB			○			
			16.D	Encoder initial communication - Process error 4	DB			○			
			16.E	Encoder initial communication - Process error 5	DB			○			
			16.F	Encoder initial communication - Process error 6	DB			○			
	17	Board error	17.1	Board error 1	DB			○	0	0	0
			17.3	Board error 2	DB			○			
			17.4	Board error 3	DB			○			
			17.5	Board error 4	DB			○			
			17.6	Board error 5	DB			○			
			17.7	Board error 7	DB			○			

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation			Alarm code (Note 5)		
						Alarm reset	CPU reset	Power cycling	ACD2 (Bit 2)	ACD1 (Bit 1)	ACD0 (Bit 0)
Alarm	19	Memory error 3 (Flash-ROM)	19.1	Flash-ROM error 1	DB			○	0	0	0
			19.2	Flash-ROM error 2	DB			○			
			19.4	Flash-ROM error 4	DB			○			
			19.5	Flash-ROM error 5	DB			○			
	1A	Servo motor combination error	1A.1	Servo motor combination error 1	DB			○	1	1	0
			1A.4	Servo motor combination error 2	DB			○			
	1E	Encoder initial communication error 2	1E.1	Encoder malfunction	DB			○	1	1	0
	1F	Encoder initial communication error 3	1F.1	Incompatible encoder	DB			○	1	1	0
	20	Encoder normal communication error 1	20.1	Encoder normal communication - Receive data error 1	EDB			○	1	1	0
			20.2	Encoder normal communication - Receive data error 2	EDB			○			
			20.3	Encoder normal communication - Receive data error 3	EDB			○			
			20.5	Encoder normal communication - Transmission data error 1	EDB			○			
			20.6	Encoder normal communication - Transmission data error 2	EDB			○			
			20.7	Encoder normal communication - Transmission data error 3	EDB			○			
			20.9	Encoder normal communication - Receive data error 4	EDB			○			
			20.A	Encoder normal communication - Receive data error 5	EDB			○			
	21	Encoder normal communication error 2	21.1	Encoder data error 1	EDB			○	1	1	0
			21.2	Encoder data update error	EDB			○			
			21.3	Encoder data waveform error	EDB			○			
			21.5	Encoder hardware error 1	EDB			○			
			21.6	Encoder hardware error 2	EDB			○			
			21.9	Encoder data error 2	EDB			○			
	24	Main circuit error	24.1	Ground fault detected at hardware detection circuit	DB			○	1	0	0
			24.2	Ground fault detected at software detection function	DB	○	○	○			
	25	Absolute position erased	25.1	Servo motor encoder - Absolute position erased	DB			○			
	30	Regenerative error	30.1	Regeneration heat error	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)	0	0	1
			30.2	Regeneration signal error	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)			
			30.3	Regeneration feedback signal error	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)			
	31	Overspeed	31.1	Abnormal motor speed	SD	○	○	○	1	0	1
	32	Overcurrent	32.1	Overcurrent detected at hardware detection circuit (during operation)	DB			○	1	0	0
			32.2	Overcurrent detected at software detection function (during operation)	DB	○	○	○			
			32.3	Overcurrent detected at hardware detection circuit (during a stop)	DB			○			
			32.4	Overcurrent detected at software detection function (during a stop)	DB	○	○	○			
	33	Overvoltage	33.1	Main circuit voltage error	EDB	○	○	○	0	0	1
	34	SSCNET receive error 1	34.1	SSCNET receive data error	SD	○	○ (Note 4)	○			
			34.2	SSCNET connector connection error	SD	○	○	○			
			34.3	SSCNET communication data error	SD	○	○	○			
			34.4	Hardware error signal detection	SD	○	○	○			
	35	Command frequency error	35.1	Command frequency error	SD	○	○	○	1	0	1

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation			Alarm code (Note 5)		
						Alarm reset	CPU reset	Power cycling	ACD2 (Bit 2)	ACD1 (Bit 1)	ACD0 (Bit 0)
Alarm	36	SSCNET receive error 2	36.1	Continuous communication data error	SD	○	○	○			
	37	Parameter error	37.1	Parameter setting range error	DB		○	○	0	0	0
			37.2	Parameter combination error	DB		○	○			
			37.3	Point table setting error	DB			○			
	39	Program error	39.1	Program error	DB			○	0	0	0
			39.2	Instruction argument external error	DB			○			
			39.3	Register No. error	DB			○			
			39.4	Non-correspondence command error	DB			○			
	3A	Inrush current suppression circuit error	3A.1	Inrush current suppression circuit error	EDB			○	0	0	0
	3E	Operation mode error	3E.1	Operation mode error	DB		○	○			
			3E.6	Operation mode switch error	DB			○	0	0	0
	45	Main circuit device overheat	45.1	Main circuit device overheat error 1	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)	0	1	1
	46	Servo motor overheat	46.1	Abnormal temperature of servo motor 1	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)	0	1	1
			46.5	Abnormal temperature of servo motor 3	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)			
			46.6	Abnormal temperature of servo motor 4	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)			
	47	Cooling fan error	47.2	Cooling fan speed reduction error	SD			○	0	1	1
	50	Overload 1	50.1	Thermal overload error 1 during operation	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)	0	1	1
			50.2	Thermal overload error 2 during operation	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)			
			50.3	Thermal overload error 4 during operation	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)			
			50.4	Thermal overload error 1 during a stop	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)			
			50.5	Thermal overload error 2 during a stop	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)			
			50.6	Thermal overload error 4 during a stop	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)			
	51	Overload 2	51.1	Thermal overload error 3 during operation	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)	0	1	1
			51.2	Thermal overload error 3 during a stop	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)			
	52	Error excessive	52.1	Excess droop pulse 1	SD	○	○	○	1	0	1
			52.3	Excess droop pulse 2	SD	○	○	○			
			52.4	Error excessive during 0 torque limit	SD	○	○	○			
			52.5	Excess droop pulse 3	EDB	○	○	○			
	54	Oscillation detection	54.1	Oscillation detection error	EDB	○	○	○	0	1	1
	56	Forced stop error	56.2	Over speed during forced stop	EDB	○	○	○	1	1	0
			56.3	Estimated distance over during forced stop	EDB	○	○	○			
	61	Operation error	61.1	Point table setting range error	DB	○		○	1	0	1
	69	Command error	69.1	Forward rotation-side software limit detection - Command excess error	SD	○	○	○	1	0	1
			69.2	Reverse rotation-side software limit detection - Command excess error	SD	○	○	○			
			69.3	Forward rotation stroke end detection - Command excess error	SD	○	○	○			
			69.4	Reverse rotation stroke end detection - Command excess error	SD	○	○	○			
	86	Network communication error	86.1	Network communication error 1	SD	○		○	0	0	0
			86.4	Network communication error 4	SD	○		○			
			86.5	Network communication error 5	SD	○		○			

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)	Alarm deactivation			Alarm code (Note 5)		
						Alarm reset	CPU reset	Power cycling	ACD2 (Bit 2)	ACD1 (Bit 1)	ACD0 (Bit 0)
Alarm	8A	USB communication time-out error/serial communication time-out error/Modbus RTU communication time-out error	8A.1	USB communication time-out error/serial communication time-out error	SD	○	○	○	0	0	0
			8A.2	Modbus RTU communication time-out error	SD	○	○	○			
	8C	Network module communication error	8C.1	Network module communication error 1	SD			○	0	0	0
			8C.2	Network module communication error 2	SD			○			
			8C.3	Network module communication error 3	SD			○			
			8C.4	Network module communication error 4	SD			○			
			8C.5	Network module communication error 5	SD			○			
			8C.6	Network module communication error 6	SD			○			
			8C.7	Network module communication error 7	SD			○			
	8E	USB communication error/serial communication error/Modbus RTU communication error	8E.1	USB communication receive error/serial communication receive error	SD	○	○	○	0	0	0
			8E.2	USB communication checksum error/serial communication checksum error	SD	○	○	○			
			8E.3	USB communication character error/serial communication character error	SD	○	○	○			
			8E.4	USB communication command error/serial communication command error	SD	○	○	○			
			8E.5	USB communication data number error/serial communication data number error	SD	○	○	○			
			8E.6	Modbus RTU communication receive error	SD	○	○	○			
			8E.7	Modbus RTU communication message frame error	SD	○	○	○			
			8E.8	Modbus RTU communication CRC error	SD	○	○	○			
	888/ 88888	Watchdog	88._/ 8888._	Watchdog	DB			○			

Note 1. After resolving the source of trouble, cool the equipment for approximately 30 minutes.

2. The following shows three stop methods of DB, EDB, and SD.

DB: Dynamic brake stop (For a servo amplifier without the dynamic brake, the servo motor coasts.)

EDB: Electronic dynamic brake stop (available with specified servo motors)

Refer to the following table for the specified servo motors. The stop method for other than the specified servo motors is DB.

For MR-JE_A, setting [Pr. PF09] to "(_ _ _ 3)" enables the electronic dynamic brake.

Series	Servo motor
HG-KN	HG-KN053/HG-KN13/HG-KN23/HG-KN43
HG-SN	HG-SN52

SD: Forced stop deceleration

3. This is applicable when [Pr. PA04] is set to the initial value. The stop method of SD can be changed to DB using [Pr. PA04].
4. In some controller communication status, the alarm factor may not be removed.
5. Alarm codes are outputted from the MR-JE-_A or MR-JE-_C. Refer to section 1.1 for details.

8.3 Warning list

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)
Warning	90	Home position return incomplete warning	90.1	Home position return incomplete	
			90.2	Home position return abnormal termination	
			90.5	Z-phase unpassed	
	91	Servo amplifier overheat warning (Note 1)	91.1	Main circuit device overheat warning	
	92	Battery cable disconnection warning	92.1	Encoder battery cable disconnection warning	
			92.3	Battery degradation	
	96	Home position setting warning	96.1	In-position warning at home positioning	
			96.2	Command input warning at home positioning	
			96.3	Servo off warning at home positioning	
	97	Positioning specification warning	97.1	Program operation disabled warning	
			97.2	Next station position warning	
	98	Software limit warning	98.1	Forward rotation-side software stroke limit reached	
			98.2	Reverse rotation-side software stroke limit reached	
	99	Stroke limit warning	99.1	Forward rotation stroke end off	(Note 4)
			99.2	Reverse rotation stroke end off	(Note 4)
	9B	Error excessive warning	9B.1	Excess droop pulse 1 warning	
			9B.3	Excess droop pulse 2 warning	
			9B.4	Error excessive warning during 0 torque limit	
	9F	Battery warning	9F.1	Low battery	
	E0	Excessive regeneration warning	E0.1	Excessive regeneration warning	
	E1	Overload warning 1	E1.1	Thermal overload warning 1 during operation	
			E1.2	Thermal overload warning 2 during operation	
			E1.3	Thermal overload warning 3 during operation	
			E1.4	Thermal overload warning 4 during operation	
			E1.5	Thermal overload warning 1 during a stop	
			E1.6	Thermal overload warning 2 during a stop	
			E1.7	Thermal overload warning 3 during a stop	
			E1.8	Thermal overload warning 4 during a stop	
	E3	Absolute position counter warning	E3.1	Multi-revolution counter travel distance excess warning	
			E3.2	Absolute position counter warning	
			E3.4	Absolute positioning counter EEP-ROM writing frequency warning	
			E3.5	Encoder absolute positioning counter warning	
	E4	Parameter warning	E4.1	Parameter setting range error warning	
	E6	Servo forced stop warning	E6.1	Forced stop warning	SD
	E7	Controller forced stop warning	E7.1	Controller forced stop input warning	SD

	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)
Warning	E8	Cooling fan speed reduction warning	E8.1	Decreased cooling fan speed warning	
	E9	Main circuit off warning	E9.1	Servo-on signal on during main circuit off	DB
			E9.2	Bus voltage drop during low speed operation	DB
			E9.3	Ready-on signal on during main circuit off	DB
	EC	Overload warning 2	EC.1	Overload warning 2	
	ED	Output watt excess warning	ED.1	Output watt excess warning	
	F0	Tough drive warning	F0.1	Instantaneous power failure tough drive warning	
			F0.3	Vibration tough drive warning	
	F2	Drive recorder - Miswriting warning	F2.1	Drive recorder - Area writing time-out warning	
			F2.2	Drive recorder - Data miswriting warning	
	F3	Oscillation detection warning	F3.1	Oscillation detection warning	
	F4	Positioning warning	F4.4	Target position setting range error warning	
			F4.6	Acceleration time constant setting range error warning	
			F4.7	Deceleration time constant setting range error warning	
			F4.8	Control command input error warning	
			F4.9	Home position return type error warning	
	F5	Simple cam function - Cam data miswriting warning	F5.1	Cam data - Area writing time-out warning	
			F5.2	Cam data - Area miswriting warning	
			F5.3	Cam data checksum error	
	F6	Simple cam function - Cam control warning	F6.1	Cam axis one cycle current value restoration failed	
			F6.2	Cam axis feed current value restoration failed	
			F6.3	Cam unregistered error	
			F6.4	Cam control data setting range error	
			F6.5	Cam No. external error	
			F6.6	Cam control inactive	

Note 1. After resolving the source of trouble, cool the equipment for approximately 30 minutes.
2. The following shows two stop methods of DB and SD.
DB: Dynamic brake stop (For a servo amplifier without the dynamic brake, the servo motor coasts.)
SD: Forced stop deceleration
3. This is applicable when [Pr. PA04] is set to the initial value. The stop method of SD can be changed to DB using [Pr. PA04].
4. Quick stop or slow stop can be selected using [Pr. PD30] for the MR-JE-_A or using [Pr. PD35] for the MR-JE-_C (except in the profile mode).

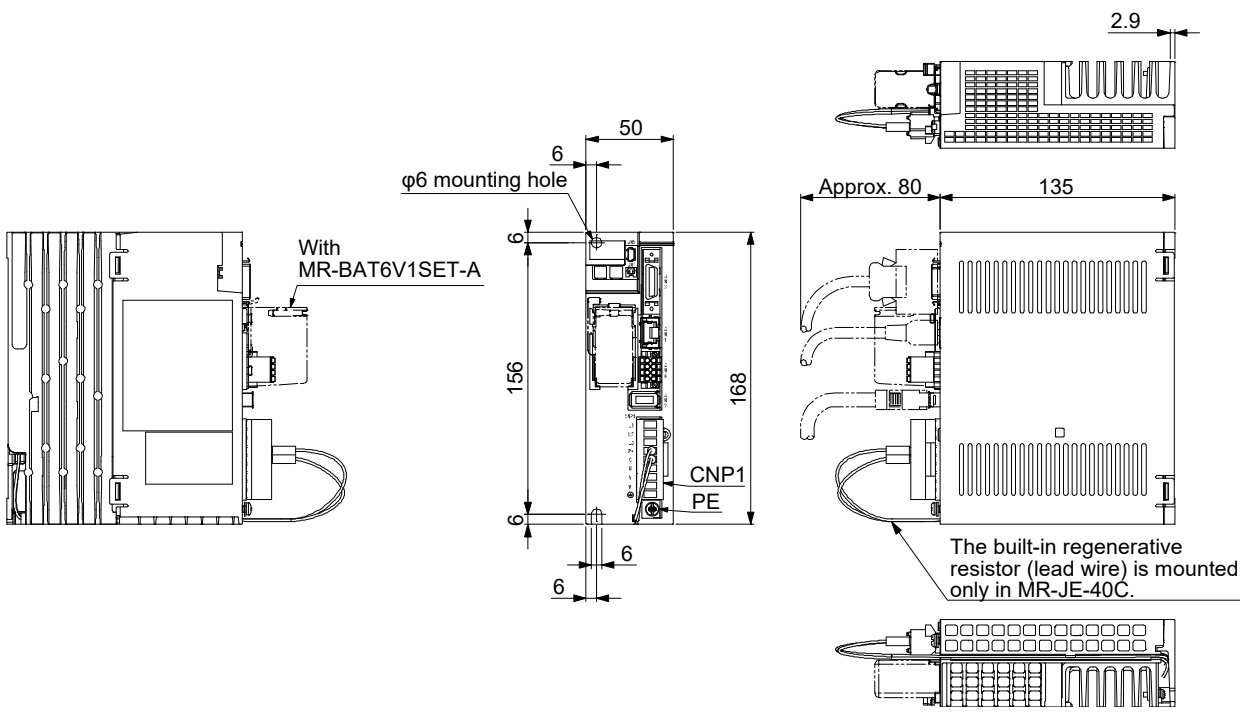
MEMO

9. DIMENSIONS

9.1 Servo amplifier

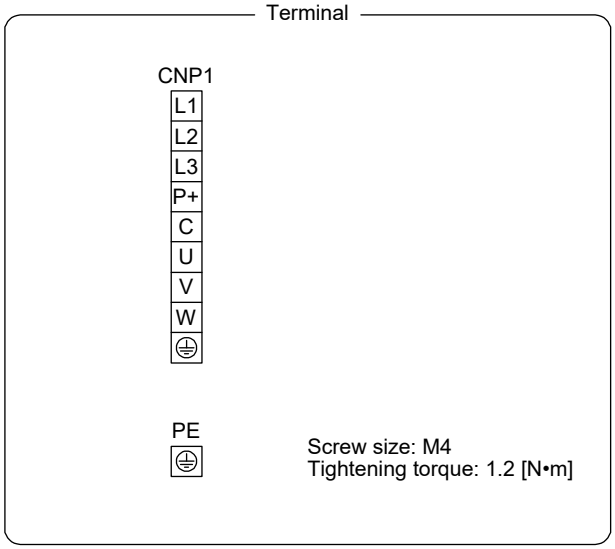
(1) MR-JE-10C to MR-JE-40C

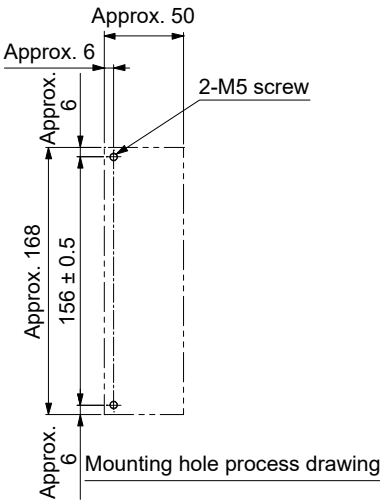
[Unit: mm]



Mass: 0.8 [kg]

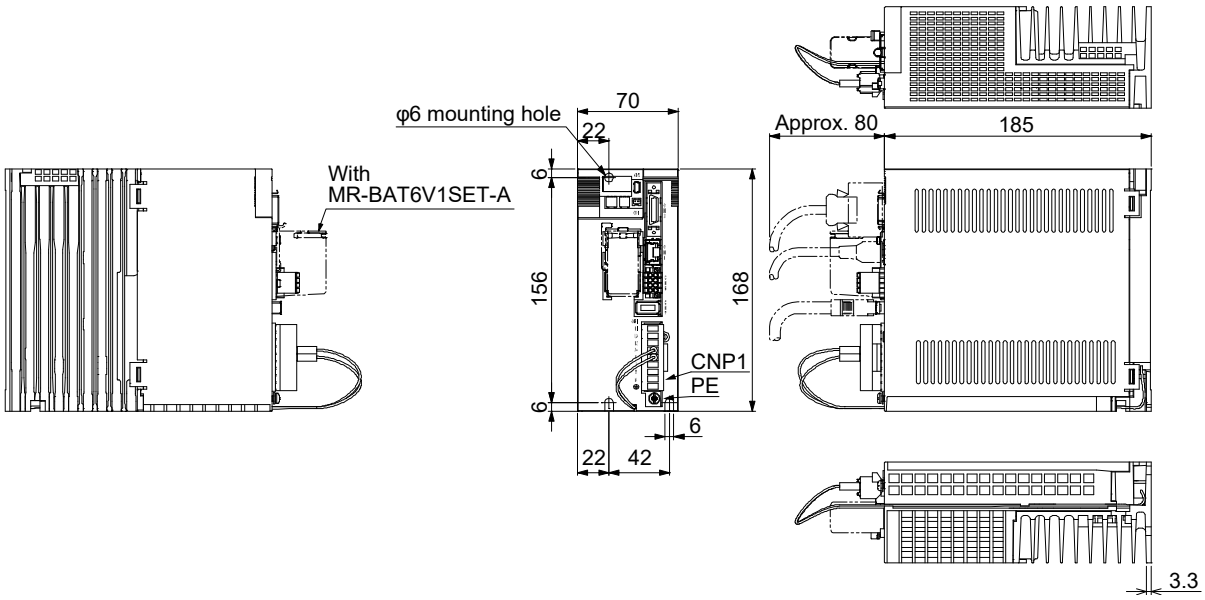
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]





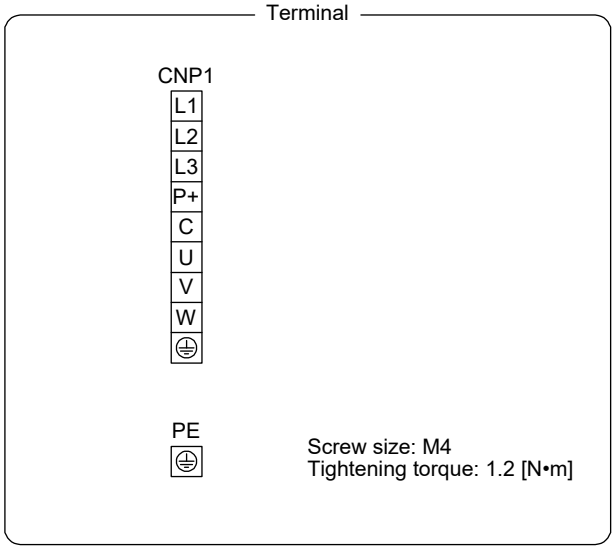
(2) MR-JE-70C/MR-JE-100C

[Unit: mm]

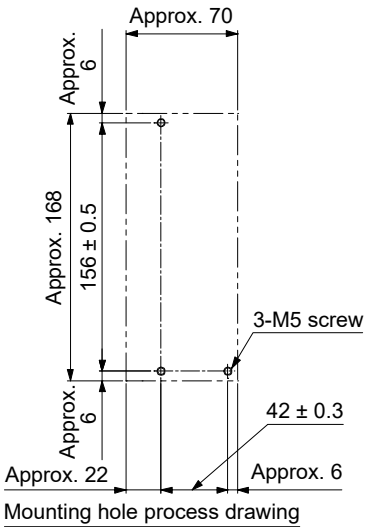


Mass: 1.5 [kg]

Terminal



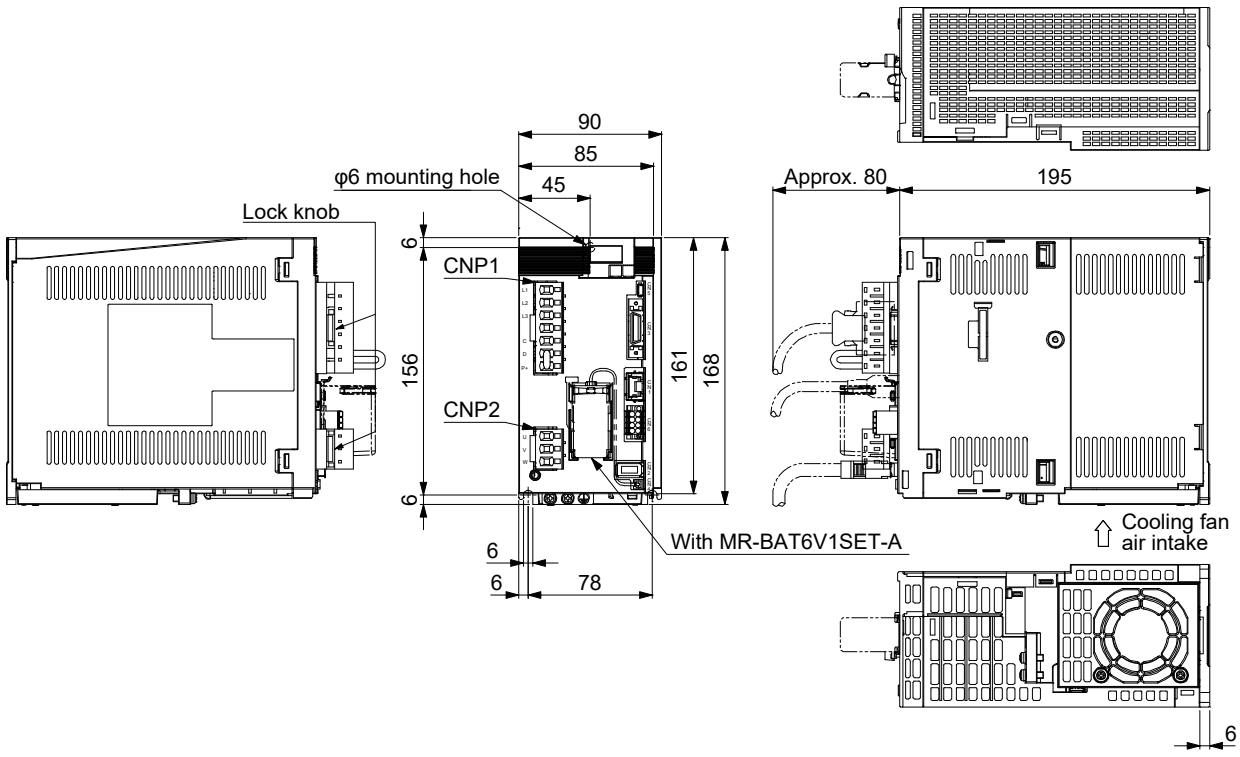
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



Mounting hole process drawing

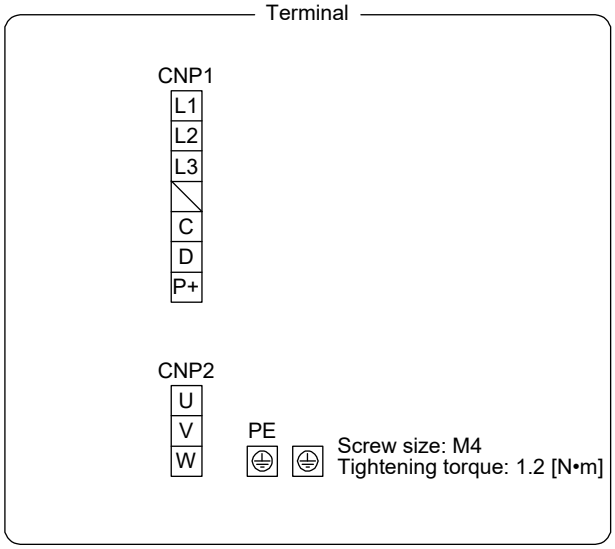
(3) MR-JE-200C/MR-JE-300C

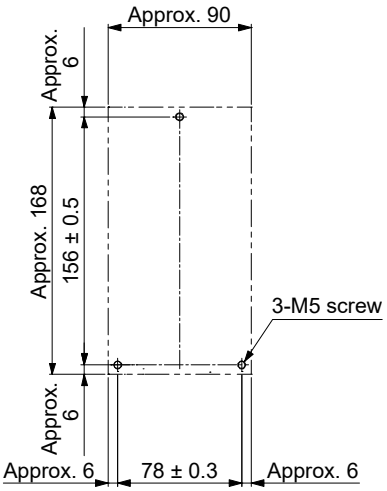
[Unit: mm]



Mass: 2.1 [kg]

Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]





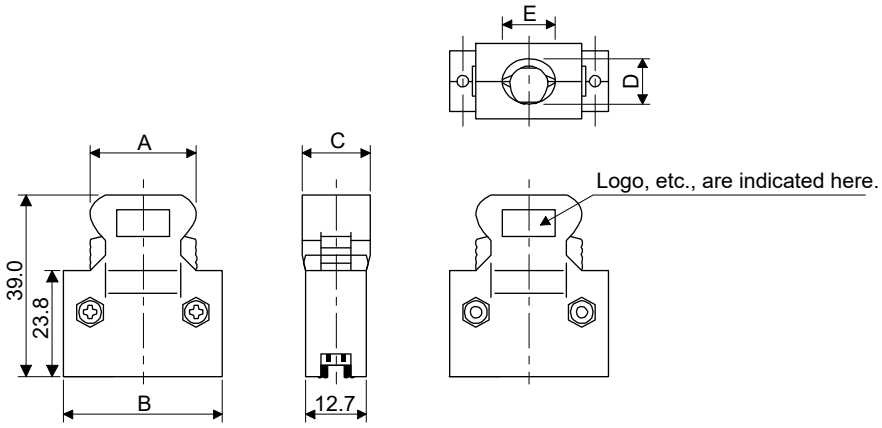
Mounting hole process drawing

9.2 Connector

(1) Miniature delta ribbon (MDR) system (3M)

(a) One-touch lock type

[Unit: mm]

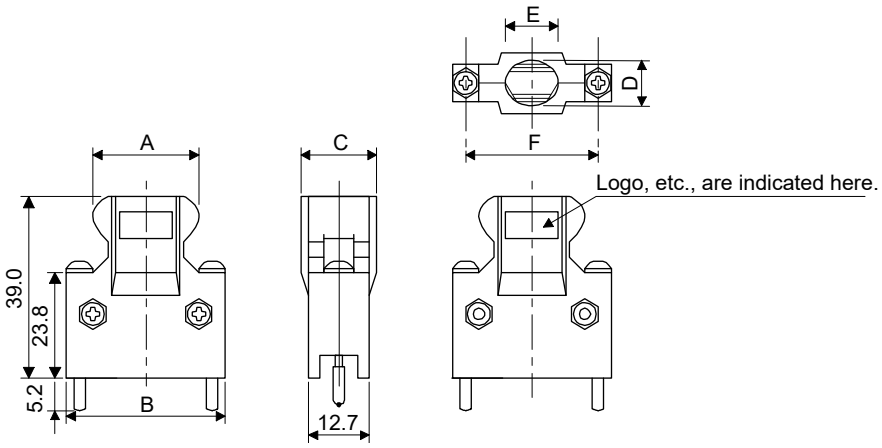


Connector	Shell kit	Each type of dimension				
		A	B	C	D	E
10120-3000PE	10320-52F0-008	22.0	33.3	14.0	10.0	12.0

(b) Jack screw M2.6 type

This is not available as option.

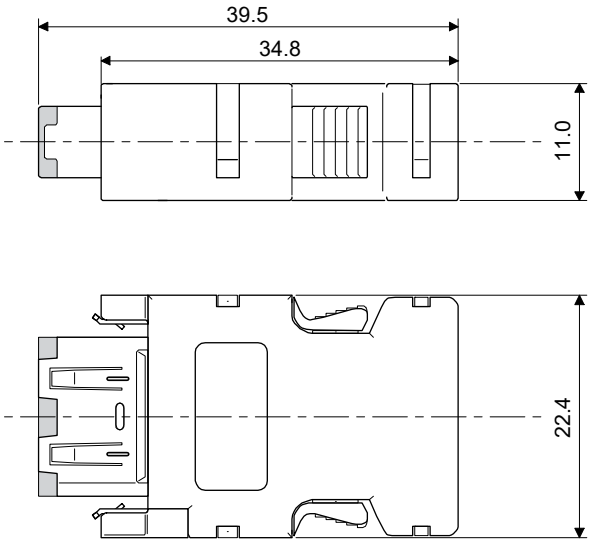
[Unit: mm]



Connector	Shell kit	Each type of dimension					
		A	B	C	D	E	F
10120-3000PE	10320-52F0-008	22.0	33.3	14.0	10.0	12.0	27.4

(2) SCR connector system (3M)
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008

[Unit: mm]

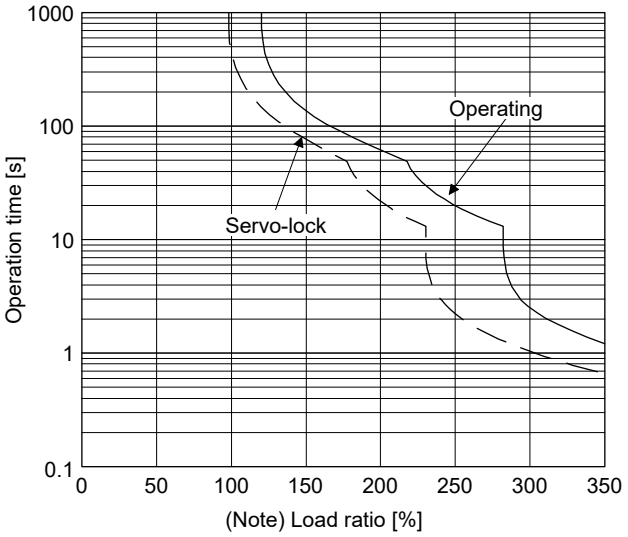


MEMO

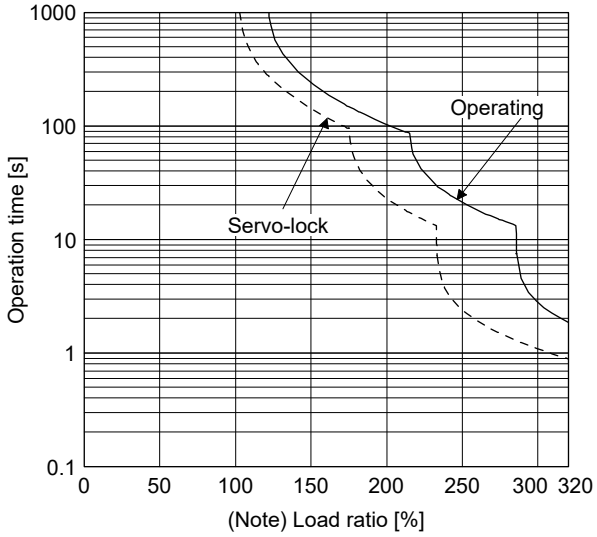
10. CHARACTERISTICS

10.1 Overload protection characteristics

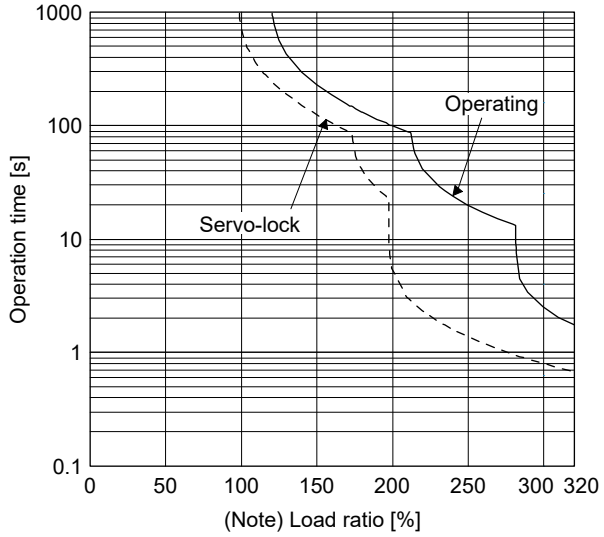
An electronic thermal is built in the servo amplifier to protect the servo motor, servo amplifier and servo motor power wires from overloads.
[AL. 50 Overload 1] occurs if overload operation performed is above the electronic thermal protection curve shown in fig. 10.1. [AL. 51 Overload 2] occurs if the maximum current is applied continuously for several seconds due to machine collision, etc. Use the equipment on the left-side area of the continuous or broken line in the graph.
For the system where the unbalanced torque occurs, such as a vertical axis system, the unbalanced torque of the machine should be kept at 70% or lower of the motor's rated torque.
This servo amplifier has servo motor overload protective function. (The servo motor overload current (full load current) is set on the basis of 120% rated current of the servo amplifier.)



HG-KN13_



HG-KN23_/HG-KN43_/HG-KN73_/HG-SN52_/
HG-SN102_



HG-SN152_/HG-SN202_/HG-SN302_

Note. If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor stop status (servo-lock status) or in a 50 r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal protection.

Fig. 10.1 Electronic thermal protection characteristics

10.2 Power supply capacity and generated loss

(1) Amount of heat generated by the servo amplifier

Table 10.1 indicates servo amplifiers' power supply capacities and losses generated under rated load. For thermal design of an enclosed type cabinet, use the values in the table in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and servo-off according to the duty used during operation. When the servo motor is run at less than the rated speed, the power supply capacity will be smaller than the value in the table, but the servo amplifier's generated heat will not change.

Table 10.1 Power supply capacity and generated loss per servo motor at rated output

Servo amplifier	Servo motor	(Note 1) Power supply capacity [kVA]	(Note 2) Servo amplifier-generated heat [W]		Area required for heat dissipation [m^2]
			At rated output	With servo-off	
MR-JE-10C	HG-KN13_	0.3	25	15	0.5
MR-JE-20C	HG-KN23_	0.5	25	15	0.5
MR-JE-40C	HG-KN43_	0.9	35	15	0.7
MR-JE-70C	HG-KN73_	1.3	50	15	1.0
	HG-SN52_	1.0	40	15	0.8
MR-JE-100C	HG-SN102_	1.7	50	15	1.0
MR-JE-200C	HG-SN152_	2.5	90	20	1.8
	HG-SN202_	3.5			
MR-JE-300C	HG-SN302_	4.8	120	20	2.4

Note 1. The power supply equipment capacity changes with the power supply impedance. This value is applicable when the power factor improving AC reactor is not used.

2. Heat generated during regeneration is not included in the servo amplifier-generated heat. To calculate heat generated by the regenerative option, refer to section 11.2.

(2) Heat dissipation area for an enclosed type cabinet

The enclosed type cabinet (hereafter called the cabinet) which will contain the servo amplifier should be designed to ensure that its temperature rise is within +10 °C at the ambient temperature of 40 °C. Calculate the necessary cabinet dissipation area (allowing a margin of approximately 5 °C for the ambient temperature of 55 °C maximum) with equation (10.1).

$$A = \frac{P}{K \cdot \Delta T} \quad \cdots\cdots (10.1)$$

A : Heat dissipation area [m^2]
P : Loss generated in the cabinet [W]
ΔT : Difference between internal and ambient temperatures [°C]
K : Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with equation 10.1, assume that P is the sum of all losses generated in the cabinet. Refer to table 10.1 for heat generated by the servo amplifier. "A" indicates the effective area for heat dissipation, but if the cabinet is directly installed on an insulated wall, that extra amount must be added to the cabinet's surface area. The required heat dissipation area will vary with the conditions in the cabinet. If convection in the cabinet is poor and heat builds up, effective heat dissipation will not be possible. Therefore, arrangement of the equipment in the cabinet and the use of a cooling fan should be considered. Table 10.1 lists the cabinet dissipation area for each servo amplifier (guideline) when the servo amplifier is operated at the ambient temperature of 40 °C under rated load.

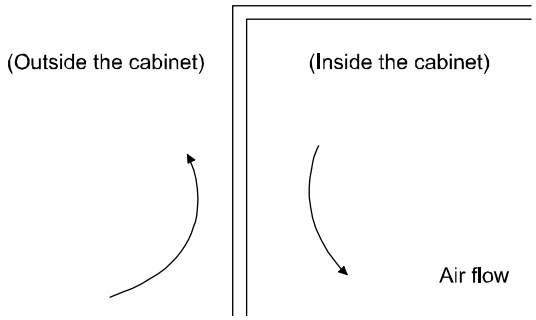


Fig. 10.2 Temperature distribution in an enclosed type cabinet

When air flows along the outer wall of the cabinet, effective heat exchange will be possible, because the temperature slope inside and outside the cabinet will be steeper.

10.3 Dynamic brake characteristics

⚠CAUTION	●The coasting distance is a theoretically calculated value which ignores the running load such as friction. The calculated value will be longer than the actual distance. If the braking distance is not longer than the calculated value, a moving part may crash into the stroke end, which is very dangerous. Install the anti-crash mechanism such as an air brake or an electric/mechanical stopper such as a shock absorber to reduce the shock of moving parts.

POINT

●Do not use dynamic brake to stop in a normal operation as it is the function to stop in emergency.

●For a machine operating at the recommended load to motor inertia ratio or less, the estimated number of usage times of the dynamic brake is 1000 times while the machine decelerates from the rated speed to a stop once in 10 minutes.

●Be sure to enable EM1 (Forced stop 1) after servo motor stops when using EM1 (Forced stop 1) frequently in other than emergency.

10.3.1 Dynamic brake operation

(1) Calculation of coasting distance

Fig. 10.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use equation 10.2 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the servo motor and machine operation speeds. (Refer to (2) in this section.)

A working part generally has a friction force. Therefore, actual coasting distance will be shorter than a maximum coasting distance calculated with the following equation.

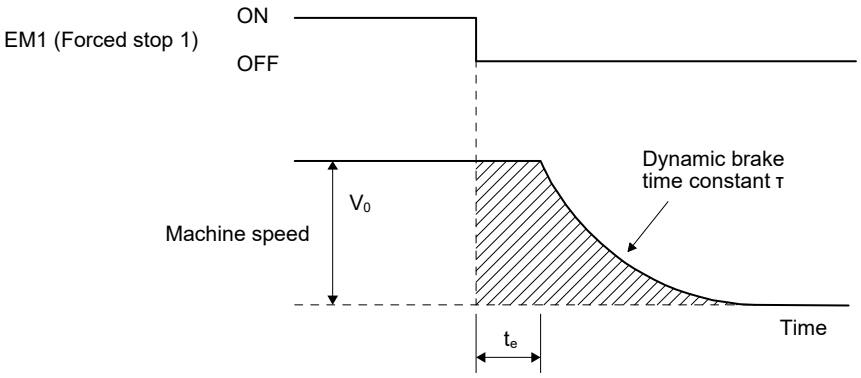


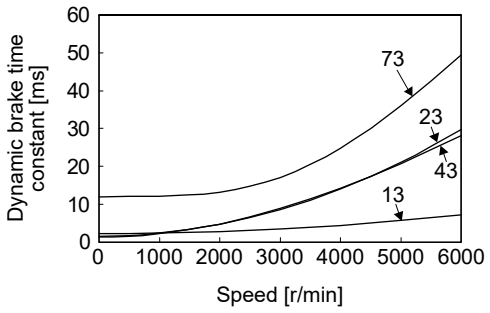
Fig. 10.3 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \quad \cdots\cdots (10.2)$$

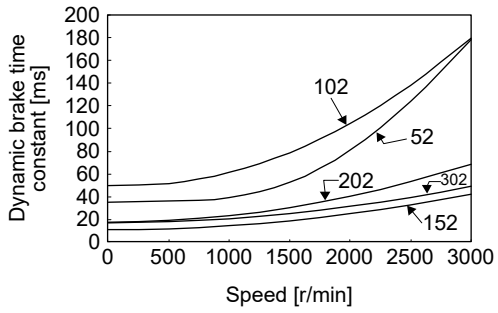
L_{max}: Maximum coasting distance ·····[mm]
V_0: Machine's fast feed speed ····· [mm/min]
J_M: Moment of inertia of the servo motor ····· [× 10^{-4} kg•m^2]
J_L: Load moment of inertia converted into equivalent value on servo motor shaft····· [× 10^{-4} kg•m^2]
τ: Dynamic brake time constant ····· [s]
t_e: Delay time of control section ····· [s]
There is internal relay delay time of about 10 ms.

(2) Dynamic brake time constant

The following shows necessary dynamic brake time constant τ for equation 10.2.



HG-KN series



HG-SN series

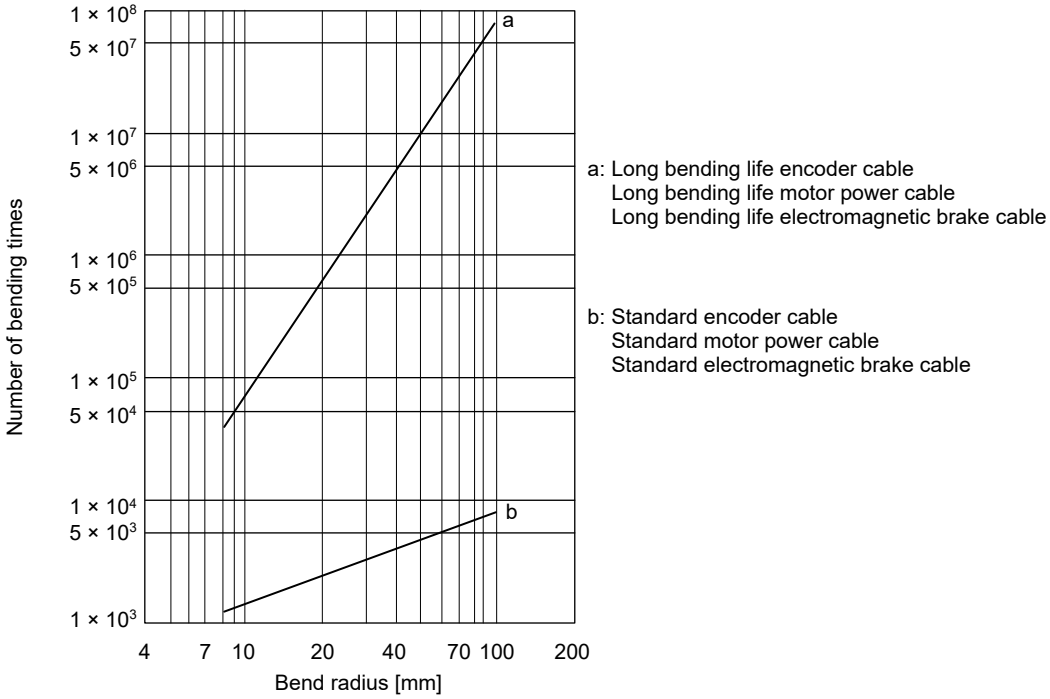
10.3.2 Permissible load to motor inertia when the dynamic brake is used

Use the dynamic brake under the load to motor inertia ratio indicated in the following table. If the ratio is higher than this value, the dynamic brake may burn. If there is a possibility that the ratio may exceed the value, contact your local sales office.
The values of the permissible load to motor inertia ratio in the table are the values at the maximum rotation speed of the servo motor.

Servo motor	Permissible load to motor inertia ratio [multiplier]
HG-KN13_	30
HG-KN23_	
HG-KN43_	
HG-KN73_	
HG-SN52_	
HG-SN102_	
HG-SN152_	
HG-SN202_	24
HG-SN302_	16

10.4 Cable bending life

The bending life of the cables is shown below. This graph calculated values. Since they are not guaranteed values, provide a little allowance for these values.



10.5 Inrush current at power-on

POINT
●For a servo amplifier of 400 W or less, the inrush current values can change depending on frequency of turning on/off the power and ambient temperature.

The following table indicates the inrush currents (reference data) that will flow when 240 V AC is applied. Even when you use a 1-phase 200 V AC power supply with MR-JE-10C to MR-JE-200C, the inrush currents will be the same.

Servo amplifier	Inrush currents (A_{0-P})
MR-JE-10C, MR-JE-20C, MR-JE-40C	32 A (attenuated to approx. 3 A in 20 ms)
MR-JE-70C, MR-JE-100C	36 A (attenuated to approx. 7 A in 20 ms)
MR-JE-200C, MR-JE-300C	102 A (attenuated to approx. 12 A in 20 ms)

Since large inrush currents flow in the power supplies, always use molded-case circuit breakers and magnetic contactors. (Refer to section 11.7.)
When circuit protectors are used, it is recommended that the inertia delay type, which is not tripped by an inrush current, be used.

MEMO

11. OPTIONS AND PERIPHERAL EQUIPMENT

⚠WARNING	●Before connecting options and peripheral equipment, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION	●Use the specified peripheral equipment and options to prevent a malfunction or a fire.

POINT

●We recommend using HIV wires to wire the servo amplifiers, options, and peripheral equipment. Therefore, the recommended wire sizes may differ from those used for the previous servo amplifiers.

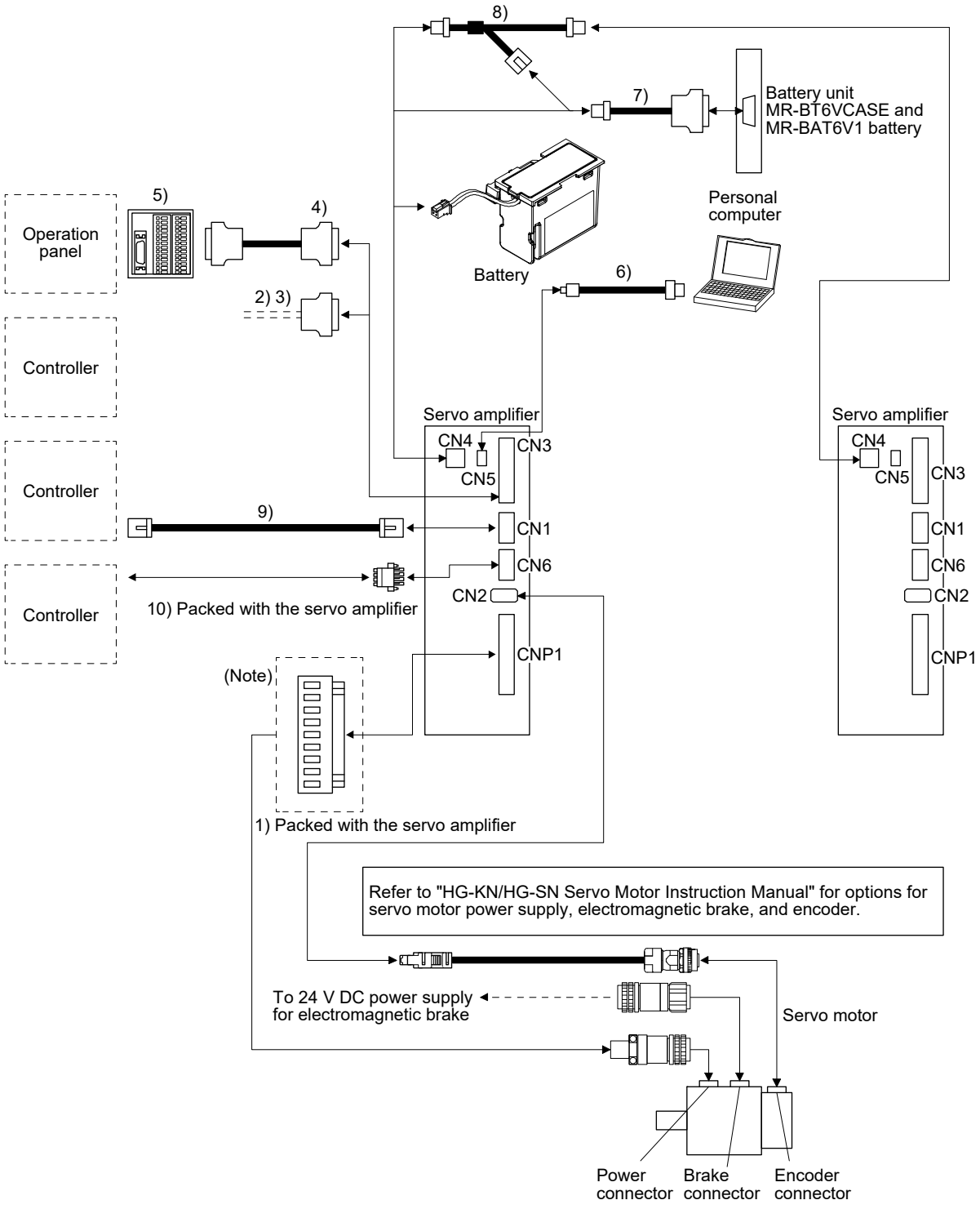
11.1 Cable/connector sets

POINT

●The IP rating indicated for cables and connectors is their protection against ingress of dust and raindrops when they are connected to a servo amplifier or servo motor. If the IP rating of the cable, connector, servo amplifier and servo motor vary, the overall IP rating depends on the lowest IP rating of all components.

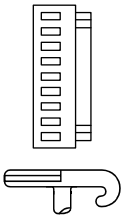
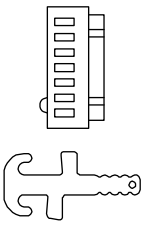
Please purchase the cable and connector options indicated in this section.

11.1.1 Combinations of cable/connector sets



Note. Connectors for 1 kW or less. Refer to section 3.3.3 (1) (b) for 2 kW or more.

11. OPTIONS AND PERIPHERAL EQUIPMENT

No.	Product name	Model	Description	Application
1)	Servo amplifier CNP1 power connector	MR-JECNP1-01	CNP1 Connector: 09JFAT-SAXGDK-H5.0 (JST) Applicable wire size: AWG 18 to 14 Insulator OD: to 3.9 mm Open tool: J-FAT-OT (N) or J-FAT-OT (JST) 	Supplied with servo amplifiers of 1 kW or less
		MR-JECNP1-02	CNP1 Connector: 06(7-4)JFAT-SAXGFK-XL (JST) Applicable wire size: AWG 16 to 10 Insulator OD: to 4.7 mm Open tool: J-FAT-OT-EXL (JST) 	Supplied with servo amplifiers of 2 kW and 3 kW
	Servo amplifier power connector	MR-JECNP2-02	CNP2 Connector: 03JFAT-SAXGFK-XL (JST) Applicable wire size: AWG 16 to 10 Insulator OD: to 4.7 mm 	
2)	Connector set	MR-J2CMP2	 Connector: 10126-3000PE Shell kit: 10326-52F0-008 (3M or equivalent)	Quantity: 1
3)	Connector set	MR-ECN1	 Connector: 10126-3000PE Shell kit: 10326-52F0-008 (3M or equivalent)	Quantity: 20
4)	Junction terminal block Cable	MR-TBNATBL_M Cable length: 0.5/1 m (Refer to section 11.3.)	Junction terminal block connector Connector: 10126-6000EL Shell kit: 10326-3210-000 (3M or equivalent) Servo amplifier-side connector Connector: 10126-6000EL Shell kit: 10326-3210-000 (3M or equivalent) 	For junction terminal block connection
5)	Junction terminal block	MR-TB26A	Refer to section 11.3.	
6)	USB cable	MR-J3USBCBL3M Cable length: 3 m	CN5 connector mini-B connector (5-pins) Personal computer connector A connector 	For connection with PC-AT compatible personal computer
7)	Battery cable	MR-BT6V1CBL_M Cable length: 0.3/1 m (Refer to section 11.1.2.)	Housing: PAP-02V-O Contact: SPHD-001G-P0.5 (JST) Connector: 10114-3000PE Shell kit: 10314-52F0-008 (3M or equivalent) 	For connection with battery unit
8)	Junction battery cable	MR-BT6V2CBL_M Cable length: 0.3/1 m (Refer to section 11.1.2.)	Housing: PAP-02V-O Contact: SPHD-001G-P0.5 (JST) Housing: PALR-02VF-O Contact: SPAL-001GU-P0.5 (JST) Housing: PAP-02V-O Contact: SPHD-001G-P0.5 (JST)	For battery junction
9)	Ethernet cable	(Refer to section 11.1.3.)	Category 5e or higher, (STP) straight cable The (STP) straight cable is not an option.	Connection cable for the CN1 connector

No.	Product name	Model	Description	Application
10)	RS-485 communication connector (Note)		CN6 connector DFMC 1,5/4-STF-3,5 2BDSLD QSO (Phoenix Contact or equivalent product)	Supplied with servo amplifier

Note. RS-485 connector for communication can be used only on Modbus RTU.

11.1.2 Battery cable/junction battery cable

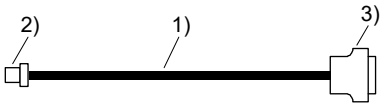
(1) Model explanations

The numbers in the cable length field of the table indicate the symbol filling the underline "_" in the cable model. The cables of the lengths with the symbols are available.

Cable model	Cable length		Bending life	Application/remark
	0.3 m	1 m		
MR-BT6V1CBL_M	03	1	Standard	For connection with MR-BT6VCASE
MR-BT6V2CBL_M	03	1	Standard	For junction

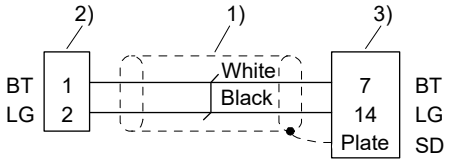
(2) MR-BT6V1CBL_M

(a) Appearance



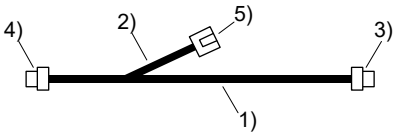
Components	Description
1) Cable	VSVC 7/0.18 × 2C
2) Connector	Housing: PAP-02V-O Contact: SPHD-001G-P0.5 (JST)
3) Connector	Connector: 10114-3000PE Shell kit: 10314-52F0-008 (3M or equivalent)

(b) Internal wiring diagram



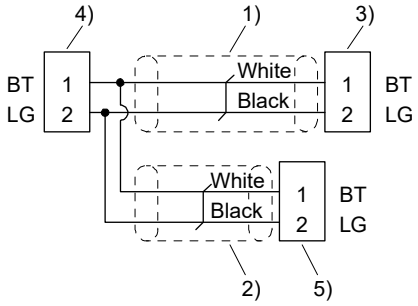
(3) MR-BT6V2CBL_M

(a) Appearance



Components	Description
1) Cable	VSVC 7/0.18 × 2C
2) Cable	
3) Connector	Housing: PAP-02V-O Contact: SPHD-001G-P0.5 (JST)
4) Connector	
5) Connector	Housing: PALR-02VF-O Contact: SPAL-001GU-P0.5 (JST)

(b) Internal wiring diagram



11.1.3 Ethernet cable

For the wiring of CC-Link IE Field Network Basic and Modbus/TCP, use a cable which meets the following standards.

Item	Description
Cable type	Category 5e or higher, (STP) straight cable
Standard	One of the following standards must be met. ・IEEE802.3 1000BASE-T ・ANSI/TIA/EIA-568-B (Higher than Category 5e)
Connector	RJ-45 connector with shield

11.2 Regenerative option

⚠CAUTION ●Do not use servo amplifiers with regenerative options other than the combinations specified below. Otherwise, it may cause a fire.

11.2.1 Combination and regenerative power

The power values in the table are resistor-generated powers and not rated powers.

Servo amplifier	Regenerative power [W]					
	Built-in regenerative resistor	MR-RB032 [40 Ω]	MR-RB12 [40 Ω]	MR-RB30 [13 Ω]	MR-RB32 [40 Ω]	(Note) MR-RB50 [13 Ω]
MR-JE-10C		30				
MR-JE-20C		30	100			
MR-JE-40C	10	30	100			
MR-JE-70C	20	30	100		300	
MR-JE-100C	20	30	100		300	
MR-JE-200C	100			300		500
MR-JE-300C	100			300		500

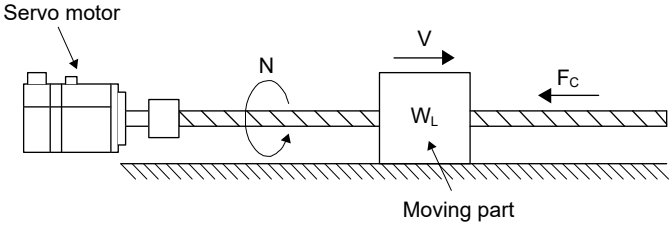
Note. Always install a cooling fan.

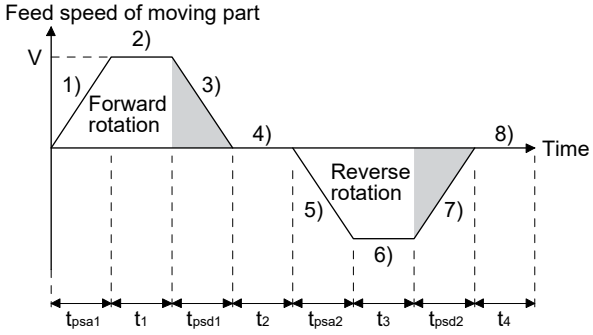
11.2.2 Selection of regenerative option

A regenerative option for a horizontal axis can be selected with the rough calculation shown in this section. To select a regenerative option precisely, use the capacity selection software.

(1) Rotary servo motor

(a) Regenerative energy calculation





V: Feed speed of moving part	[mm/min]
N: Servo motor speed (N = V/ΔS)	[r/min]
ΔS: Travel distance per servo motor revolution (ΔS = P_B)	[mm/rev]
P_B: Ball screw lead	[mm]
L_B: Ball screw length	[mm]
D_B: Ball screw diameter	[mm]
W_L: Moving part mass	[kg]
F_C: Load antidrag setting	[N]
T_L: Load torque converted into equivalent value on servo motor shaft [N•m]	[N•m]
η: Drive system efficiency	
μ: Friction coefficient	
J_L: Load moment of inertia converted into equivalent value on servo motor shaft	[kg•cm^2]
J_M: Moment of inertia of the servo motor	[kg•cm^2]
π: Pi constant	
g: Gravitational acceleration	[m/s^2]

Formulas for calculating torque and energy in operation

Regenerative power	Torque applied to servo motor [N•m] (Note 1, 2)	Energy E [J]
1)	$T_1 = \frac{(J_L/\eta + J_M) \cdot N}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psa1}} + T_L$	$E_1 = \frac{0.1047}{2} \cdot N \cdot T_1 \cdot t_{psa1}$
2)	$T_2 = T_L$	$E_2 = 0.1047 \cdot N \cdot T_2 \cdot t_1$
3)	$T_3 = \frac{-(J_L \cdot \eta + J_M) \cdot N}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psd1}} + T_L$	$E_3 = \frac{0.1047}{2} \cdot N \cdot T_3 \cdot t_{psd1}$
4), 8)	$T_4, T_8 = 0$	$E_4, E_8 = 0$ (No regeneration)
5)	$T_5 = \frac{(J_L/\eta + J_M) \cdot N}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psa2}} + T_L$	$E_5 = \frac{0.1047}{2} \cdot N \cdot T_5 \cdot t_{psa2}$
6)	$T_6 = T_L$	$E_6 = 0.1047 \cdot N \cdot T_6 \cdot t_3$
7)	$T_7 = \frac{-(J_L \cdot \eta + J_M) \cdot N}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psd2}} + T_L$	$E_7 = \frac{0.1047}{2} \cdot N \cdot T_7 \cdot t_{psd2}$

Note 1. Load torque converted into equivalent value on servo motor shaft T_L can be calculated with the following expression.

$T_L = \{(F_C + (\mu \times W_L \times g)) \times \Delta S\}/(2000 \times \pi \times \eta)$

2. Load moment of inertia converted into equivalent value on servo motor shaft J_L can be calculated with the following expression.

$J_L = J_{L1} + J_{L2} + J_{L3}$

J_{L1} is the load moment of inertia of the moving part, J_{L2} is the load moment of inertia of the ball screw, and J_{L3} is the load moment of inertia of the coupling. J_{L1} and J_{L2} can be calculated with the following expressions.

$J_{L1} = W_L \times (\Delta S/(20 \times \pi))^2$

$J_{L2} = \{(\pi \times 0.0078 \times (L_B/10))/32\} \times (D_B/10)^4$

From the calculation results in 1) to 8), find the absolute value (Es) of the sum total of negative energies.

(2) Losses of servo motor and servo amplifier in regenerative mode

The following table lists the efficiencies and other data of the servo motor and servo amplifier in the regenerative mode.

Servo amplifier	Inverse efficiency [%]	Capacitor charging [J]
MR-JE-10C	55	11
MR-JE-20C	75	11
MR-JE-40C	85	14
MR-JE-70C	85	25

Servo amplifier	Inverse efficiency [%]	Capacitor charging [J]
MR-JE-100C	85	25
MR-JE-200C	85	42
MR-JE-300C	85	42

Inverse efficiency (η_m): Efficiency including some efficiencies of the servo motor and servo amplifier when rated (regenerative) torque is generated at rated speed. Efficiency varies with the speed and generated torque. Since the characteristics of the electrolytic capacitor change with time, allow for approximately 10% higher inverse efficiency.

Capacitor charging (Ec): Energy charged into the electrolytic capacitor in the servo amplifier

Subtract the capacitor charging from the result of multiplying the sum total of regenerative energies by the inverse efficiency to calculate the energy consumed by the regenerative option.

$ER\ [J] = \eta_m \cdot Es - Ec$

Select a necessary regenerative option by calculating the power consumption of the regenerative option on the basis of one-cycle operation period tf [s].

PR [W] = ER/tf

11.2.3 Parameter setting

Set [Pr. PA02] according to the option to be used.

[Pr. PA02]

0	0		

Regenerative option selection
00: Regenerative option is not used.
- For servo amplifier of 200 W or less, regenerative resistor is not used.
- For servo amplifier of 0.4 kW to 3 kW, built-in regenerative resistor is used.

02: MR-RB032
03: MR-RB12
04: MR-RB32
05: MR-RB30 (Note)
06: MR-RB50 (Cooling fan is required.) (Note)

Note. This is used with servo amplifiers with software version A3 or later.

11.2.4 Connection of regenerative option

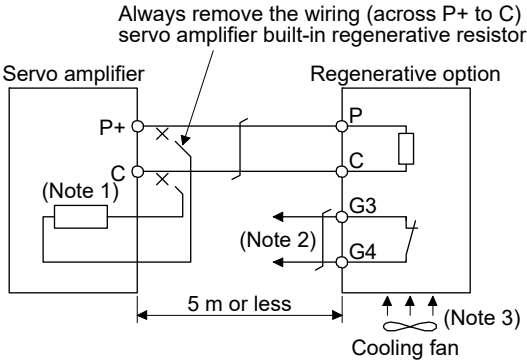
POINT

- When you use a regenerative option with an MR-JE-40C to MR-JE-100C, remove the built-in regenerative resistor and wiring from the servo amplifier.
- When MR-RB50 is used, a cooling fan is required to cool it. The cooling fan should be prepared by the customer.
- For the wire sizes used for wiring, refer to section 11.6.
- A built-in regenerative resistor should not be mounted/removed frequently.
- When you remount a built-in regenerative resistor, check the lead wires of the built-in regenerative resistor for scratches or cracks.

The regenerative option generates heat of 100 °C higher than the ambient temperature. Fully consider heat dissipation, installation position, wires used, etc. before installing the option. For wiring, use flame-resistant wires or make the wires flame-resistant and keep them away from the regenerative option. Use twisted wires with a maximum length of 5 m for a connection with the servo amplifier.

(1) MR-JE-100C or less

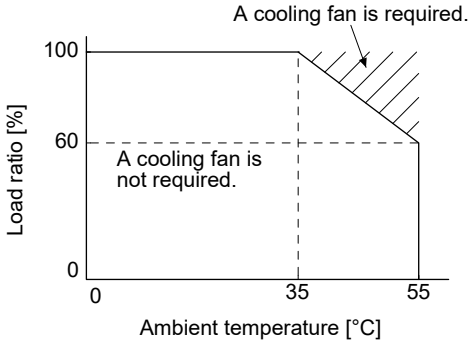
When you use a regenerative option for MR-JE-40C to MR-JE-100C, remove wirings of P+ and C, remove the built-in regenerative resistor, and then connect the regenerative option between P+ and C. G3 and G4 are terminals for thermal sensor. Between G3 and G4 is opened when the regenerative option overheats abnormally.



Note 1. The built-in regenerative resistor is not provided for MR-JE-10C and MR-JE-20C.

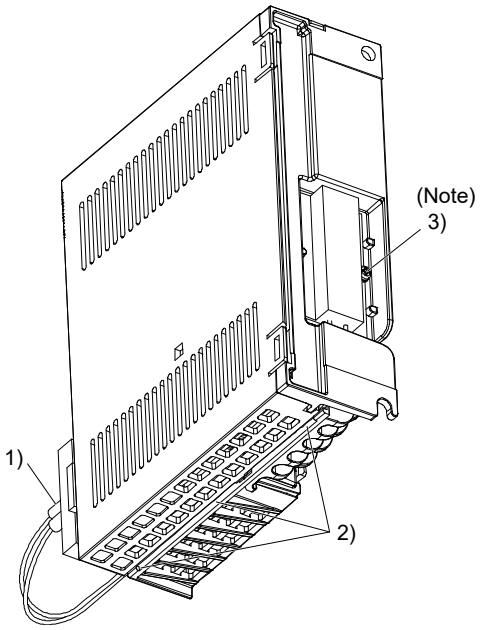
2. Make up a sequence which will switch off the magnetic contactor when abnormal heating occurs.
   G3-G4 contact specifications
   Maximum voltage: 120 V AC/DC
   Maximum current: 0.5 A/4.8 V DC
   Maximum capacity: 2.4 VA

3. When the ambient temperature is more than 55 °C and the regenerative load ratio is more than 60% in MR-RB32, forcefully cool the air with a cooling fan (1.0 m^3/min or more, 92 mm × 92 mm). A cooling fan is not required if the ambient temperature is 35 °C or less. (A cooling fan is required for the shaded area in the following graph.)



To remove the built-in regenerative resistor mounted on the back of MR-JE-40C to MR-JE-100C, follow the procedures 1) to 3) with referring to the illustration.

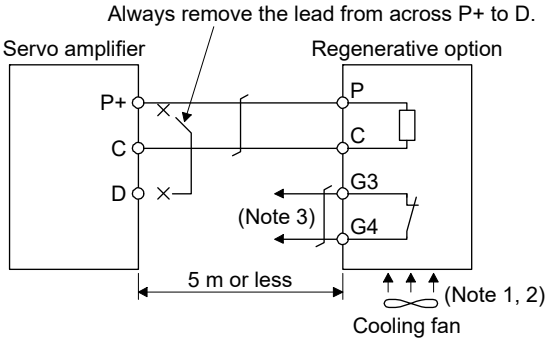
1) Disconnect the wirings of the built-in regenerative resistor from the power connector (CNP1). (Refer to (3) (b) of 3.3.2.)
2) Remove the wirings of the built-in regenerative resistor from the closest position to the power connector (CNP1) in order. Please pay full attention not to break the wirings.
3) Remove the screw fixing the built-in regenerative resistor and dismount the built-in regenerative resistor.



Note. Screw size: M3
Tightening torque: 0.72 [N•m]

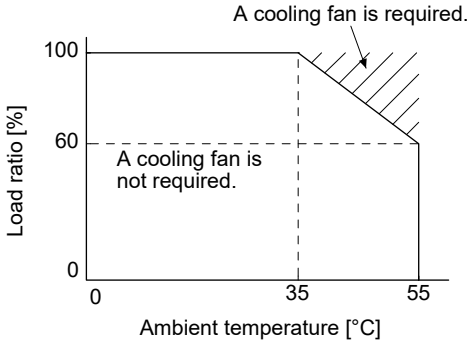
(2) MR-JE-200C or more

Always remove the wiring from across P+ to D and fit the regenerative option across P+ to C. G3 and G4 are terminals for thermal sensor. Between G3 and G4 is opened when the regenerative option overheats abnormally.



Note 1. When using the MR-RB50, forcibly cool it with a cooling fan (1.0 m^3/min or more, 92 mm × 92 mm).

2. When the ambient temperature is more than 55 °C and the regenerative load ratio is more than 60% in MR-RB30, forcefully cool the air with a cooling fan (1.0 m^3/min or more, 92 mm × 92 mm). A cooling fan is not required if the ambient temperature is 35 °C or less. (A cooling fan is required for the shaded area in the following graph.)



3. Make up a sequence which will switch off the magnetic contactor when abnormal heating occurs.

G3-G4 contact specifications

Maximum voltage: 120 V AC/DC

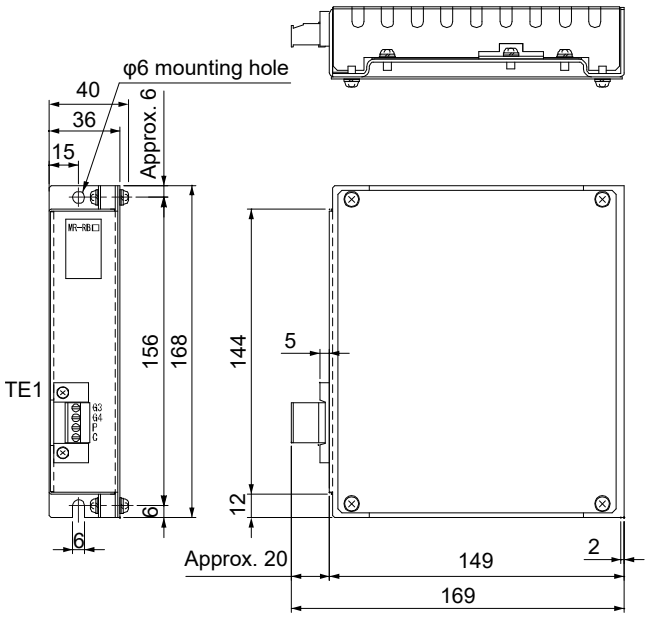
Maximum current: 0.5 A/4.8 V DC

Maximum capacity: 2.4 VA

11.2.5 Dimensions

(1) MR-RB12

[Unit: mm]



- TE1 terminal

G3
G4
P
C

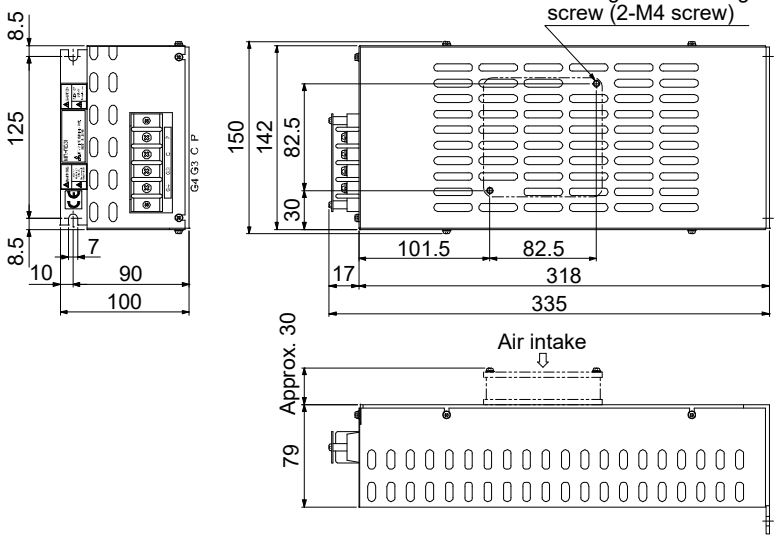
Applicable wire size: 0.2 mm² to 2.5 mm² (AWG 24 to 12)
Tightening torque: 0.5 to 0.6 [N•m]

- Mounting screw
  Screw size: M5
  Tightening torque: 3.24 [N•m]

Mass: 1.1 [kg]

(2) MR-RB30/MR-RB32

[Unit: mm]



- Terminal

P
C
G3
G4

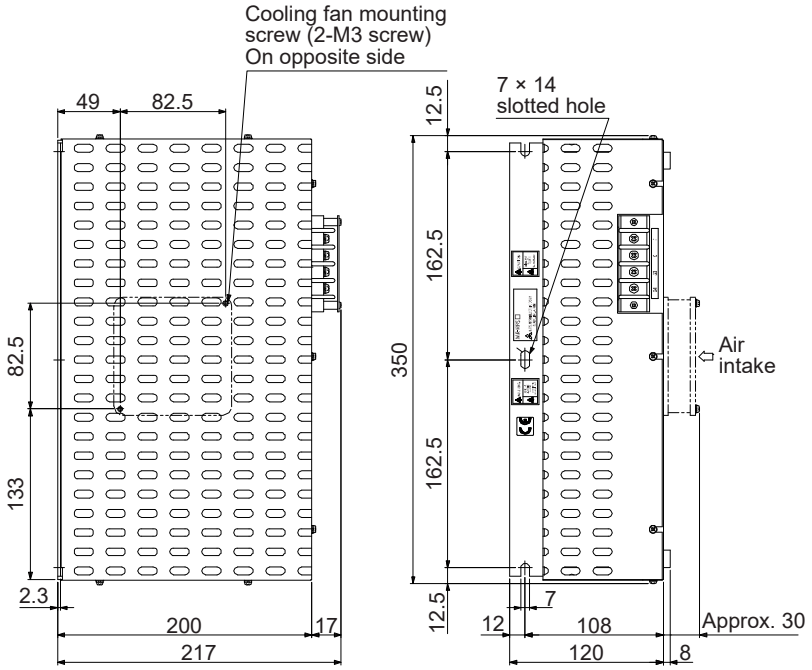
Screw size: M4
Tightening torque: 1.2 [N•m]

- Mounting screw
  Screw size: M6
  Tightening torque: 5.4 [N•m]

Mass: 2.9 [kg]

(3) MR-RB50

[Unit: mm]



- Terminal block

P
C
G3
G4

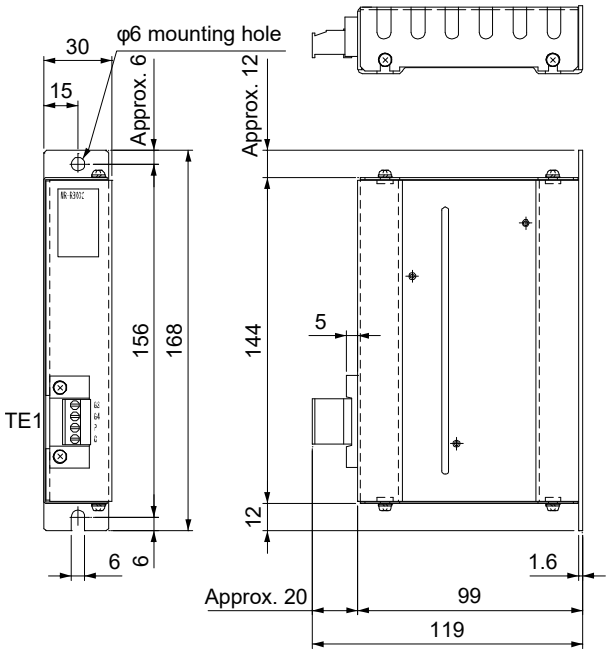
Screw size: M4
Tightening torque: 1.2 [N•m]

- Mounting screw
Screw size: M6
Tightening torque: 5.4 [N•m]

Mass: 5.6 [kg]

(4) MR-RB032

[Unit: mm]



- TE1 terminal

G3
G4
P
C

Applicable wire size: 0.2 mm² to 2.5 mm² (AWG 24 to 12)
Tightening torque: 0.5 to 0.6 [N•m]

- Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]

Mass: 0.5 [kg]

11.3 Junction terminal block MR-TB26A

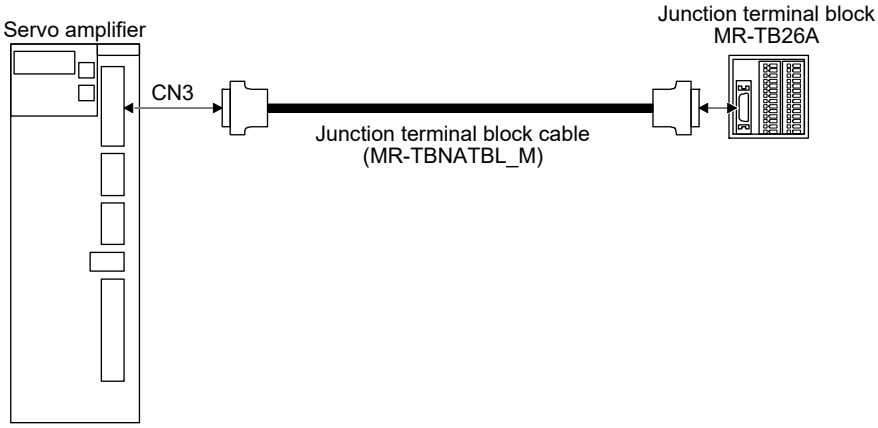
(1) Usage

Always use the junction terminal block (MR-TB26A) with the option cable (MR-TBNATBL_M) as a set. To use a junction terminal block, mount it to the DIN rail.

M R - T B N A T B L 0 5 M

Cable length
05: 0.5 m
1: 1 m

Terminal numbers on a junction terminal block correspond with the pin numbers on the CN3 connector of a servo amplifier. The terminal symbol S is for the shield.



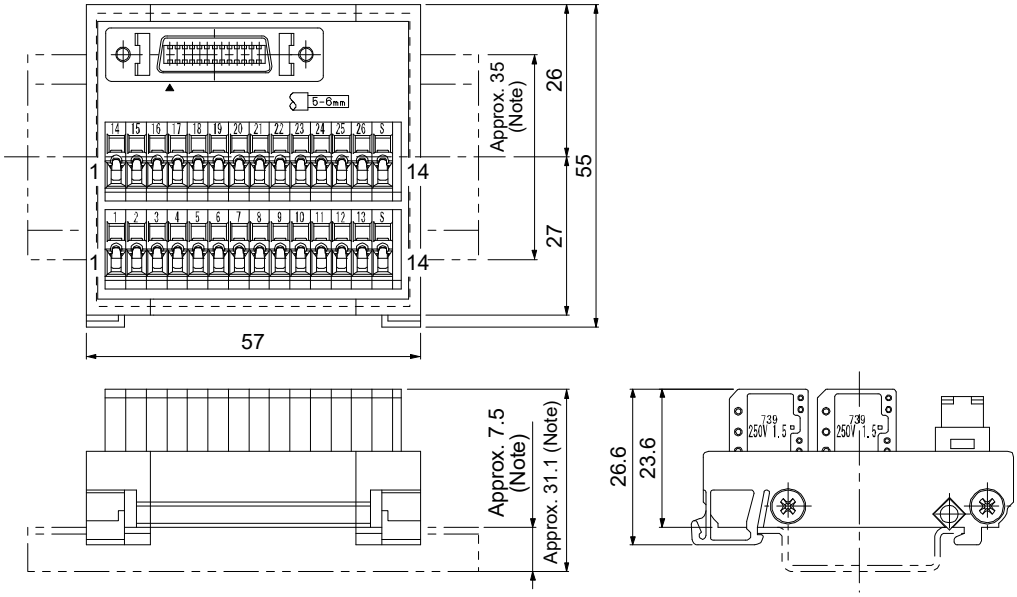
Ground the junction terminal block cable using the S terminal of the junction terminal block.

(2) Specifications

Item \ Junction terminal block		MR-TB26A
Rating		32 V AC/DC 0.5 A
Usable cables	Stranded wire	0.08 mm^2 to 1.5 mm^2 (AWG 28 to 14)
	Solid wire	φ0.32 mm to 1.2 mm
	Wire insulator OD	φ3.4 mm or less
Tool		210-619 (WAGO) or equivalent 210-119SB (WAGO) or equivalent
Stripped length		5 mm to 6 mm

(3) Dimensions

[Unit: mm]



Note. Values in parenthesis are the sizes when installed with a 35 mm DIN rail.

11.4 MR Configurator2

POINT

- To ensure safety of the system against unauthorized access via a network, take security measures such as using a firewall.
- For the MR-JE servo amplifier, use MR Configurator2 with software version 1.63R or later.
- For connection with an Ethernet port, an IP address setting is required. For details, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".
- When writing parameters or performing test operations through Ethernet, make the setting so that the IP address of the personal computer is within the range of the operation specification IP address.

MR Configurator2 (SW1DNC-MRC2-_) uses the communication function of the servo amplifier to perform parameter setting changes, graph display, test operation, etc. on a personal computer.

11.4.1 Specifications

Item	Description
Project	Create/read/save/delete project, system setting, and print
Parameter	Parameter setting
Positioning-data	Point table (Note)
Monitor	Display all, I/O monitor, graph, and ABS data display
Diagnosis	Alarm display, alarm onset data, drive recorder, no motor rotation, system configuration, life diagnosis, and machine diagnosis
Test operation	Jog operation, positioning operation, motor-less operation, DO forced output, single-step feed (Note), program operation, and test mode information
Adjustment	One-touch tuning, tuning, and machine analyzer
Others	Servo assistant, parameter setting range update, switch display language, and help display

Note. It can be used on servo amplifiers with software version A4 or later and on MR Configurator2 with software version 1.72A or later.

11.4.2 System requirements

(1) Configuration diagram

To use this software, the following components are required in addition to the servo amplifier and servo motor.

Equipment	Description	
(Note 1, 2, 3, 4, 5) Personal computer	OS	Microsoft® Windows® 10 Home Microsoft® Windows® 10 Pro Microsoft® Windows® 10 Enterprise Microsoft® Windows® 10 Education Microsoft® Windows® 8.1 Enterprise Microsoft® Windows® 8.1 Pro Microsoft® Windows® 8.1 Microsoft® Windows® 8 Enterprise Microsoft® Windows® 8 Pro Microsoft® Windows® 8 Microsoft® Windows® 7 Enterprise Microsoft® Windows® 7 Ultimate Microsoft® Windows® 7 Professional Microsoft® Windows® 7 Home Premium Microsoft® Windows® 7 Starter Microsoft® Windows Vista® Enterprise Microsoft® Windows Vista® Ultimate Microsoft® Windows Vista® Business Microsoft® Windows Vista® Home Premium Microsoft® Windows Vista® Home Basic Microsoft® Windows® XP Professional, Service Pack3 or later Microsoft® Windows® XP Home Edition, Service Pack3 or later
	CPU (recommended)	Desktop personal computer: Intel® Celeron® processor 2.8 GHz or more Laptop personal computer: Intel® Pentium® M processor 1.7 GHz or more
	Memory (recommended)	512 MB or more (for 32-bit OS), 1 GB or more (for 64-bit OS)
	Free space on the hard disk:	1 GB or more
	Communication interface	USB port or Ethernet port
Browser	Windows® Internet Explorer® 4.0 or more	
Display	One whose resolution is 1024 × 768 or more and that can provide a high color (16 bit) display. Connectable with the above personal computer.	
Keyboard	Connectable with the above personal computer.	
Mouse	Connectable with the above personal computer.	
Printer	Connectable with the above personal computer.	
USB cable	MR-J3USBCBL3M	
Ethernet cable	Refer to section 11.1.3.	

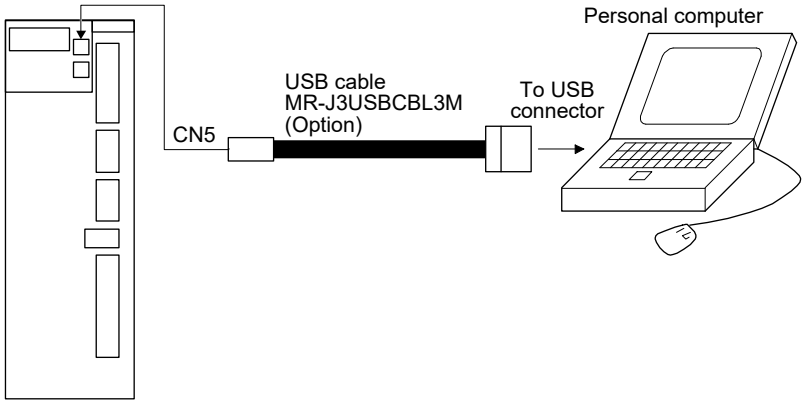
Note 1. On some personal computers, MR Configurator2 may not run properly.

2. The following functions cannot be used.
   - Windows Program Compatibility mode
   - Fast User Switching
   - Remote Desktop
   - Large Fonts Mode (Display property)
   - DPI settings other than 96 DPI (Display property)

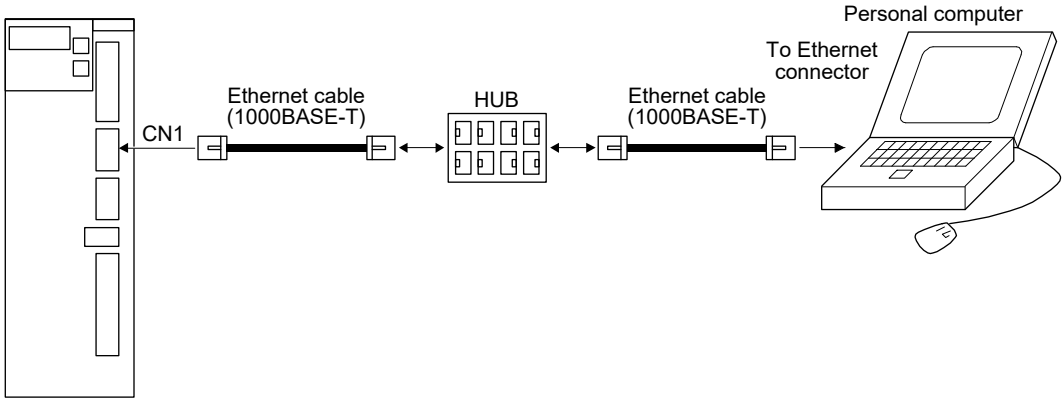
   For 64-bit operating system, this software is compatible with Windows® 7 and Windows® 8.
3. When Windows® 7 or later is used, the following functions cannot be used.
   - Windows XP Mode
   - Windows touch
4. When using this software with Windows Vista® or later, log in as a user having USER authority or higher.
5. When Windows® 8 or later is used, the following functions cannot be used.
   - Hyper-V
   - Modern UI style

(2) Connection with servo amplifier

(a) By USB cable



(b) By Ethernet cable



11.4.3 Precautions for using USB and Ethernet communication functions

Note the following to prevent an electric shock and malfunction of the servo amplifier.

(1) Power connection of personal computers
Connect your personal computer with the following procedures.

(a) When you use a personal computer with AC power supply

1) When using a personal computer with a three-core power plug or power plug with grounding wire, use a three-pin socket or ground the grounding wire.

2) When your personal computer has two-core plug and has no grounding wire, connect the personal computer to the servo amplifier with the following procedures.

a) Disconnect the power plug of the personal computer from an AC power socket.

b) Check that the power plug was disconnected and connect the device to the servo amplifier.

c) Connect the power plug of the personal computer to the AC power socket.

(b) When you use a personal computer with battery
You can use as it is.

(2) Connection with other devices using servo amplifier communication function
When the servo amplifier is charged with electricity due to connection with a personal computer and the charged servo amplifier is connected with other devices, the servo amplifier or the connected devices may malfunction. Connect the servo amplifier and other devices with the following procedures.

(a) Shut off the power of the device for connecting with the servo amplifier.

(b) Shut off the power of the servo amplifier which was connected with the personal computer and check the charge lamp is off.

(c) Connect the device with the servo amplifier.

(d) Turn on the power of the servo amplifier and the device.

11.5 Battery

POINT
●Refer to app. 1 and 2 for battery transportation and the new EU Battery Directive.

The battery is used to construct an absolute position detection system. For construction of an absolute position detection system, refer to chapter 12.

11.5.1 Selection of battery

Applicable batteries differ depending on servo amplifiers. Select a proper battery.

(1) Applications of the batteries

Model	Name	Application	Built-in battery
MR-BAT6V1SET-A	Battery	For absolute position data-hold	MR-BAT6V1
MR-BT6VCASE	Battery case	For absolute position data-hold for multiple-axis servo motors	MR-BAT6V1

(2) Combination of battery and servo amplifier

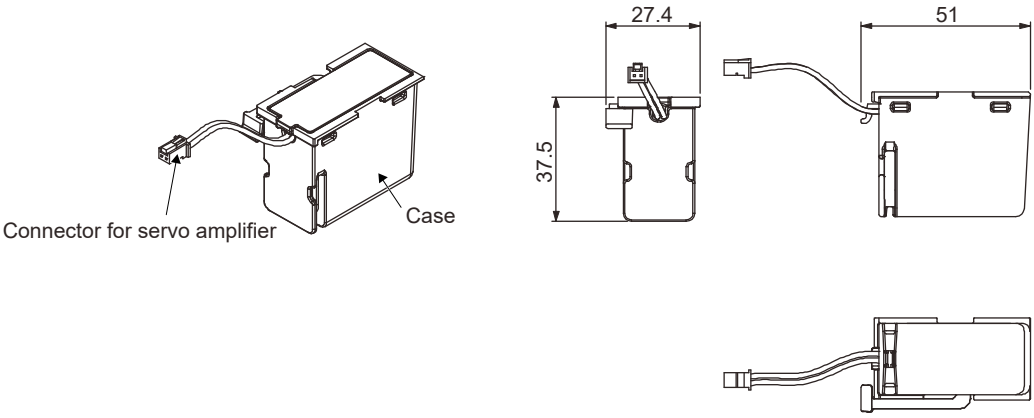
Model	MR-JE-_C
MR-BAT6V1SET-A	○
MR-BT6VCASE	○

11.5.2 MR-BAT6V1SET-A battery

POINT
●For the specifications and the year and month of manufacture of the built-in MR-BAT6V1 battery, refer to section 11.5.4.

(1) Parts identification and dimensions

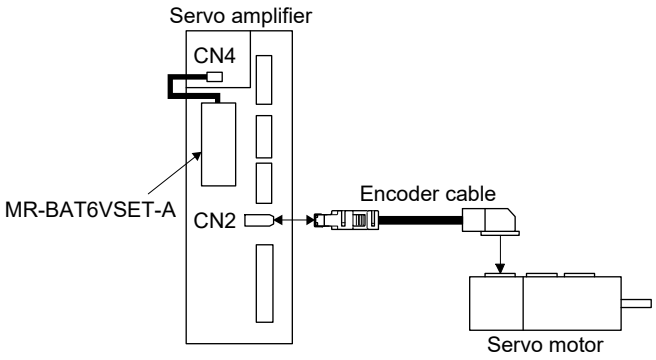
[Unit: mm]



Mass: 55 [g] (including MR-BAT6V1 battery)

(2) Battery connection

Connect a battery as follows.



(3) Battery replacement procedure

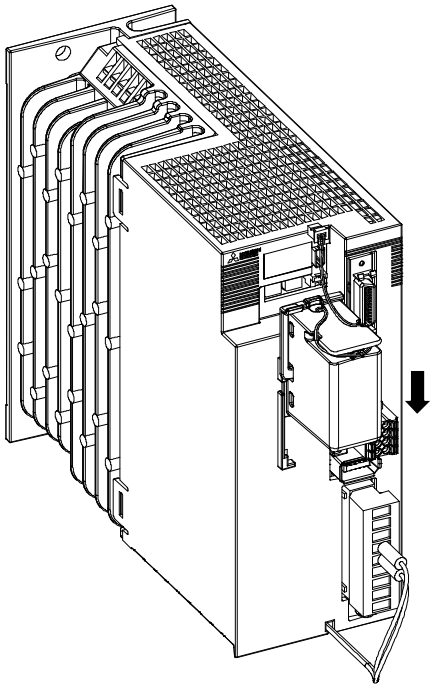
⚠WARNING	●Before replacing a battery, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION	●The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions. ・Ground human body and work bench. ・Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

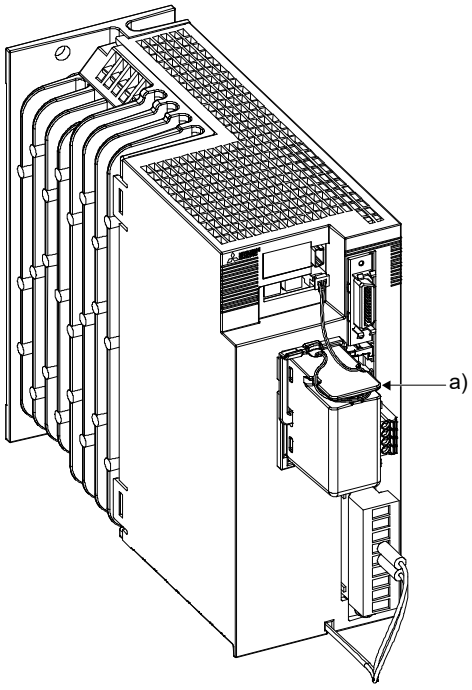
POINT

●Replacing a battery will erase the absolute position data.
●Before replacing batteries, check that the new battery is within battery life.

(a) Mounting method

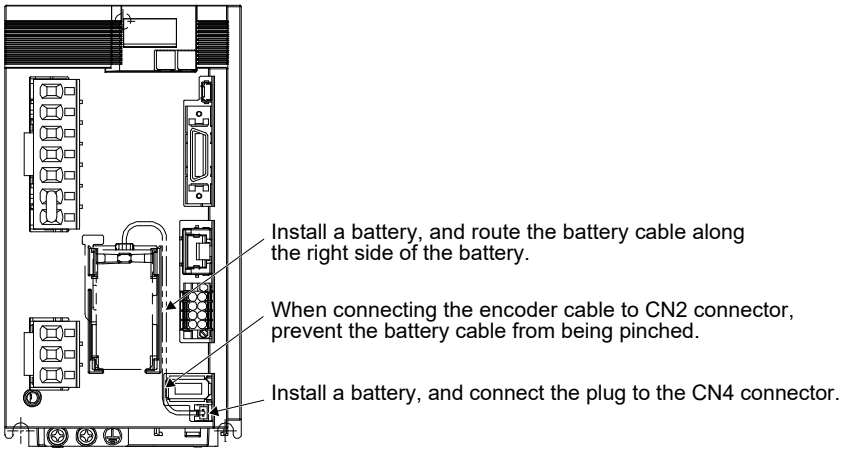


Pull down the battery along the rail.



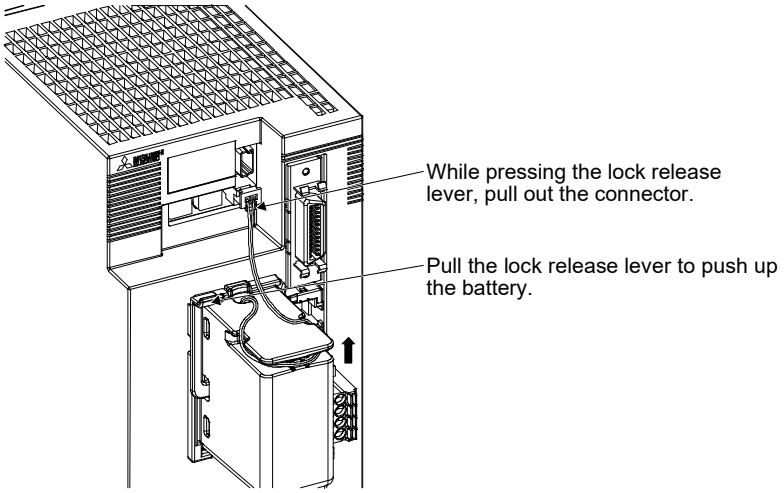
Wrap the excess wire around a) of the battery.

For MR-JE-200C or more, connect the battery cable as follows.



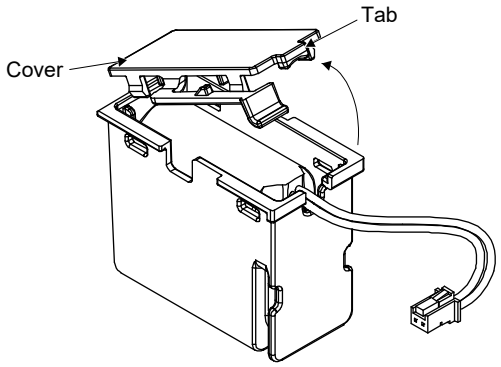
(b) Removal procedure

⚠CAUTION	●Pulling out the connector of the battery without the lock release lever pressed may damage the CN4 connector of the servo amplifier or the connector of the battery.

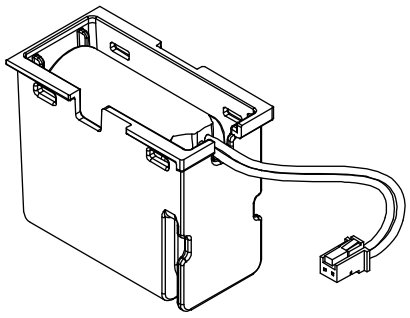


(4) Replacement procedure of the built-in battery

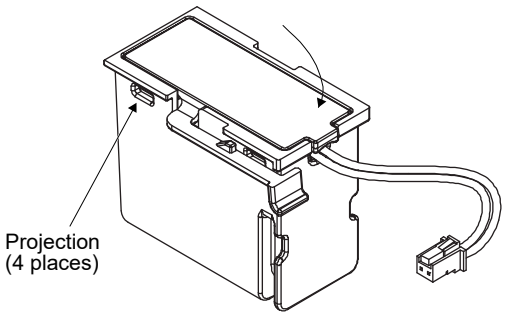
When the MR-BAT6V1SET-A reaches the end of its life, replace the MR-BAT6V1 battery in the MR-BAT6V1SET-A.



1) Hold the tab and open the cover.



2) Replace the battery with a new MR-BAT6V1 battery.



3) Press the cover until it is fixed with the projection of the locking part to close the cover.

11.5.3 MR-BT6VCASE battery case

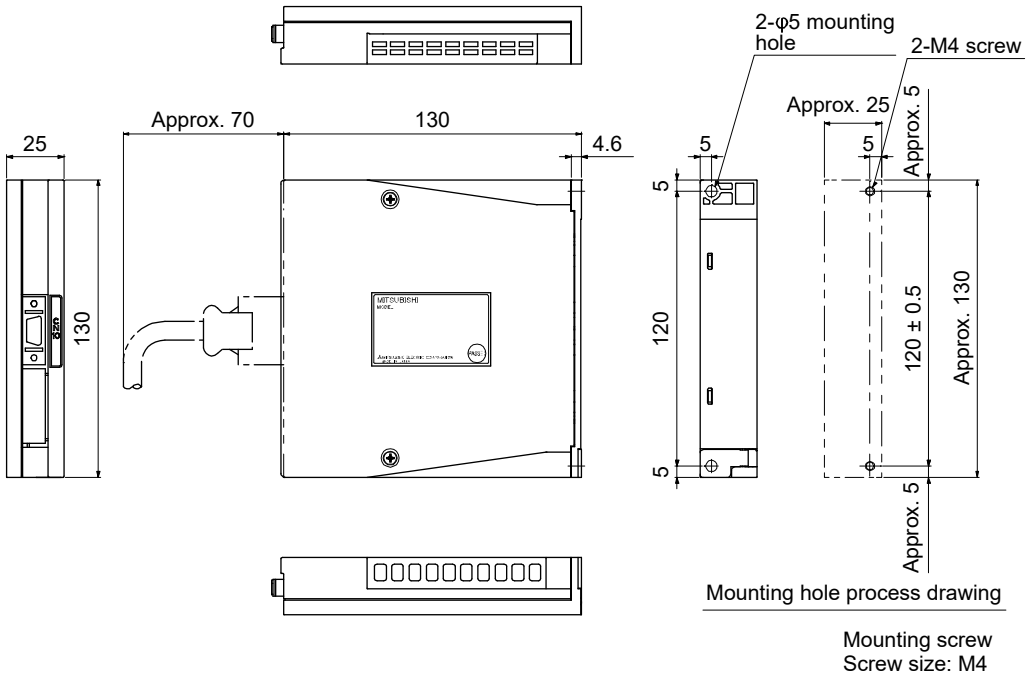
POINT
●The battery unit consists of an MR-BT6VCASE battery case and five MR-BAT6V1 batteries. ●For the specifications and the year and month of manufacture of the MR-BAT6V1 battery, refer to section 11.5.4.

MR-BT6VCASE is a case used for connecting and mounting five MR-BAT6V1 batteries. No battery is included in the battery case. Prepare MR-BAT6V1 batteries separately.

(1) Number of connectable servo motors
One MR-BT6VCASE case can hold the absolute position data of up to 8-axis servo motors. Servo motors in an incremental system are included as the axis numbers.

(2) Dimensions

[Unit: mm]

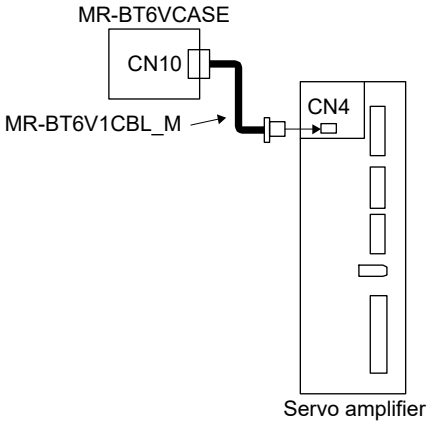


[Mass: 0.18 kg]

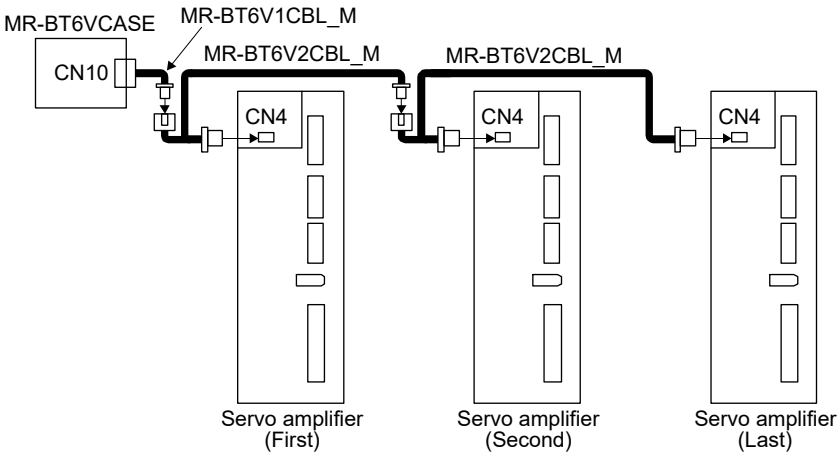
(3) Battery connection

POINT
●One battery unit can be connected to up to 8-axis servo motors. Servo motors in an incremental system are included as the axis numbers.

(a) When using 1-axis servo amplifier



(b) When using up to 8-axis servo amplifiers



(4) Battery replacement procedure

⚠WARNING	●Before replacing a battery, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION	●The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions. ・Ground human body and work bench. ・Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

POINT
●Replacing a battery will erase the absolute position data. ●Before replacing batteries, check that the new battery is within battery life.

(a) Assembly of the battery unit

⚠CAUTION
- Do not mount new and old batteries together.
- When you change a battery, change all batteries at the same time.

POINT
- Always mount five MR-BAT6V1 batteries to the MR-BT6VCASE battery case.

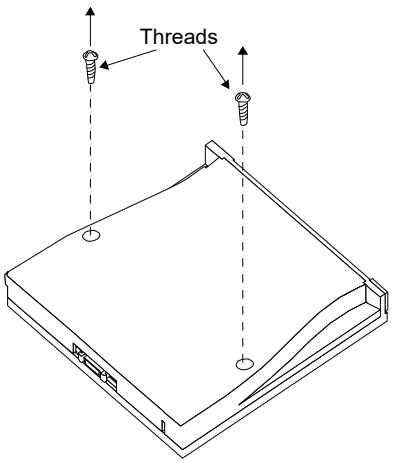
1) Things to be prepared

Product name	Model	Quantity	Remark
Battery case	MR-BT6VCASE	1	MR-BT6VCASE is a case used for connecting and mounting five MR-BAT6V1 batteries.
Battery	MR-BAT6V1	5	Lithium battery (primary battery, nominal + 6 V)

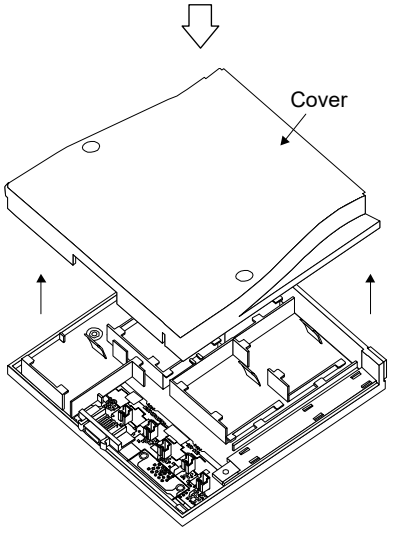
2) Disassembly and assembly of the battery case MR-BT6VCASE

a) Disassembly of the case

MR-BT6VCASE is shipped assembled. To mount MR-BAT6V1 batteries, the case needs to be disassembled.

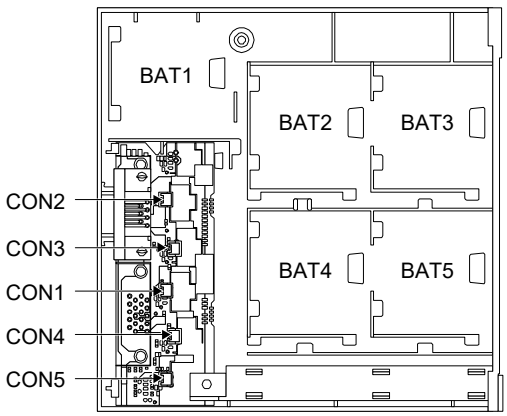


Remove the two screws using a Phillips head screwdriver.

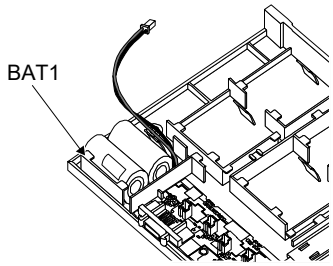


Remove the cover.

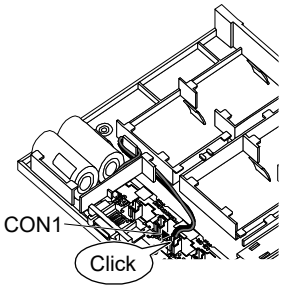
Parts identification



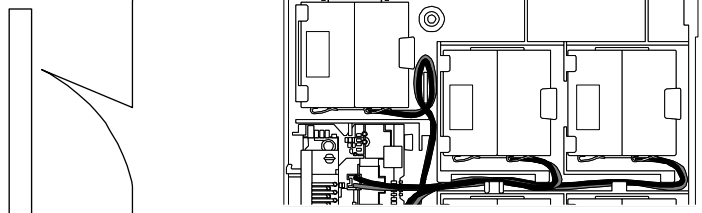
b) Mounting MR-BAT6V1



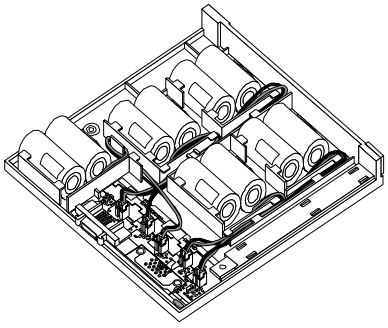
Securely mount an MR-BAT6V1 to the BAT1 holder.



Insert the MR-BAT6V1 connector mounted on the BAT1 holder to CON1.
Confirm the click sound at this point.
The connector has to be connected in the right direction.
If the connector is pushed forcefully in the incorrect direction, the connector will break.
Place the MR-BAT6V1 lead wire to the duct designed to store lead wires.
Insert MR-BAT6V1 to the holder in the same procedure in the order from BAT2 to BAT5.

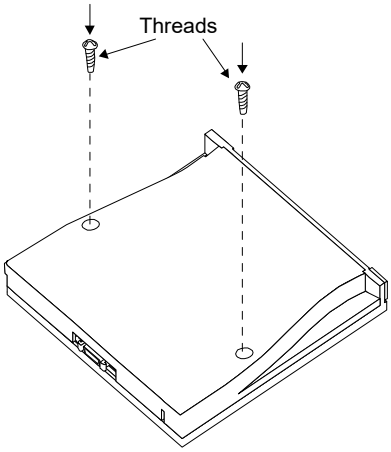


Bring out the lead wire from the space between the ribs, and bend it as shown above to store it in the duct. Connect the lead wire to the connector. Be careful not to get the lead wire caught in the case or other parts.
When the lead wire is damaged, external short circuit may occur, and the battery can become hot.



c) Assembly of the case
After all MR-BAT6V1 batteries are mounted, fit the cover and insert screws into the two holes and tighten them. Tightening torque is 0.71 N•m.

POINT
●When assembling the case, be careful not to get the lead wires caught in the fitting parts or the screwing parts.



d) Precautions for removal of battery
The connector attached to the MR-BAT6V1 battery has the lock release lever. When removing the connector, pull out the connector while pressing the lock release lever.

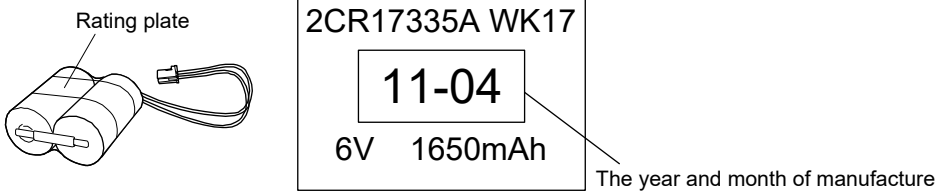
3) Battery cable removal

⚠CAUTION	●Pulling out the connector of the MR-BT6V1CBL and MR-BT6V2CBL without the lock release lever pressed may damage the CN4 connector of the servo amplifier or the connector of the MR-BT6V1CBL or MR-BT6V2CBL.

Pull out the connector in the same procedure as that of the MR-BAT6V1SET-A. Refer to section 11.5.2 (3) (b).

11.5.4 MR-BAT6V1 battery

The MR-BAT6V1 battery is a lithium primary battery for replacing MR-BAT6V1SET-A and a primary lithium battery built-in MR-BT6VCASE. Always store the MR-BAT6V1 in a case when using it.
The year and month of manufacture of the MR-BAT6V1 battery are described on the rating plate put on an MR-BAT6V1 battery.



Item	Description
Battery pack	2CR17335A (CR17335A × 2 pcs. in series)
Nominal voltage [V]	6
Nominal capacity [mAh]	1650
Storage temperature [°C]	0 to 55
Operating temperature [°C]	0 to 55
Lithium content [g]	1.2
Mercury content	Less than 1 ppm
Dangerous goods class	Not subject to the dangerous goods (Class 9) Refer to app. 1 for details.
Operating humidity and storage humidity	5 %RH to 90 %RH (non-condensing)
(Note) Battery life	5 years from date of manufacture
Mass [g]	34

Note. Quality of the batteries degrades by the storage condition. The battery life is 5 years from the production date regardless of the connection status.

11.6 Selection example of wires

POINT

●To comply with the IEC/EN/UL/CSA standard, use the wires shown in app. 3 for wiring. To comply with other standards, use a wire that is complied with each standard.

●Selection conditions of wire size are as follows.

Construction condition: Single wire set in midair

Wiring length: 30 m or shorter

The following diagram shows the wires used for wiring. Use the wires given in this section or equivalent.

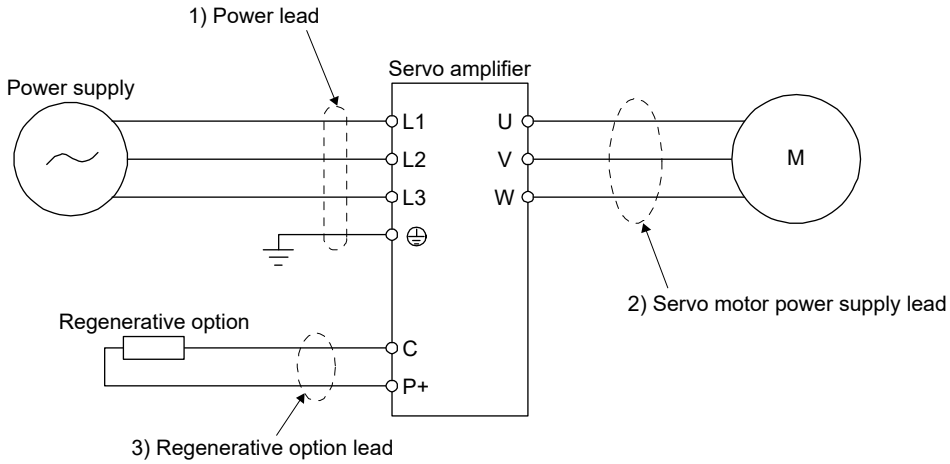


Table 11.1 shows examples for using the 600 V Grade heat-resistant polyvinyl chloride insulated wire (HIV wire).

Table 11.1 Wire size selection example (HIV wire)

Servo amplifier	Wire [mm^2]		
	1) L1/L2/L3/⏚	3) P+/C	2) U/V/W/⏚ (Note 1)
MR-JE-10C	2 (AWG 14)	2 (AWG 14)	AWG 18 to 14 (Note 2)
MR-JE-20C			
MR-JE-40C			
MR-JE-70C			
MR-JE-100C			
MR-JE-200C (3-phase power supply input)			AWG 16 to 10
MR-JE-200C (1-phase power supply input)	3.5 (AWG 12)		
MR-JE-300C	2 (AWG 14)		

Note 1. The wire size shows applicable size of the servo amplifier connector. For wires connecting to the servo motor, refer to "HG-KN/HG-SN Servo Motor Instruction Manual".

2. Be sure to use the size of 2 mm^2 when corresponding to IEC/EN/UL/CSA standard.

11.7 Molded-case circuit breakers, fuses, magnetic contactors

> **⚠CAUTION**
> - To prevent the servo amplifier from smoke and a fire, select a molded-case circuit breaker which shuts off with high speed.
> - Always use one molded-case circuit breaker and one magnetic contactor with one servo amplifier.

When using a fuse instead of the molded-case circuit breaker, use the one having the specifications given in this section.

Servo amplifier	Molded-case circuit breaker (Note 1, 4)			Fuse			Magnetic contactor (Note 2)
	Frame, rated current		Voltage AC [V]	Class	Current [A]	Voltage AC [V]	
	Power factor improving reactor is not used	Power factor improving reactor is used					
MR-JE-10C	30 A frame 5 A	30 A frame 5 A	240	T	10	300	S-N10 S-T10
MR-JE-20C							
MR-JE-40C	30 A frame 10 A	30 A frame 5 A			15		
MR-JE-70C	30 A frame 15 A	30 A frame 10 A			20		
MR-JE-100C (3-phase power supply input)							
MR-JE-100C (1-phase power supply input)	30 A frame 15 A	30 A frame 15 A			30		
MR-JE-200C	30 A frame 20 A	30 A frame 20 A			40		S-N20 (Note 3) S-T21
MR-JE-300C	30 A frame 30 A	30 A frame 30 A			70		S-N20 S-T21

Note 1. When having the servo amplifier comply with the IEC/EN/UL/CSA standard, refer to app. 3.
2. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
3. S-N18 can be used when auxiliary contact is not required.
4. Use a molded-case circuit breaker having the operation characteristics equal to or higher than Mitsubishi Electric general-purpose products.

The Type E Combination motor controller can also be used instead of a molded-case circuit breaker.

Servo amplifier	Rated input voltage AC [V]	Input phase	Type E Combination motor controller			SCCR [kA]
			Model	Rated voltage AC [V]	Rated current [A] (Heater design)	
MR-JE-10C	200 to 240	3-phase	MMP-T32	240	1.6	50
MR-JE-20C					2.5	
MR-JE-40C					4	
MR-JE-70C					6.3	
MR-JE-100C					8	
MR-JE-200C					18	
MR-JE-300C					25	25

11.8 Power factor improving AC reactor

(1) Advantages

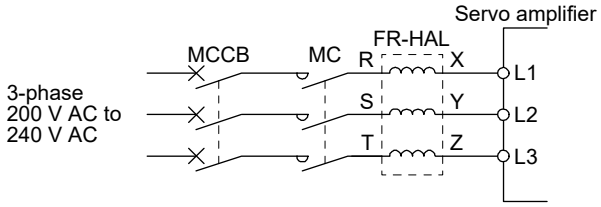
- It improves the power factor by increasing the form factor of the servo amplifier's input current.
- It decreases the power supply capacity.
- The input power factor is improved to about 80%.

(2) Restrictions

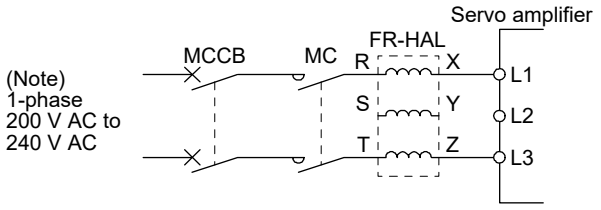
When using power factor improving reactors for two servo amplifiers or more, be sure to connect a power factor improving reactor to each servo amplifier. If using only one power factor improving reactor, enough improvement effect of phase factor cannot be obtained unless all servo amplifiers are operated.

(3) Connection example

(a) When using 3-phase 200 V AC to 240 V AC power supply

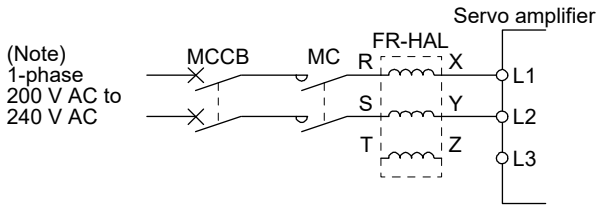


(b) When using 1-phase 200 V AC to 240 V AC power supply for MR-JE-10C to MR-JE-100C



Note. Connect the power supply to L1 and L3. Leave L2 open.

(c) When using 1-phase 200 V AC to 240 V AC power supply for MR-JE-200C



Note. Connect the power supply to L1 and L2. Leave L3 open.

(4) Dimensions

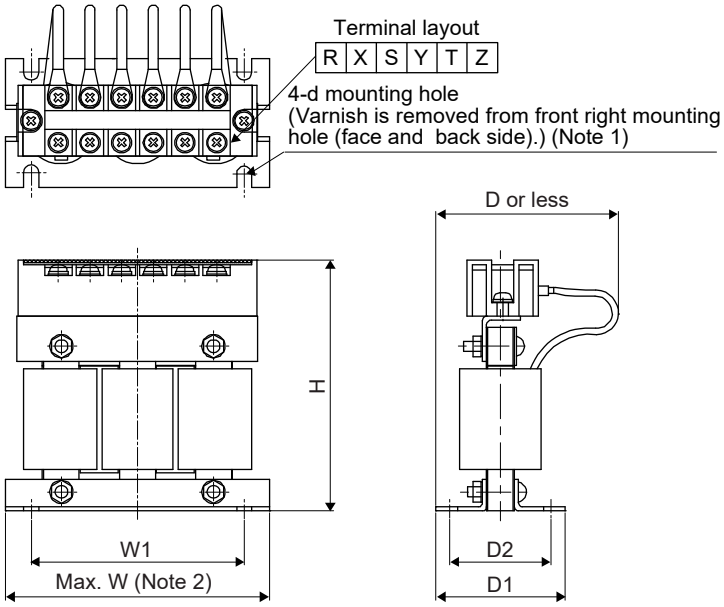


Fig. 11.1

Servo amplifier	Power factor improving AC reactor	Dimensions	Dimensions [mm]							Terminal size	Mass [kg]
			W	W1	H	D (Note 3)	D1	D2	d		
MR-JE-10C, MR-JE-20C	FR-HAL-0.4K	Fig. 11.1	104	84	99	72	51	40	M5	M4	0.6
MR-JE-40C	FR-HAL-0.75K		104	84	99	74	56	44	M5	M4	0.8
MR-JE-70C	FR-HAL-1.5K		104	84	99	77	61	50	M5	M4	1.1
MR-JE-100C (3-phase power supply input)	FR-HAL-2.2K		115 (Note 3)	40	115	77	71	57	M6	M4	1.5
MR-JE-100C (1-phase power supply input) MR-JE-200C (3-phase power supply input)	FR-HAL-3.7K		115 (Note 3)	40	115	83	81	67	M6	M4	2.2
MR-JE-200C (1-phase power supply input) MR-JE-300C	FR-HAL-5.5K		115 (Note 3)	40	115	83	81	67	M6	M4	2.3

Note 1. Use this for grounding.
2. W ± 2 is applicable for FR-HAL-0.4K to FR-HAL-1.5K.
3. Maximum dimensions. The dimension varies depending on the input/output lines.

11.9 Relay (recommended)

The following relays should be used with the interfaces.

Interface	Selection example
Digital input (interface DI-1) Relay used for digital input command signals	To prevent defective contacts, use a relay for small signal (twin contacts). (Ex.) Omron: type G2A, type MY
Digital output (interface DO-1) Relay used for digital output signals	Small relay with 12 V DC or 24 V DC of rated current 40 mA or less (Ex.) Omron: type MY

11.10 Noise reduction techniques

Noises are classified into external noises which enter the servo amplifier to cause it to malfunction and those radiated by the servo amplifier to cause peripheral equipment to malfunction. Since the servo amplifier is an electronic device which handles small signals, the following general noise reduction techniques are required. Also, the servo amplifier can be a source of noise as its outputs are chopped by high carrier frequencies. If peripheral equipment malfunctions due to noises produced by the servo amplifier, take measures to suppress the noises. The measures will vary slightly with the routes of noise transmission.

(1) Noise reduction techniques

(a) General reduction techniques

- Avoid bundling power lines (input/output) and signal cables together or running them in parallel to each other. Separate the power lines from the signal cables.
- Use a shielded twisted pair cable for connection with the encoder and for control signal transmission, and connect the external conductor of the cable to the SD terminal.
- Ground the servo amplifier, servo motor, etc. together at one point. (Refer to section 3.11.)

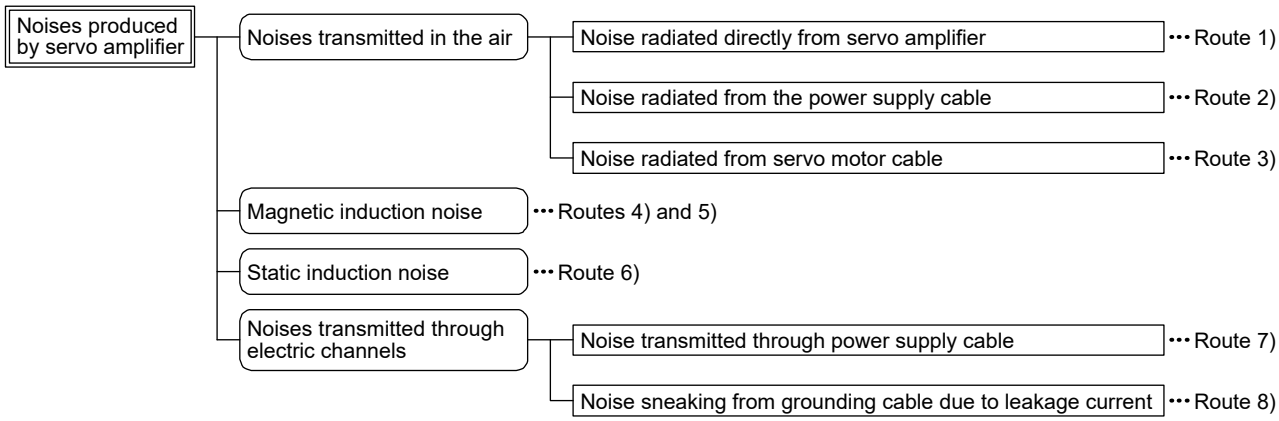
(b) Reduction techniques for external noises that cause the servo amplifier to malfunction

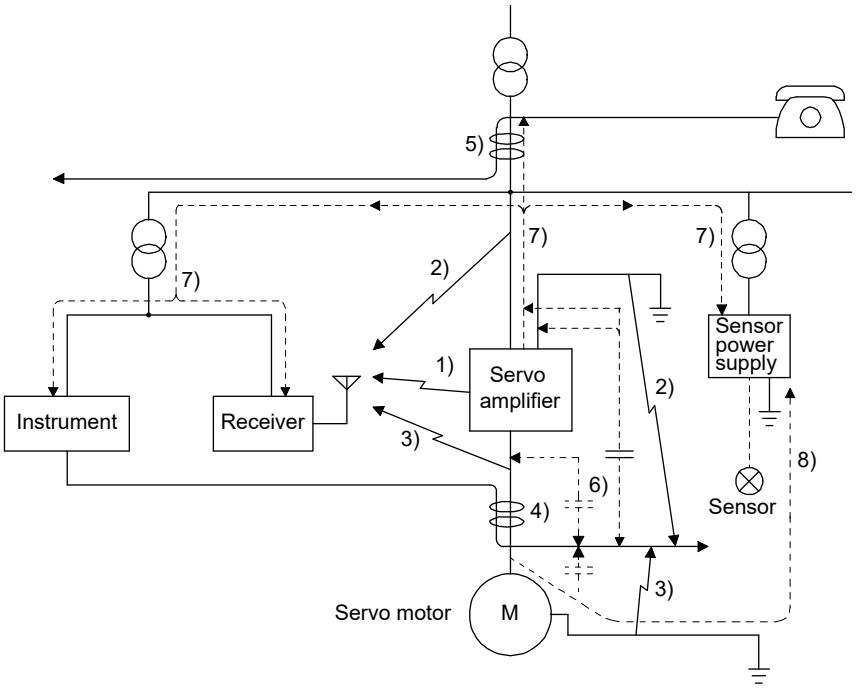
If there are noise sources (such as a magnetic contactor, an electromagnetic brake, and many relays which make a large amount of noise) near the servo amplifier and the servo amplifier may malfunction, the following countermeasures are required.

- Provide surge absorbers on the noise sources to suppress noises.
- Attach data line filters to the signal cables.
- Ground the shields of the encoder connecting cable and the control signal cables with cable clamp fittings.
- Although a surge absorber is built into the servo amplifier, to protect the servo amplifier and other equipment against large exogenous noise and lightning surge, attaching a varistor to the power input section of the equipment is recommended.

(c) Techniques for noises radiated by the servo amplifier that cause peripheral equipment to malfunction

Noises produced by the servo amplifier are classified into those radiated from the cables connected to the servo amplifier and its main circuits (input and output circuits), those induced electromagnetically or statically by the signal cables of the peripheral equipment located near the main circuit cables, and those transmitted through the power supply cables.





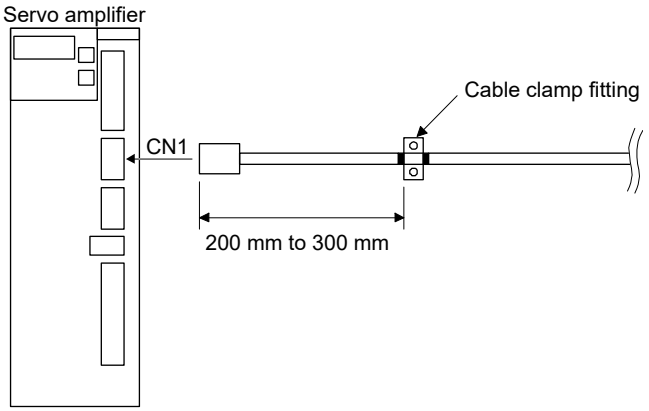
Noise transmission route	Suppression techniques
1) 2) 3)	When measuring instruments, receivers, sensors, etc. which handle weak signals and may malfunction due to noise and/or their signal cables are contained in a cabinet together with the servo amplifier or run near the servo amplifier, such devices may malfunction due to noises transmitted through the air. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the servo amplifier. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. 3. Avoid wiring the power lines (input/output lines of the servo amplifier) and signal lines side by side or bundling them together. 4. Insert a line noise filter to the I/O cables or a radio noise filter on the input line. 5. Use shielded wires for the signal and power lines, or put the lines in separate metal conduits.
4) 5) 6)	When the power lines and the signal lines are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the servo amplifier. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. 3. Avoid wiring the power lines (input/output lines of the servo amplifier) and signal lines side by side or bundling them together. 4. Use shielded wires for the signal and power lines, or put the lines in separate metal conduits.
7)	When the power supply of peripheral equipment is connected to the power supply of the servo amplifier system, noises produced by the servo amplifier may be transmitted back through the power supply cable and the devices may malfunction. The following techniques are required. 1. Install the radio noise filter (FR-BIF) on the power lines (Input lines) of the servo amplifier. 2. Install the line noise filter (FR-BSF01) on the power lines of the servo amplifier.
8)	If the grounding wires of the peripheral equipment and the servo amplifier make a closed loop circuit, leakage current may flow through, causing the equipment to malfunction. In this case, the malfunction may be prevented by the grounding wires disconnected from the equipment.

(d) Noise reduction techniques for the network cable

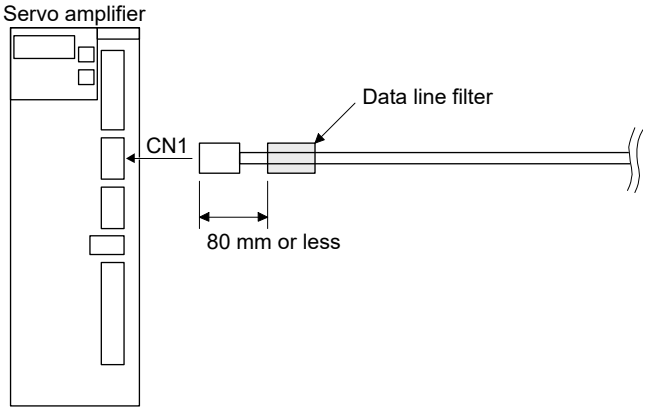
POINT
●Take measures against noise for both ends of the network cable.

When using it in an environment with excessive noise, directly connect the shield of the network cable to the ground plate with cable clamp fittings at a place 200 mm to 300 mm from the servo amplifier.
When connecting the network cable from outside the cabinet, connect it to the ground plate at a place 5 mm to 10 mm away from the cabinet entrance.
To reinforce measures against noise, it is recommended to install a data line filter (TDK ZCAT1730-0730) to the network cable. Install the data line filter to a place 80 mm or less from the servo amplifier.

1) For inside the cabinet
   a) When using cable clamp fittings

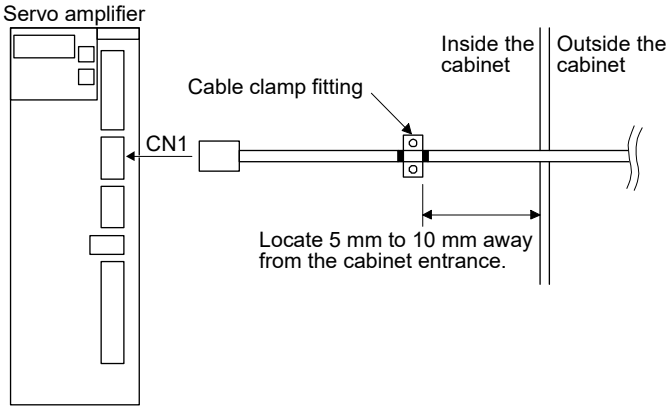


   b) When using a data line filter

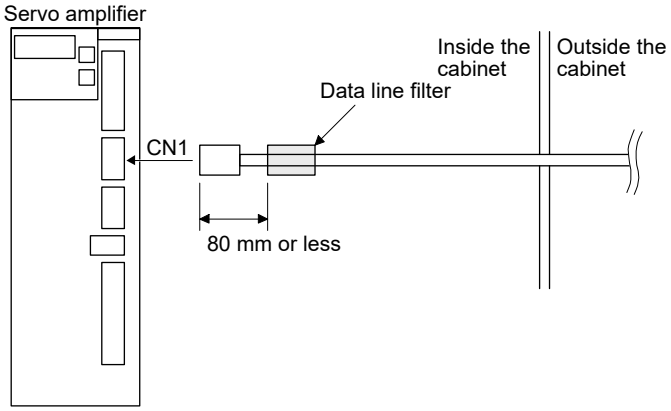


2) For outside the cabinet

a) When using cable clamp fittings



b) When using a data line filter



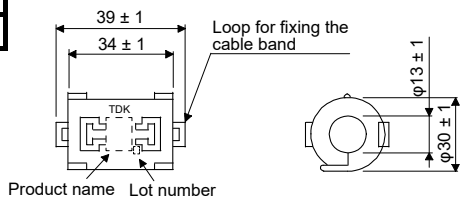
(2) Noise reduction techniques

(a) Data line filter (recommended)

Noise can be prevented by installing a data line filter onto the encoder cable, etc.
For example, ZCAT3035-1330 by TDK, ESD-SR-250 by NEC TOKIN, GRFC-13 by Kitagawa Industries, and E04SRM563218 by SEIWA ELECTRIC are available as data line filters.
As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below. These impedances are reference values and not guaranteed values.

Impedance [Ω]	
10 MHz to 100 MHz	100 MHz to 500 MHz
80	150

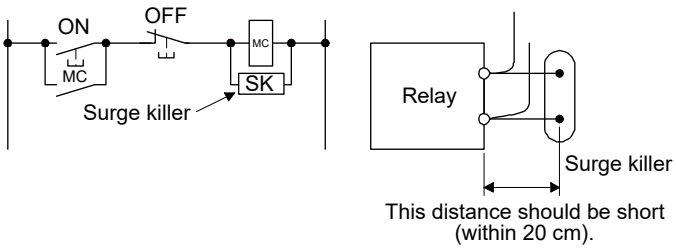
[Unit: mm]



Outline drawing (ZCAT3035-1330)

(b) Surge killer (recommended)

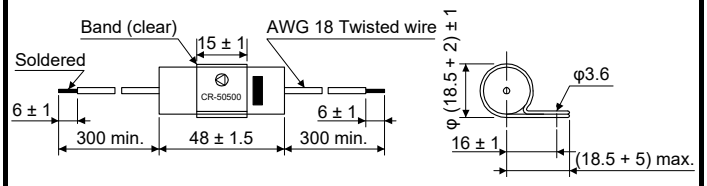
Use of a surge killer is recommended for AC relay, magnetic contactor or the like near the servo amplifier. Use the following surge killer or equivalent.



(Ex.) CR-50500 Okaya Electric Industries)

Rated voltage AC [V]	C [μF ± 20%]	R [Ω ± 30%]	Test voltage
250	0.5	50 (1/2 W)	Between terminals: 625 V AC, 50/60 Hz 60 s Between terminal and case: 2000 V AC, 50/60 Hz 60 s

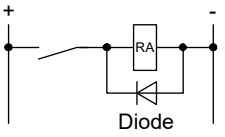
Dimensions [Unit: mm]



Note that a diode should be installed to a DC relay or the like.

Maximum voltage: not less than four times the drive voltage of the relay or the like

Maximum current: not less than two times the drive current of the relay or the like



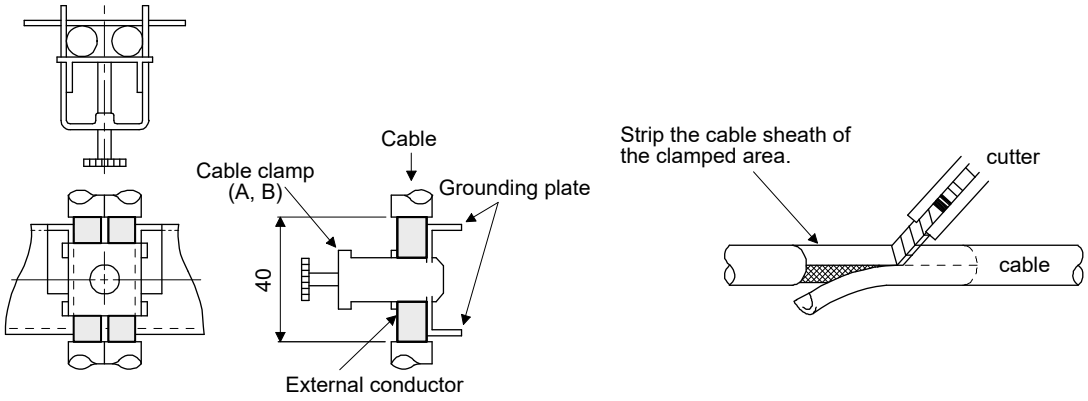
(c) Cable clamp fitting AERSBAN-_SET

Generally, connecting the grounding of the shielded wire to the SD terminal of the connector provides a sufficient effect. However, the effect can be increased when the shielded wire is connected directly to the grounding plate as shown below.

Install the grounding plate near the servo amplifier for the encoder cable. Peel part of the cable sheath to expose the external conductor, and press that part against the grounding plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The cable clamp comes as a set with the grounding plate.

[Unit: mm]

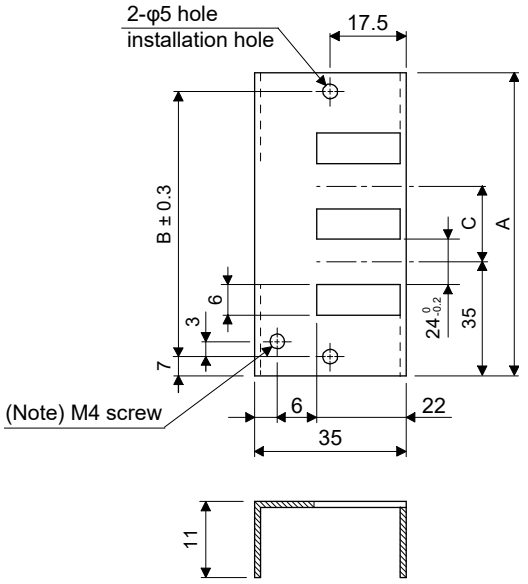


Clamp section diagram

・Dimensions

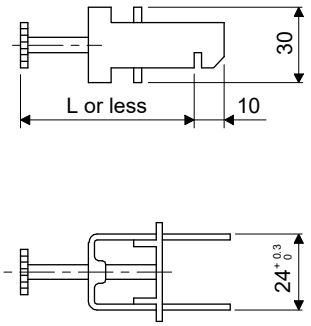
[Unit: mm]

Grounding plate



[Unit: mm]

Clamp section diagram



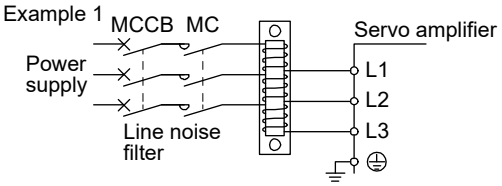
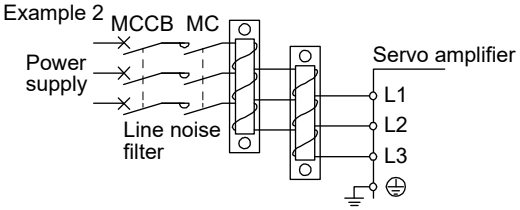
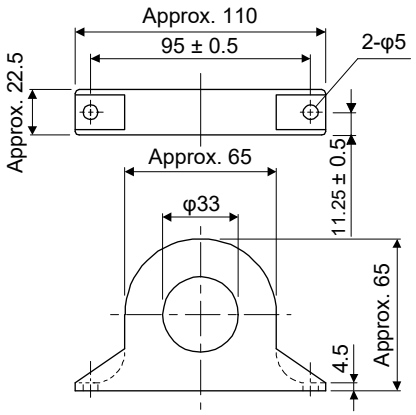
Note. Screw hole for grounding. Connect it to the grounding plate of the cabinet.

Model	A	B	C	Accessory fittings
AERSBAN-DSET	100	86	30	Clamp A: 2 pcs.
AERSBAN-ESET	70	56		Clamp B: 1 pc.

Clamp fitting	L
A	70
B	45

(d) Line noise filter (FR-BSF01)

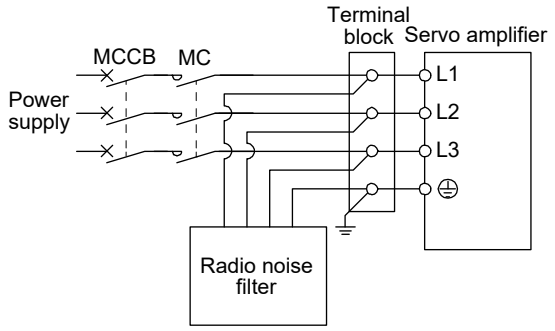
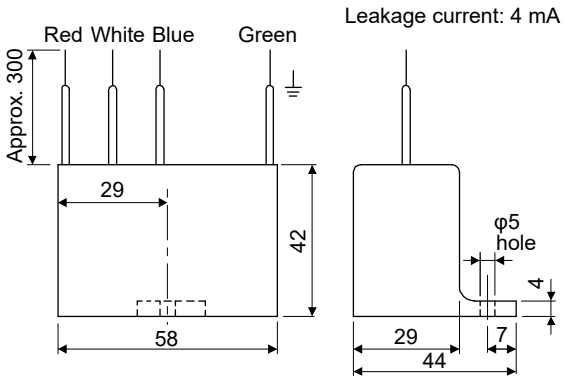
This filter is effective in suppressing noises radiated from the power supply side and output side of the servo amplifier and also in suppressing high-frequency leakage current (0-phase current). It especially affects the noises between 0.5 MHz and 5 MHz band.

Connection diagram	Dimensions [Unit: mm]
The line noise filters can be installed on lines of the power supply (L1/L2/L3) and of the servo motor power (U/V/W). Pass each of the wires through the line noise filter an equal number of times in the same direction. For wires of the power supply, the effect of the filter rises as the number of passes increases, but generally four passes would be appropriate. For the servo motor power lines, passes must be four times or less. Do not pass the grounding wire through the filter. Otherwise, the effect of the filter will drop. Wind the wires by passing through the filter to satisfy the required number of passes as shown in Example 1. If the wires are too thick to wind, use two or more filters to have the required number of passes as shown in Example 2. Place the line noise filters as close to the servo amplifier as possible for their best performance. Example 1  (Number of passes: 4) Example 2  Two filters are used (Total number of passes: 4)	FR-BSF01 (for wire size 3.5 mm^2 (AWG 12) or less) 

(e) Radio noise filter (FR-BIF)

This filter is effective in suppressing noises radiated from the power supply side of the servo amplifier especially in 10 MHz and lower radio frequency bands. The FR-BIF is designed for the input only.

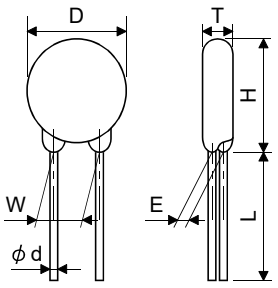
200 V class: FR-BIF

Connection diagram	Dimensions [Unit: mm]
Make the connection cables as short as possible. Grounding is always required. When using the FR-BIF with a single-phase power supply, always insulate the lead wires that are not used for wiring. 	

(f) Varistor for input power supply (recommended)

Varistors are effective to prevent exogenous noise and lightning surge from entering the servo amplifier. When using a varistor, connect it between each phase of the input power supply of the equipment. For varistors, the TND20V-431K and TND20V-471K, manufactured by NIPPON CHEMI-CON, are recommended. For detailed specification and usage of the varistors, refer to the manufacturer catalog.

Power supply voltage	Varistor	Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1 mA
		Permissible circuit voltage		Surge current immunity	Energy immunity	Rated pulse power	[A]	[V]		
		AC [Vrms]	DC [V]	8/20 μs [A]	2 ms [J]	[W]			[pF]	[V]
200 V class	TND20V-431K	275	350	10000/1 times	195	1.0	100	710	1300	430 (387 to 473)
	TND20V-471K	300	385	7000/2 times	215			775	1200	470 (423 to 517)



[Unit: mm]

Model	D Max.	H Max.	T Max.	E ±1.0	(Note) L Min.	φd ±0.05	W ±1.0
TND20V-431K	21.5	24.5	6.4	3.3	20	0.8	10.0
TND20V-471K			6.6	3.5			

Note. For special purpose items for lead length (L), contact the manufacturer.

11.11 Earth-leakage current breaker

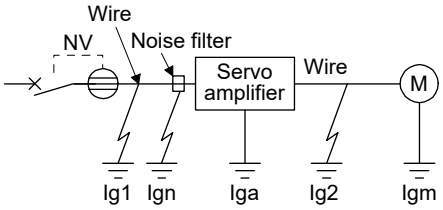
(1) Selection method

High-frequency chopper currents controlled by pulse width modulation flow in the AC servo circuits. Leakage currents containing harmonic contents are larger than those of the motor which is run with a commercial power supply.

Select an earth-leakage current breaker according to the following formula, and ground the servo amplifier, servo motor, etc. securely.

To minimize leakage currents, make the input and output wires as short as possible, and keep a distance of 30 cm or longer between the wires and ground.

$$\text{Rated sensitivity current} \geq 10 \cdot \{Ig1 + Ign + Iga + K \cdot (Ig2 + Igm)\} \text{ [mA]} \quad \cdots\cdots (11.1)$$



Earth-leakage current breaker		K
Type	Mitsubishi Electric products	
Models provided with harmonic and surge reduction techniques	NV-SP NV-SW NV-CP NV-CW NV-HW	1
General models	BV-C1 NFB NV-L	3

Ig1: Leakage current on the electric channel from the earth-leakage current breaker to the input terminals of the servo amplifier (Found from Fig. 11.2.)

Ig2: Leakage current on the electric channel from the output terminals of the servo amplifier to the servo motor (found from Fig. 11.2.)

Ign: Leakage current when a filter is connected to the input side (4.4 mA per one FR-BIF)

Iga: Leakage current of the servo amplifier (Found from table 11.3.)

Igm: Leakage current of the servo motor (Found from table 11.2.)

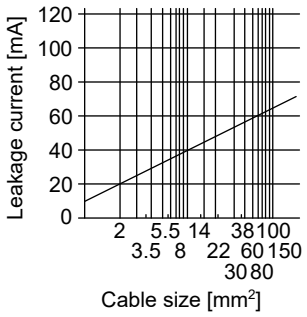


Fig. 11.2 Example of leakage current per km (Ig1, Ig2) for CV cable run in metal conduit

Table 11.2 Servo motor leakage current example (Igm)

Servo motor power [kW]	Leakage current [mA]
0.1 to 1	0.1
1.5 to 2	0.2
3	0.3

Table 11.3 Servo amplifier leakage current example (Iga)

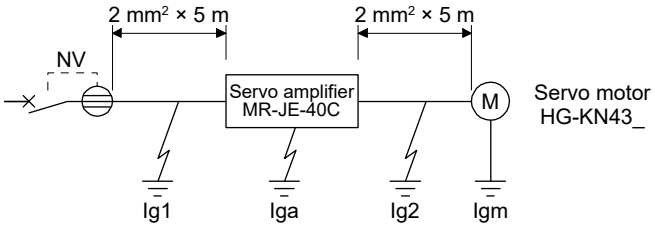
Servo amplifier capacity [kW]	Leakage current [mA]
0.1 to 0.4	0.1
0.75 to 3	0.15

Table 11.4 Earth-leakage current breaker selection example

Servo amplifier capacity [kW]	Rated sensitivity current of earth-leakage current breaker [mA]
MR-JE-10C to MR-JE- 300C	15

(2) Selection example

Indicated below is an example of selecting an earth-leakage current breaker under the following conditions.



Use an earth-leakage current breaker designed for suppressing harmonics/surges.
Find the terms of equation (11.1) from the diagram.

$$Ig1 = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

$$Ig2 = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

Ign = 0 (not used)

Iga = 0.1 [mA]

Igm = 0.1 [mA]

Insert these values in equation (11.1).

$$Ig \geq 10 \cdot \{0.1 + 0 + 0.1 + 1 \cdot (0.1 + 0.1)\}$$
$$\geq 4 \text{ [mA]}$$

According to the result of calculation, use an earth-leakage current breaker having the rated sensitivity current (Ig) of 4.0 mA or more.
Use an earth-leakage current breaker having Ig of 15 mA with the NV-SP/SW/CP/CW/HW series.

11.12 EMC filter (recommended)

> POINT
>
> ●For when multiple servo amplifiers are connected to one EMC filter, refer to section 6.4 of "EMC Installation Guidelines".

It is recommended that one of the following filters be used to comply with EN EMC directive. Some EMC filters have large in leakage current.

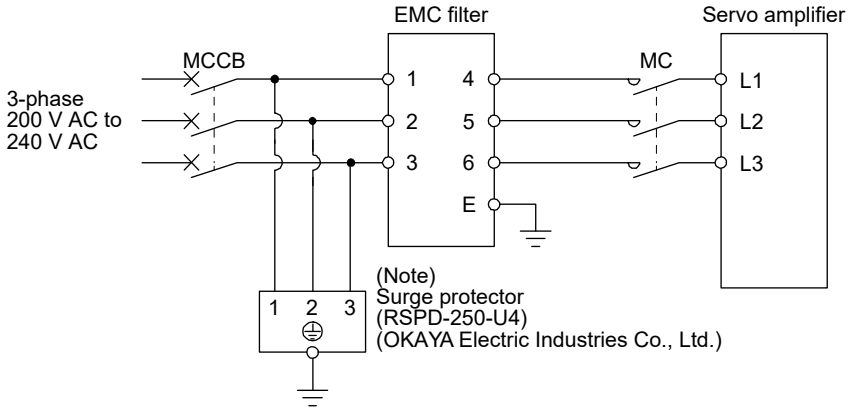
(1) Combination with the servo amplifier

Servo amplifier	Recommended filter (Soshin Electric)				Mass [kg]
	Model	Rated current [A]	Rated voltage [V AC]	Leakage current [mA]	
MR-JE-10C to MR-JE-100C	HF3010A-UN (Note)	10	250	5	3.5
MR-JE-200C, MR-JE-300C	HF3030A-UN (Note)	30			5.5

Note. A surge protector is separately required to use any of these EMC filters.

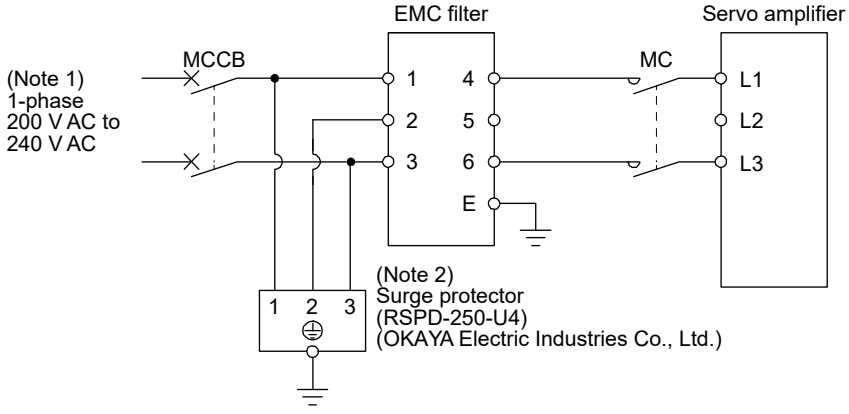
(2) Connection example

(a) When using 3-phase 200 V AC to 240 V AC power supply



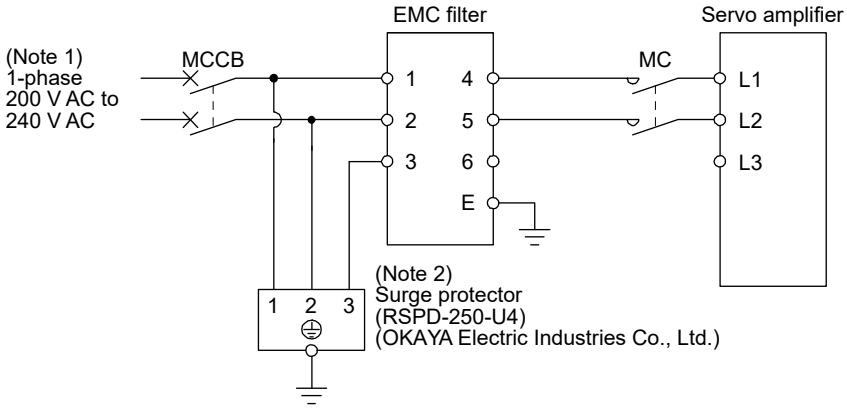
Note. The example is when a surge protector is connected.

(b) When using 1-phase 200 V AC to 240 V AC power supply for MR-JE-10C to MR-JE-100C



Note 1. Connect the power supply to L1 and L3. Leave L2 open.
2. The example is when a surge protector is connected.

(c) When using 1-phase 200 V AC to 240 V AC power supply for MR-JE-200C



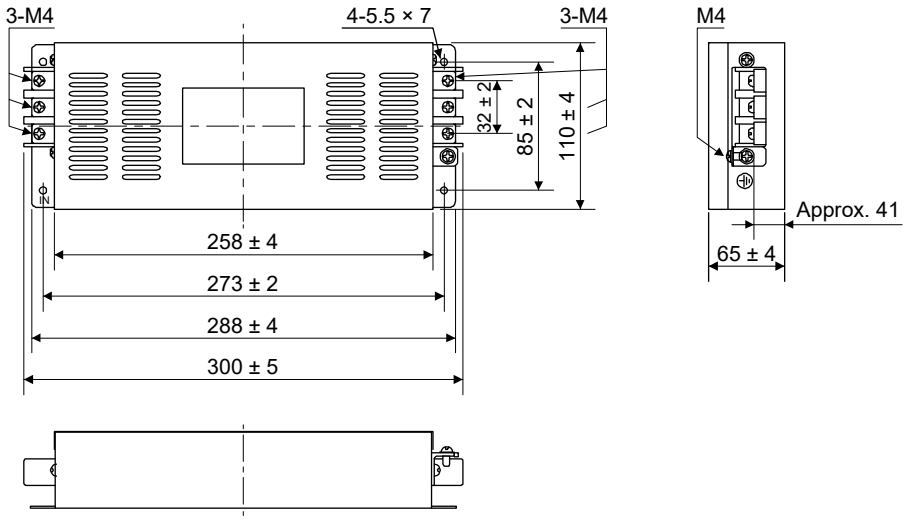
Note 1. Connect the power supply to L1 and L2. Leave L3 open.
2. The example is when a surge protector is connected.

(3) Dimensions

(a) EMC filter

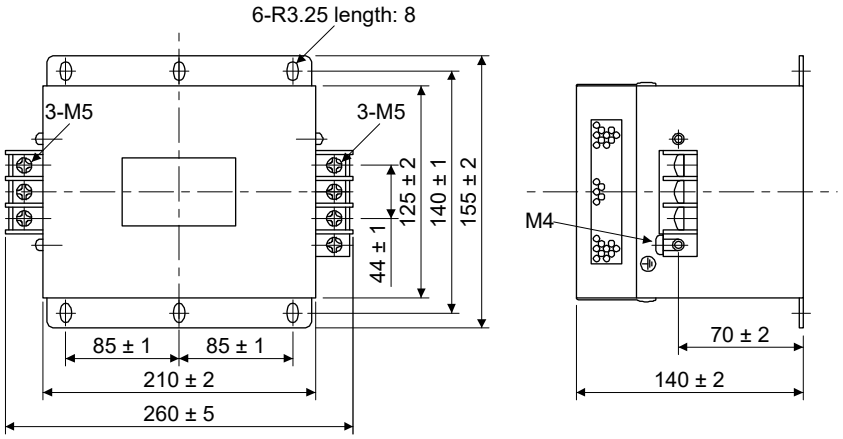
HF3010A-UN

[Unit: mm]



HF3030A-UN

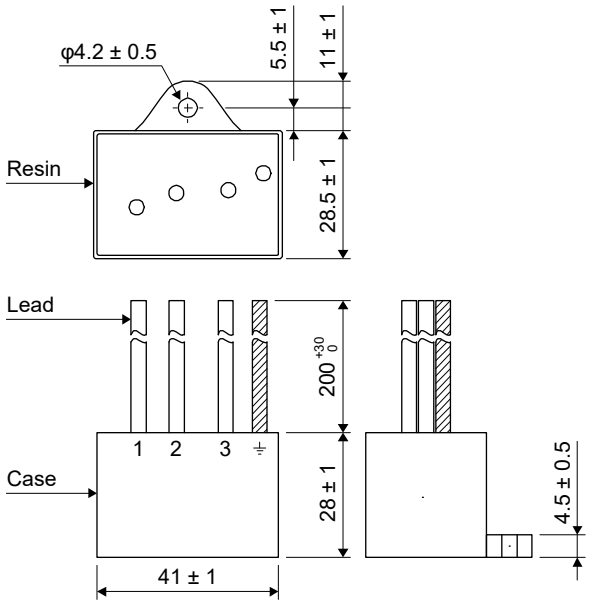
[Unit: mm]

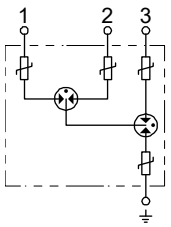


(b) Surge protector

RSPD-250-U4

[Unit: mm]





12. ABSOLUTE POSITION DETECTION SYSTEM

⚠CAUTION	●If [AL. 25 Absolute position erased] or [AL. E3 Absolute position counter warning] has occurred, always perform home position setting again. Otherwise, it may cause an unexpected operation. ●If [AL. 25], [AL. 92], or [AL. 9F] occurs due to such as short circuit of the battery, the MR-BAT6V1 battery can become hot. Use the MR-BAT6V1 battery with case to prevent getting burnt.

POINT

●Refer to section 11.5 for the replacement procedure of the battery.
●There are two types of batteries, MR-BAT6V1SET-A and MR-BT6VCASE available to construct the absolute position detection system.
●When absolute position data is erased from the encoder, always execute home position setting before operation. The absolute position data of the encoder will be erased in the followings. Additionally, when the battery is used out of specification, the absolute position data can be erased.
・The encoder cable was disconnected.
・The battery was replaced when the power supply was off.

12.1 Summary

12.1.1 Features

For normal operation, the encoder consists of a detector designed to detect a position within one revolution and a cumulative revolution counter designed to detect the number of revolutions.
The absolute position detection system always detects the absolute position of the machine and keeps it battery-backed, independently of whether the programmable controller power is on or off. Therefore, once home position return is made at the time of machine installation, home position return is not needed when power is switched on thereafter.
Even at a power failure or a malfunction, the system can be easily restored.

12.1.2 Restrictions

The system cannot be configured under the following conditions. Additionally, test operation cannot be performed in the absolute position detection system. To perform test operation, select incremental system in [Pr. PA03].

(1) Speed control mode and torque control mode

(2) Control switch-over mode (position/speed, speed/torque, and torque/position)

(3) Stroke-less coordinate system, e.g. rotary shaft, infinitely long positioning

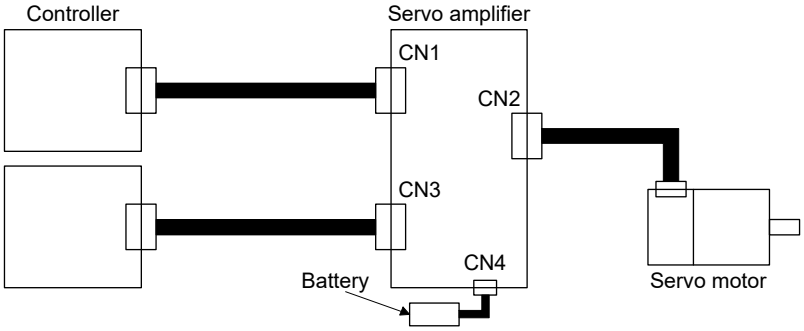
(4) Changing electronic gear after home position setting.

(5) Using alarm code output.

12.1.3 Structure

The following shows a configuration of the absolute position detection system. Refer to section 11.5 for each battery connection.

Positioning module	I/O module
RD75P4, RD75D4	RX40C7, RX41C4, RX42C4 RY40NT5P, RY41NT2P, RY42NT2P RY40PT5P, RY41PT1P, RY42PT1P
QD75P_N, QD75D_N	QX40, QX41, QX42 QY40, QY41P, QY42P, QY50
LD75P4, LD75D4	LX40C6, LX41C4, LX42C4 LY40NT5P, LY41NT1P, LY42NT1P LY40PT5P, LY41PT1P, LY42PT1P
FX_{2N}-_GM, FX_{2N}-_PG	FX_{2N} series
FX_{3U}-_	FX_{3U} series
FX_{5U}-_	FX_{5U} series



12.1.4 Parameter setting

POINT
●Set "_ _ _ 2" in [Pr. PA03] when using the absolute position detection system by communication.

Set "_ _ _ 1" in [Pr. PA03] to enable the absolute position detection system. Set "_ _ _ 2" when using the ABS transfer system by communication. Refer to section 12.3 for the ABS transfer system by communication.

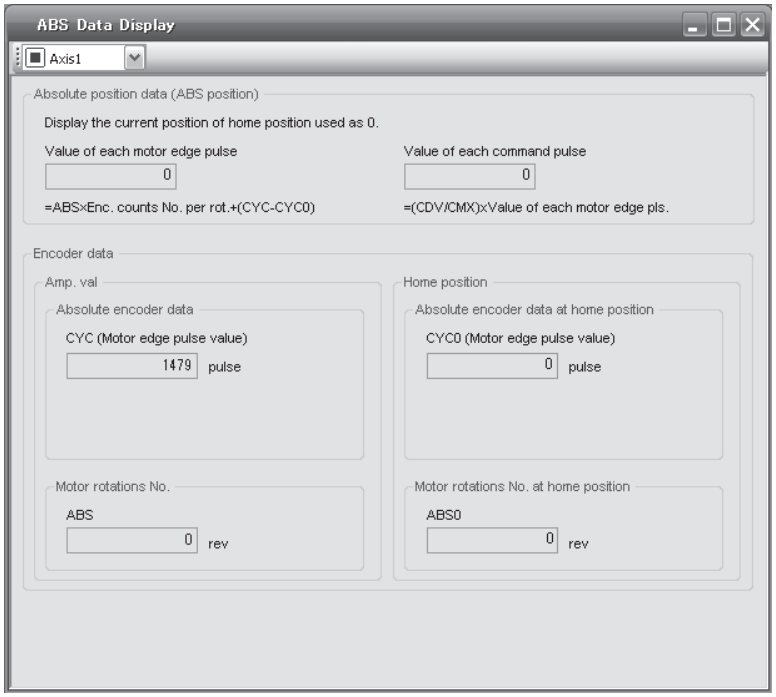
[Pr. PA03]

			1

Absolute position detection system selection
0: Disabled (incremental system)
2: Enabled (absolute position detection system by communication-based)

12.1.5 Confirmation of absolute position detection data

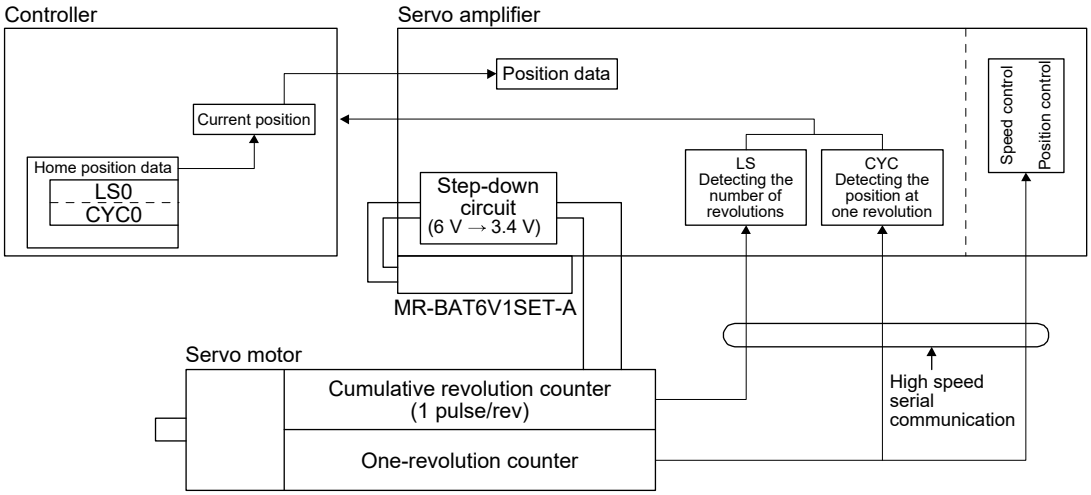
You can check the absolute position data with MR Configurator2. Choose "Monitor" and "ABS Data Display" to open the absolute position data display screen.



12.2 Battery

12.2.1 Using the MR-BAT6V1SET-A battery

(1) Configuration diagram



(2) Specifications

(a) Specification list

Item	Description
System	Electronic battery backup type
Maximum revolution range	Home position ± 32767 rev.
(Note 1) Maximum speed at power failure [r/min]	6000 (only when acceleration time until 6000 r/min is 0.2 s or longer)
(Note 2) Battery backup time	Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C) Approximately 29,000 hours (power-on time ratio: 25%, ambient temperature: 20 °C) (Note 3)

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like. Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like.

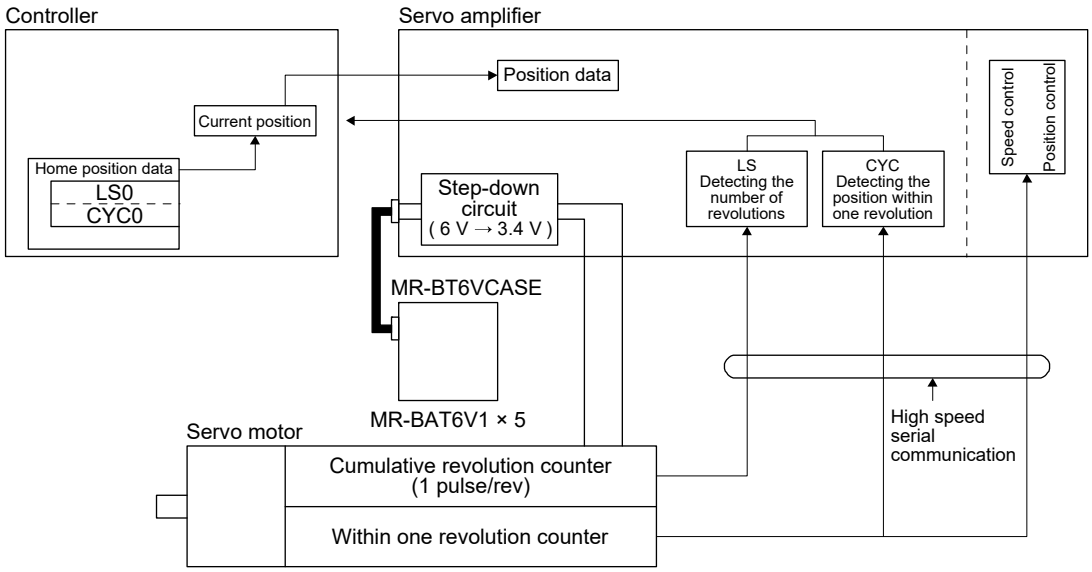
2. The data-holding time by the battery using MR-BAT6V1SET-A. Replace the batteries within three years since the operation start regardless of the power supply of the servo amplifier on/off. If the battery is used out of specification, [AL. 25 Absolute position erased] may occur.

3. The power-on time ratio 25% is equivalent to 8 hours power on for a weekday and off for a weekend.

12.2.2 Using the MR-BT6VCASE battery case

POINT
●One MR-BT6VCASE can hold the absolute position data of up to 8-axis servo motors. ●Always install five MR-BAT6V1 batteries to MR-BT6VCASE.

(1) Configuration diagram



(2) Specification list

Item	Description
System	Electronic battery backup type
Maximum revolution range	Home position ± 32767 rev.
(Note 1) Maximum speed at power failure [r/min]	6000 (only when acceleration time until 6000 r/min is 0.2 s or longer)
(Note 2) Battery backup time	Approximately 40,000 hours/2 axes or less, 30,000 hours/3 axes, or 10,000 hours/8 axes (equipment power supply: off, ambient temperature: 20 °C) Approximately 55,000 hours/2 axes or less, 38,000 hours/3 axes, or 15,000 hours/8 axes (power-on time ratio: 25%, ambient temperature: 20 °C) (Note 3)

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like. Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like.

2. The data-holding time by five MR-BAT6V1 batteries. The battery life varies depending on the number of target axes (including axis for using in the incremental system). Replace the batteries within three years since the operation start regardless of the power supply of the servo amplifier on/off. If the battery is used out of specification, [AL. 25 Absolute position erased] may occur.

3. The power-on time ratio 25% is equivalent to 8 hours power on for a weekday and off for a weekend.

12.3 Communication-based absolute position transfer system

12.3.1 Communication command

The following commands are available for reading absolute position data by communication. When reading data, ensure that the IP address of the servo amplifier or station number are correct. For communication function, refer to the "MR-JE-_C Servo Amplifier Instruction Manual (Network)".
When the master station sends the command to the slave station (servo amplifier), the slave station returns the data value to the master station.

(1) Transmission

(a) For SLMP

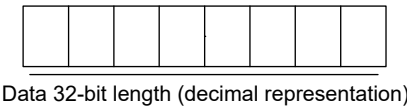
Send command 4020h sub-command 0001h Index 6064h Sub Index 0h.

(b) For Modbus/TCP or Modbus RTU

Send function code 03h start address 6064h No. of Points 01h.

(2) Reply

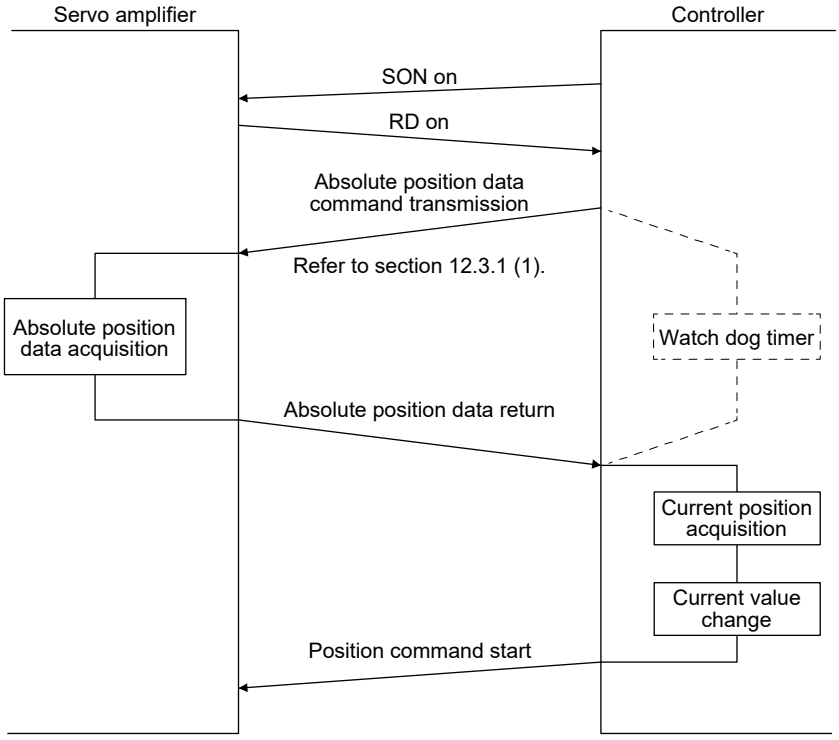
The absolute position data in the command pulse unit is returned in decimal.



12.3.2 Absolute position data transfer protocol

(1) Data transfer procedure

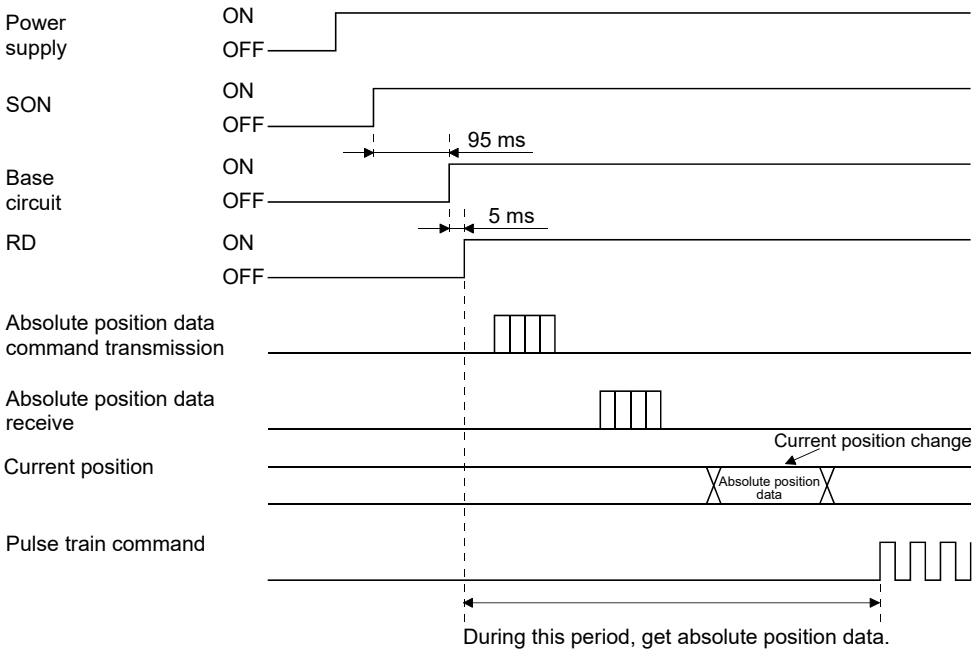
Every time SON turns on at power-on or like, the controller must read the current position data in the servo amplifier. Not performing this operation will cause a position shift.
Time-out monitoring should be performed by the controller.



(2) Transfer method

The following shows a sequence how to turn on the base circuit while it is off state because SON is off, EM2 is off, or an alarm is occurring. In the absolute position detection system every time RD turns on, always read to the controller the servo amplifier current internal position with the SLMP, Modbus/TCP or Modbus RTU communication command. The servo amplifier sends the current position to the controller on receipt of the command. At the same time, this data is set as a position command value in the servo amplifier.

(a) Sequence processing at power-on



1) The base circuit turns on after 95 ms.

2) After the base circuit is turned on, RD turns on.

3) After RD turned on and the controller acquired the absolute position data, give command pulses to the servo amplifier. If the controller gives command pulses before acquiring the absolute position data, a position shift can occur.

(b) Communication error

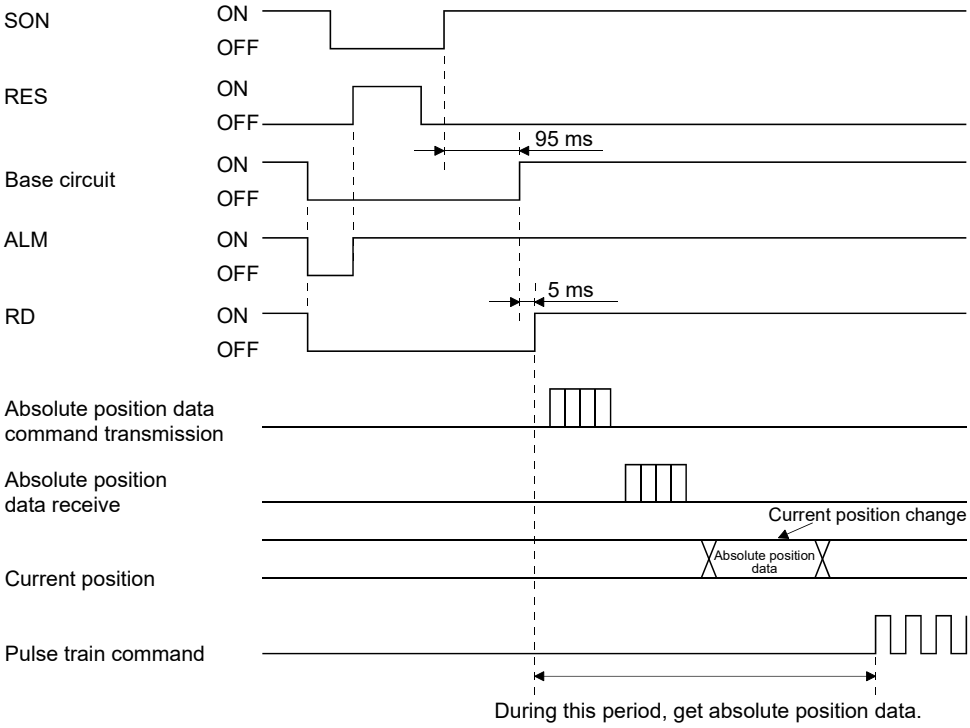
If a communication error occurs between the controller and servo amplifier, the servo amplifier sends the error code. For details of error codes, refer to "MR-JE-_C Servo Amplifier Instruction Manual (Network)".

- Section 2.4.5
- Section 3.6.5
- Section 4.8.5

If a communication error has occurred, perform retry operation. If several retries do not result in a normal termination, perform error processing.

(c) At the time of alarm reset

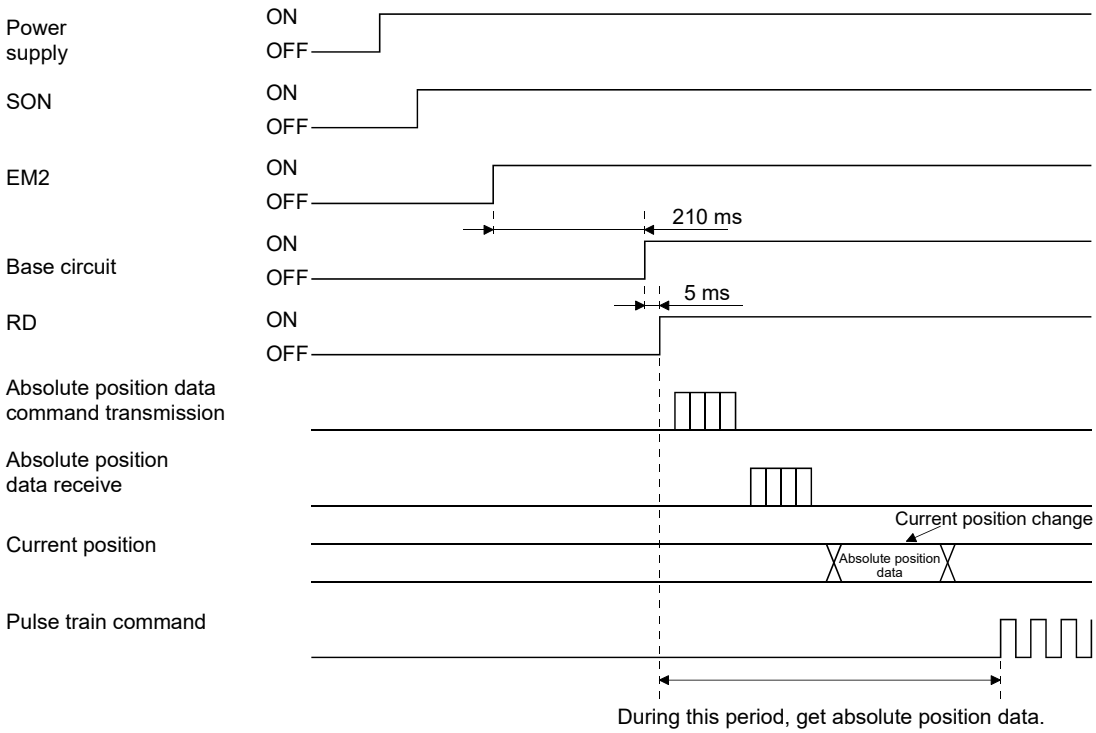
If an alarm has occurred, detect ALM and turn off SON. After removing the alarm occurrence factor and deactivating the alarm, get the absolute position data again from the servo amplifier in accordance with the procedure in (a) in this section.



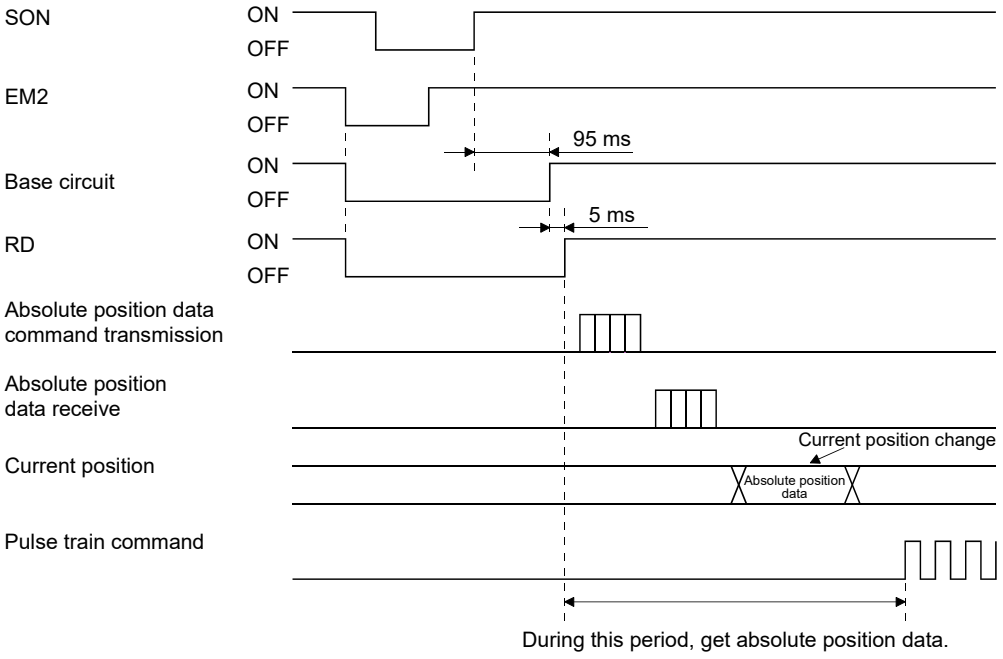
(d) At the time of forced stop reset

210 ms after the forced stop is deactivated, the base circuit turns on, and RD turns on further 5 ms after that, turns on. Always get the current position data using RD as the trigger before the position command is issued.

1) When power is switched on in a forced stop status



2) When a forced stop is activated during servo on



MEMO

APPENDIX

App. 1 Handling of AC servo amplifier batteries for the United Nations Recommendations on the Transport of Dangerous Goods

United Nations Recommendations on the Transport of Dangerous Goods Rev. 15 (hereinafter Recommendations of the United Nations) has been issued. To reflect this, transport regulations for lithium metal batteries are partially revised in the Technical Instruction (ICAO-TI) by the International Civil Aviation Organization (ICAO) and the International Maritime Dangerous Goods Code (IMDG Code) by the International Maritime Organization (IMO).
To comply the instruction and code, we have modified the indication on the package for general-purpose AC servo batteries.
The above change will not affect the function and performance of the product.

(1) Target model

(a) Battery (cell)

Model	Option model	Type	Lithium content	Mass of battery	Remark
ER6	MR-J3BAT	Cell	0.65 g	16 g	Cells with more than 0.3 grams of lithium content must be handled as dangerous goods (Class 9) depending on packaging requirements.
ER17330	MR-BAT	Cell	0.48 g	13 g	
	A6BAT	Cell	0.48 g	13 g	

(b) Battery unit (assembled battery)

Model	Option model	Type	Lithium content	Mass of battery	Remark
ER6	MR-J2M-BT	Assembled battery (Seven)	4.55 g	112 g	Assembled batteries with more than two grams of lithium content must be handled as dangerous goods (Class 9) regardless of packaging requirements.
CR17335A	MR-BAT6V1	Assembled battery (Two)	1.20 g	34 g	Assembled batteries with more than 0.3 grams of lithium content must be handled as dangerous goods (Class 9) depending on packaging requirements.
	MR-BAT6V1SET(-A)	Assembled battery (Two)	1.20 g	34 g	
	MR-BAT6V1BJ	Assembled battery (Two)	1.20 g	34 g	

(2) Purpose

Safer transportation of lithium metal batteries.

(3) Change in regulations

The following points are changed for lithium metal batteries in transportation by sea or air based on the revision of Recommendations of the United Nations Rev. 15 and ICAO-TI 2009-2010 edition, and IATA Dangerous Goods Regulations 54th Edition (effective January 1, 2013). For lithium metal batteries, cells are classified as UN3090, and batteries contained in or packed with equipment are classified as UN3091.

(a) Transportation of lithium metal batteries alone

Packaging requirement	Classification	Main requirement
Less than eight cells per package with less than one gram of lithium content	UN3090 PI968 Section II	The package must pass a 1.2 m drop test, and the handling label with battery illustration (size: 120 × 110 mm) must be attached on the package.
Less than two assembled batteries per package with less than two grams of lithium content		
More than eight cells per package with less than one gram of lithium content	UN3090 PI968 Section IB	The package must pass a 1.2 m drop test, and the handling label with battery illustration (size: 120 × 110 mm) must be attached on the package. The Class 9 hazard label must be attached or others to comply with dangerous goods (Class 9).
More than two assembled batteries per package with less than two grams of lithium content		
Cells with more than one gram of lithium content	UN3090 PI968 Section IA	The package must be compliant with Class 9 Packages, and the Class 9 hazard label must be attached or others to comply with dangerous goods (Class 9).
Assembled batteries with more than two grams of lithium content		

(b) Transportation of lithium metal batteries packed with or contained in equipment

1) For batteries packed with equipment, follow the necessary requirements of UN3091 PI969. Batteries are classified into either Section II/Section I depending on the lithium content/packaging requirements.

2) For batteries contained in equipment, follow the necessary requirements of UN3091 PI970. Batteries are classified into either Section II/Section I depending on the lithium content/packaging requirements.
The special handling may be unnecessary depending on the number of batteries and gross mass per package.

Fig. app. 1 Example of Mitsubishi label with battery illustration

(Available until December 31, 2018)

* Place for UN number (s)
** Place for telephone number for additional information

Fig. app. 2 Example of Mitsubishi label with battery illustration

(Available from January 1, 2017)

The handling label shown in Fig. app. 1 has been changed to the one shown in Fig. app. 2 in accordance with the IATA Dangerous Goods Regulations 58th Edition (effective January 1, 2017). However, the label shown in Fig. app. 1 may be used until December 31, 2018 (for two years as an interim measure).

(4) Details of the package change
The following caution is added to the packages of the target batteries.
"Containing lithium metal battery. Regulations apply for transportation."

(5) Transportation precaution for customers

For sea or air transportation, attaching the handling label (figure) must be attached to the package of a Mitsubishi Electric cell or battery. In addition, attaching it to the outer package containing several packages of Mitsubishi Electric cells or batteries is also required. When the content of a package must be handled as dangerous goods (Class 9), the Shipper's Declaration for Dangerous Goods is required, and the package must be compliant with Class 9 Packages. Documentations like the handling label in the specified design and the Shipper's Declaration for Dangerous Goods are required for transportation. Please attach the documentations to the packages and the outer package.

The IATA Dangerous Goods Regulations are revised, and the requirements are changed annually. When customers transport lithium batteries by themselves, the responsibility for the cargo lies with the customers. Thus, be sure to check the latest version of the IATA Dangerous Goods Regulations.

App. 2 Symbol for the new EU Battery Directive

Symbol for the new EU Battery Directive (2006/66/EC) that is plastered to general-purpose AC servo battery is explained here.

Note. This mark is for EU countries only.

This mark is according to the directive 2006/66/EC Article 20 Information for end-users and Annex II.
Your MITSUBISHI ELECTRIC product is designed and manufactured with high quality materials and components which can be recycled and/or reused.
This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from your household waste.
If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration.
This will be indicated as follows.
Hg: mercury (0.0005%), Cd: cadmium (0.002%), Pb: lead (0.004%)
In the European Union there are separate collection systems for used batteries and accumulators. Please, dispose of batteries and accumulators correctly at your local community waste collection/recycling center.
Please, help us to conserve the environment we live in!

App. 3 Compliance with global standards

App. 3.1 About safety

This section explains safety of users and machine operators. Please read the section carefully before mounting the equipment.

App. 3.1.1 Professional engineer

Only professional engineers should mount MR-JE servo amplifiers.
Here, professional engineers should meet all the conditions below.

(1) Persons who took a proper training of related work of electrical equipment or persons who can avoid risk based on past experience.

(2) Persons who have read and familiarized himself/herself with this installation guide and operating manuals for the protective devices (e.g. light curtain) connected to the safety control system.

App. 3.1.2 Applications of the devices

MR-JE servo amplifiers comply with the following standards.
IEC/EN 61800-5-1/GB 12668.501, IEC/EN/KN 61800-3/GB 12668.3

App. 3.1.3 Correct use

Use the MR-JE servo amplifiers within specifications. Refer to section 1.3 for specifications such as voltage, temperature, etc. Mitsubishi Electric Co. accepts no claims for liability if the equipment is used in any other way or if modifications are made to the device, even in the context of mounting and installation.

⚠WARNING	●If you need to get close to the moving parts of the machine for inspection or others, ensure safety by confirming the power off, etc. Otherwise, it may cause an accident. ●It takes 15 minutes maximum for capacitor discharging. Do not touch the unit and terminals immediately after power off.

(1) Peripheral device and power wiring

The followings are selected based on IEC/EN 61800-5-1, UL 508C, and CSA C22.2 No. 14.

(a) Local wiring

The following table shows the stranded wire sizes [AWG] symbols rated at 75 °C/60 °C.

Servo amplifier (Note 3)	75 °C/60 °C stranded wire [AWG]		
	L1/L2/L3/⏚ (Note 2)	P+/C	U/V/W/⏚ (Note 1, 2)
MR-JE-10_/MR-JE-20_/MR-JE-40_/MR-JE-70_/MR-JE-100_ (T)/ MR-JE-200_/MR-JE-300_	14/14	14/14	14/14
MR-JE-200_ (S)	12/12		

Note 1. Select wire sizes depending on the rated output of the servo motors. The values in the table are sizes based on rated output of the servo amplifiers.

2. The following shows the PE terminal specifications of the servo amplifier.
   Screw size: M4
   Tightening torque: 1.2 [N•m]
   Recommended crimp terminals: R2-4 (Manufactured by JST)
   Crimping tool: YPT-60-21 (Manufactured by JST)
3. "(S)" means 1-phase 200 V AC power input and "(T)" means 3-phase 200 V AC power input in the table.

(b) Selection example of MCCB and fuse

Use T class fuses or molded-case circuit breaker (UL 489 Listed MCCB) as the following table. The T class fuses and molded-case circuit breakers in the table are selected examples based on rated I/O of the servo amplifiers. When you select a smaller capacity servo motor to connect it to the servo amplifier, you can also use smaller capacity T class fuses or molded-case circuit breaker than ones in the table. For selecting ones other than Class T fuses and molded-case circuit breakers below and selecting a Type E Combination motor controller, refer to section 11.7.

Servo amplifier (Note)	Molded-case circuit breaker (240 V AC)	Fuse (300 V)
MR-JE-10_/MR-JE-20_/MR-JE-40_/MR-JE-70_ (T)	NF50- SVFU-5A (50 A frame 5 A)	10 A
MR-JE-70_ (S)/MR-JE-100_ (T)	NF50- SVFU -10A (50 A frame 10 A)	15 A
MR-JE-200_ (T)/MR-JE-300_	NF50- SVFU -15A (50 A frame 15 A)	30 A
MR-JE-100_ (S)	NF50-SVFU-15A (50 A frame 15 A)	30 A
MR-JE-200_ (S)	NF50-SVFU-20A (50 A frame 20 A)	40 A

Note. "(S)" means 1-phase 200 V AC power input and "(T)" means 3-phase 200 V AC power input in the table.

(c) Power supply

This servo amplifier can be supplied from star-connected supply with grounded neutral point of overvoltage category III (overvoltage category II for 1-phase servo amplifiers) set forth in IEC/EN 60664-1. For the interface power supply, use an external 24 V DC power supply with reinforced insulation on I/O terminals.

(d) Grounding

To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet. Do not connect two grounding cables to the same protective earth (PE) terminal. Always connect cables to the terminals one-to-one. This product can cause a DC current in the protective earthing conductor. To protect direct/indirect contact using an earth-leakage current breaker (RCD), only an RCD of type B can be used for the power supply side of the product.

(2) EU compliance

The EC directives were issued to standardize the regulations of the EU countries and ensure smooth distribution of safety-guaranteed products. The CE marking proves the compliance of the manufacturer with the EC directives, and this marking also applies to machines and equipment incorporating servos.

(a) EMC requirement

MR-JE servo amplifiers comply with category C3 in accordance with IEC/EN 61800-3. Install an EMC filter and surge protector on the primary side of the servo amplifier. As for I/O signal wires (max. length 10 m) and encoder cables (max. length 50 m), use shielded wires and ground the shields. However, when the encoder cable length is longer than 30 m for MR-JE-70_ and MR-JE-100_, set a radio noise filter (FR-BIF) to the input power supply side of the servo amplifier. The following shows recommended products.

EMC filter: Soshin Electric HF3000A-UN series

Surge protector: Okaya Electric Industries RSPD series

Radio noise filter: Mitsubishi Electric FR-BIF

MR-JE Series are not intended to be used on a low-voltage public network which supplies domestic premises; radio frequency interference is expected if used on such a network. The installer shall provide a guide for Installation and use, including recommended mitigation devices. To avoid the risk of crosstalk to signal cables, the installation instructions shall either recommend that the power interface cable be segregated from signal cables.
Use the DC power supply installed with the amplifiers in the same cabinet. Do not connect the other electric devices to the DC power supply.

(b) For Declaration of Conformity (DoC)

Hereby, MITSUBISHI ELECTRIC EUROPE B.V. declares that the servo amplifiers are in compliance with EC directives (EMC directive (2014/30/EU), Low voltage directive (2014/35/EU), and RoHS directive (2011/65/EU)). For the copy of Declaration of Conformity, contact your local sales office.

(3) USA/Canada compliance

This servo amplifier is designed in compliance with UL 508C and CSA C22.2 No. 14.

(a) Installation

The minimum cabinet size is 150% of MR-JE servo amplifier's volume. Also, design the cabinet so that the ambient temperature in the cabinet is 55 °C or less. The servo amplifier must be installed in the metal cabinet. Additionally, mount the servo amplifier on a cabinet that the protective earth based on the standard of IEC/EN 60204-1 is correctly connected. For environment, the units should be used in open type (UL 50) and overvoltage category shown in table in app. 3.7.1. The servo amplifier needs to be installed at or below pollution degree 2. For connection, use copper wires.

(b) Short-circuit current rating (SCCR)

Suitable For Use On A Circuit Capable Of Delivering Not More Than 100 kA rms Symmetrical Amperes, 500 Volts Maximum. For SCCR when using a Type E Combination motor controller, refer to section 11.7.

(c) Overload protection characteristics

The MR-JE servo amplifiers have solid-state servo motor overload protection. (It is set on the basis (full load current) of 120% rated current of the servo amplifier.)

(d) Over-temperature protection for motor

Motor Over temperature sensing is not provided by the drive.
Integral thermal protection(s) is necessary for motor and refer to app. 3.3 for the proper connection.

(e) Branch circuit protection

For installation in United States, branch circuit protection must be provided, in accordance with the National Electrical Code and any applicable local codes.
For installation in Canada, branch circuit protection must be provided, in accordance with the Canada Electrical Code and any applicable provincial codes.

(4) South Korea compliance

This product complies with the Radio Wave Law (KC mark). Please note the following to use the product.
이 기기는 업무용 (A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
(The product is for business use (Class A) and meets the electromagnetic compatibility requirements. The seller and the user must note the above point, and use the product in a place except for home.)

App. 3.1.4 General cautions for safety protection and protective measures

Observe the following items to ensure proper use of the MR-JE servo amplifiers.

(1) For installing systems, only qualified personnel and professional engineers should perform.

(2) When mounting, installing, and using the MR-JE servo amplifier, always observe standards and directives applicable in the country.

App. 3.1.5 Disposal

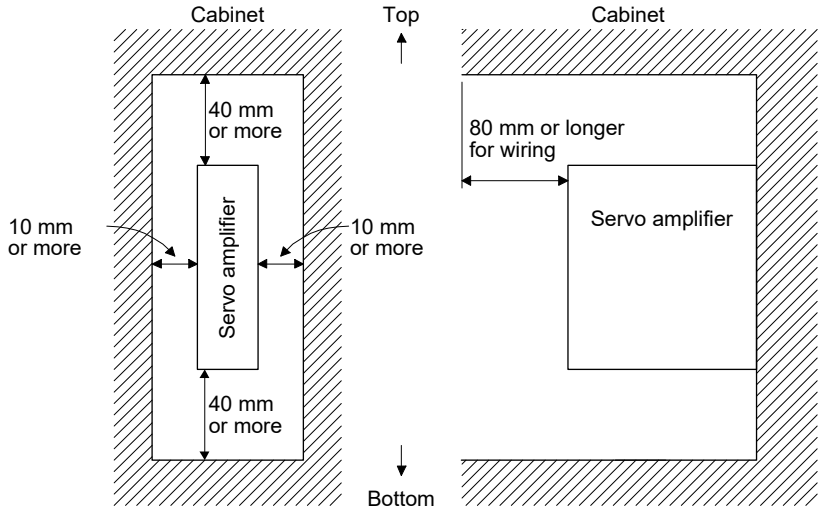
Disposal of unusable or irreparable devices should always occur in accordance with the applicable country-specific waste disposal regulations. (Example: European Waste 16 02 14)

App. 3.1.6 Lithium battery transportation

To transport lithium batteries, take actions to comply with the instructions and regulations such as the United Nations (UN), the International Civil Aviation Organization (ICAO), and the International Maritime Organization (IMO).
The batteries (MR-BAT6V1SET-A and MR-BAT6V1) are assembled batteries from two batteries (lithium metal battery CR17335A) which are not subject to the dangerous goods (Class 9) of the UN Recommendations.

App. 3.2 Installation direction and clearances

⚠CAUTION
- The devices must be installed in the specified direction. Not doing so may cause a malfunction.
- Mount the servo amplifier on a cabinet which meets IP54 in the correct vertical direction to maintain pollution degree 2.



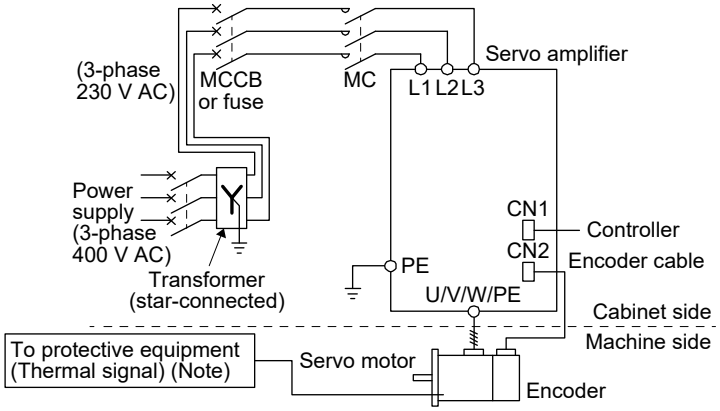
App. 3.3 Electrical Installation and configuration diagram

WARNING ●Turn off the molded-case circuit breaker (MCCB) to avoid electrical shocks or damages to the product before starting the installation or wiring.

CAUTION ●Connecting a servo motor for different axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
●Securely connect the cables in the specified method and tighten them with the specified torque. Otherwise, the servo motor may operate unexpectedly.

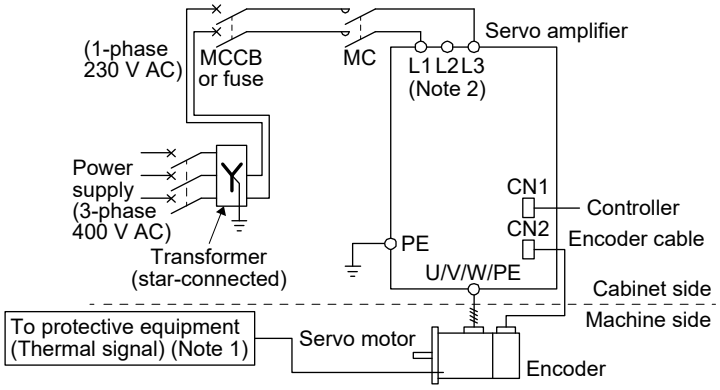
The following shows representative configuration examples to conform to the IEC/EN/UL/CSA standards.

(1) 3-phase input



Note. Please use a thermal sensor, etc. for thermal protection of the servo motor.

(2) 1-phase input



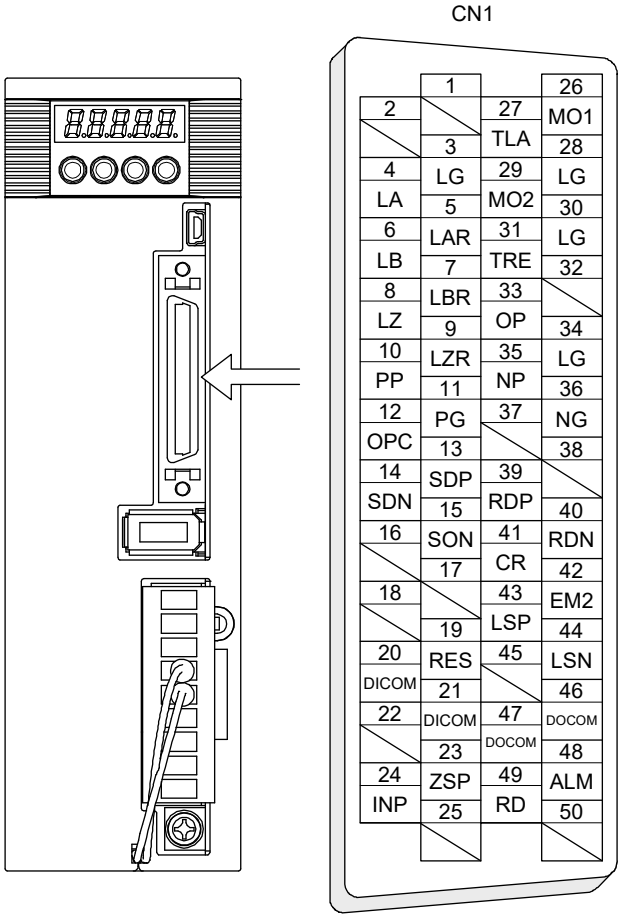
Note 1. Please use a thermal sensor, etc. for thermal protection of the servo motor.
2. For the MR-JE-200_ servo amplifiers, connect the power supply to L1 and L2. Leave L3 open.

The connectors described by rectangles are safely separated from the main circuits described by circles.
Use MR-JE servo amplifiers in combination with HG series or HJ series servo motors.

App. 3.4 Signals

App. 3.4.1 Signal

The following shows CN1 connector signals of MR-JE-10A as a typical example.



This is in position control mode.

App. 3.4.2 I/O device

The following shows typical I/O devices of MR-JE-_A. For the other devices, refer to each servo amplifier instruction manual.

Input device

Symbol	Device	Connector	Pin No.
SON	Servo-on	CN1	15
RES	Reset		19
CR	Clear		41
EM2	Forced stop 2		42
LSP	Forward rotation stroke end		43
LSN	Reverse rotation stroke end		44

Output device

Symbol	Device	Connector	Pin No.
ZSP	Zero speed detection	CN1	23
INP	In-position		24
ALM	Malfunction		48
RD	Ready		49

Power supply

Symbol	Device	Connector	Pin No.
DICOM	Digital I/F power supply input	CN1	20, 21
DOCOM	Digital I/F common		46, 47
SD	Shield		Plate

App. 3.5 Maintenance and service

> **WARNING** ●To avoid an electric shock, only qualified personnel should attempt inspections. For repair and parts replacement, contact your local sales office.

App. 3.5.1 Inspection items

It is recommended that the following points periodically be checked.

(1) Check for loose screws on the protective earth (PE) terminal. Retighten any loose screws. (tightening torque: 1.2 N•m)

(2) Servo motor bearings, brake section, etc. for unusual noise.

(3) Check the cables and the like for scratches or cracks. Perform periodic inspection according to operating conditions.

(4) Check that the connectors are securely connected to the servo motor.

(5) Check that the wires are not coming out from the connector.

(6) Check for dust accumulation on the servo amplifier.

(7) Check for unusual noise generated from the servo amplifier.

(8) Check the servo motor shaft and coupling for connection.

(9) Make sure that the emergency stop circuit operates properly such that an operation can be stopped immediately and a power is shut off by the emergency stop switch.

App. 3.5.2 Parts having service life

Service life of the following parts is listed below. However, the service life varies depending on operation and environment. If any fault is found in the parts, they must be replaced immediately regardless of their service lives. For parts replacement, please contact your local sales office.

Part name	Life guideline
Smoothing capacitor	10 years (Note 3)
Relay	Number of power-on, forced stop, and controller forced stop times: 100,000 times
Cooling fan	50,000 hours to 70,000 hours (7 years to 8 years)
Battery backup time (Note 1)	Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C)
Battery life (Note 2)	5 years from date of manufacture

Note 1. The time is for using MR-BAT6V1SET-A. For details and other battery backup time, refer to each servo amplifier instruction manual.

2. Quality of the batteries degrades by the storage condition. The battery life is 5 years from the production date regardless of the connection status.

3. The characteristic of smoothing capacitor is deteriorated due to ripple currents, etc. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will be the end of its life in 10 years of continuous operation in air-conditioned environment (ambient temperature of 40 °C or less for use at the maximum 1000 m above sea level, 30 °C or less for over 1000 m to 2000 m).

App. 3.6 Transportation and storage

⚠CAUTION

- Transport the products correctly according to their mass.
- Stacking in excess of the limited number of product packages is not allowed.
- For detailed information on the battery's transportation and handing refer to app. 1 and app. 2.
- Install the product in a load-bearing place of servo amplifier and servo motor in accordance with instruction manual.
- Do not get on or put heavy load on the equipment.
- Do not hold the lead of the built-in regenerative resistor, cables, or connectors when carrying the servo amplifier. Otherwise, it may drop.

When you keep or use it, please fulfill the following environment.

Item		Environment
Ambient temperature	Operation [°C]	0 to 55 Class 3K3 (IEC/EN 60721-3-3)
	Transportation (Note) [°C]	-20 to 65 Class 2K4 (IEC/EN 60721-3-2)
	Storage (Note) [°C]	-20 to 65 Class 1K4 (IEC/EN 60721-3-1)
Ambient humidity	Operation, transportation, storage	5 %RH to 90 %RH
Vibration resistance	Test condition	10 Hz to 57 Hz with constant amplitude of 0.075 mm 57 Hz to 150 Hz with constant acceleration of 9.8 m/s^2 to IEC/EN 61800-5-1 (Test Fc of IEC 60068-2-6)
	Operation	5.9 m/s^2
	Transportation (Note)	Class 2M3 (IEC/EN 60721-3-2)
	Storage	Class 1M2 (IEC/EN 60721-3-2)
Pollution degree		2
IP rating		IP20 (IEC/EN 60529)
		Open type (UL 50)
Altitude	Operation, storage	Max. 2000 m above sea level
	Transportation	Max. 10000 m above sea level

Note. In regular transport packaging

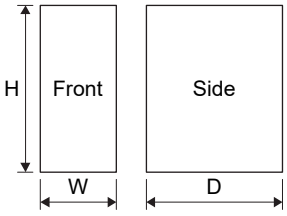
App. 3.7 Technical data

App. 3.7.1 MR-JE servo amplifier

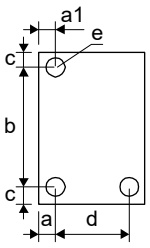
Item		MR-JE-10_/MR-JE-20_/MR-JE-40_/ MR-JE-70_/MR-JE-100_/MR-JE-200_	MR-JE-300_
Power supply	Line voltage	3-phase or 1-phase 200 V AC to 240 V AC, 50 Hz /60 Hz	3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz
	Interface (SELV)	24 V DC, (required current capacity: MR-JE-_A(S), 300 mA; MR-JE-_B, 300 mA; MR-JE-_C, 300 mA) (Note)	
Control method		Sine-wave PWM control, current control method	
Pollution degree		2 (IEC/EN 60664-1)	
Overvoltage category		1-phase 200 V AC: II (IEC/EN 60664-1), 3-phase 200 V AC: III (IEC/EN 60664-1)	
Protective class		I (IEC/EN 61800-5-1)	
Short-circuit current rating (SCCR)		100 kA	

No te. This will be 100 mA for the MR-JE-_B servo amplifiers manufactured in April 2016 or before (May 2016 or before for amplifiers manufactured in China).

App. 3.7.2 Dimensions/mounting hole process drawing



Servo amplifier	Variable dimensions [mm]			Mass [kg]
	W	H	D	
MR-JE-10_/MR-JE-20_/MR-JE-40_	50	168	135	0.8
MR-JE-70_/MR-JE-100_	70	168	185	1.5
MR-JE-200_/MR-JE-300_	90	168	195	2.1



Servo amplifier	Variable dimensions [mm]					Screw size
	a	a1	b	c	d	e
MR-JE-10_/MR-JE-20_/MR-JE-40_	6	6	156 ± 0.5	6		M5
MR-JE-70_/MR-JE-100_	22	22	156 ± 0.5	6	42 ± 0.3	M5
MR-JE-200_/MR-JE-300_	6	45	156 ± 0.5	6	78 ± 0.3	M5

App. 4 Low voltage directive

MR-JE series servo amplifiers are certificated in compliance with Low voltage directive. The following shows a certificate by the Certification Body.

Zertifikat ***Certificate***

TÜVRheinland®

Zertifikat Nr. *Certificate No.* R 50244051 | **Blatt** *Page* 0001

Ihr Zeichen *Client Reference*	Unser Zeichen *Our Reference*	Ausstellungsdatum	*Date of Issue (day/mo/yr)*
T.E.	ZO-HIM- 12311510 001	11.01.2013	

Genehmigungsinhaber *License Holder*
Mitsubishi Electric Corp.
Nagoya Works
1-14, Yada-minami 5-chome
Higashi-ku, Nagoya-shi, Aichi
461-8670 JAPAN

Fertigungsstätte *Manufacturing Plant*
Mitsubishi Electric Corp.
Nagoya Works
1-14, Yada-minami 5-chome
Higashi-ku, Nagoya-shi, Aichi
461-8670 JAPAN

Prüfzeichen *Test Mark*
TÜVRheinland CERTIFIED — Type Approved Safety Regular Production Surveillance — www.tuv.com ID 2000000000

Geprüft nach *Tested acc. to*
EN 61800-5-1:2007
IEC 61800-5-1:2007

Zertifiziertes Produkt (Geräteidentifikation) *Certified Product (Product Identification)*		Lizenzentgelte - Einheit *License Fee - Unit*
Control Unit Servo Drive Unit		
Type Designation	: MR-JE-uvw-xyz	5
	u, v, w, x, y, z = (see Appendix 1)	6
Rated Voltage	: 3AC 200-240V, 50/60Hz or AC 200-240V, 50/60Hz	
Rated Current	: (see Appendix 1)	
Protection Class	: I	
Rated Output Values	: 3AC 170V 360Hz	
Ambient Temperature	: 0°C to 55°C	
Overvoltage Category	: III (3AC200-240V) or II (AC200-240V)	
Pollution Degree	: 2	

Remark: Power circuits and secondary control circuits provide protective separation.
The unit must be installed in accordance with the manufacturer's instructions.

11

ANLAGE (Appendix): 1

Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde und es bestätigt die Konformität des Produktes mit den oben genannten Standards und Prüfgrundlagen. Zusätzliche Anforderungen in Ländern, in denen das Produkt in Verkehr gebracht werden soll, müssen zusätzlich betrachtet werden. Die Herstellung des zertifizierten Produktes wird überwacht.
This certificate is based on our Testing and Certification Regulation and states the conformity of the product with the standards and testing requirements as indicated above. Any additional requirements in countries where the product is going to be marketed have to be considered additionally. The manufacturing of the certified product is subject to surveillance.

TÜV Rheinland LGA Products GmbH Zertifizierungsstelle

Zertifizierungsstelle

TÜV Rheinland LGA Products GmbH - Tillystraße 2 - 90431 Nürnberg
Tel.: (+49/221)8 06 - 13 71 e-mail: cert-validity@de.tuv.com
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Dipl.-Ing. (FH) M. Geiser

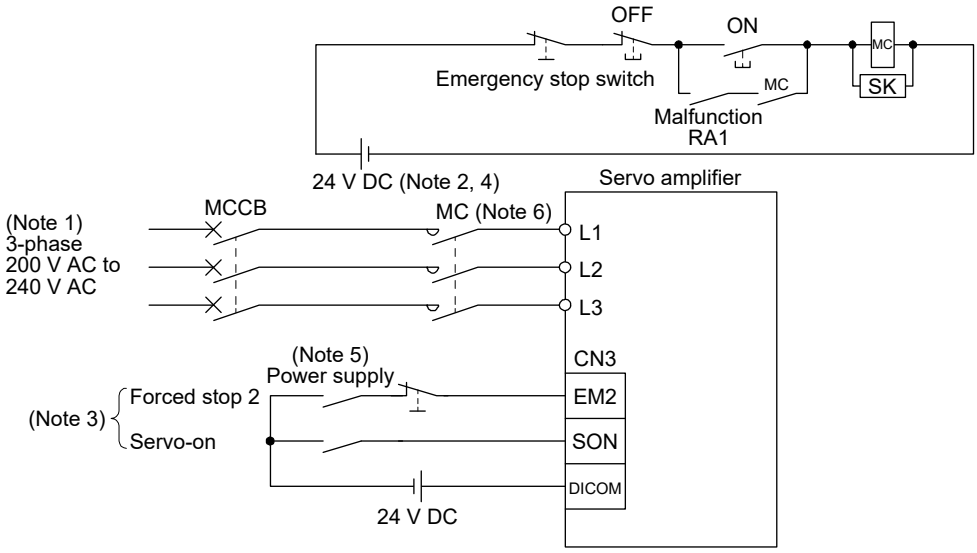
10/020 04.08 ® TÜV, TUEV and TUV are registered trademarks. Utilisation and application requires prior approval.

Supplementation: Refer to section 1.6 (2) for the models shown in "(see app. 1)".

App. 5 When turning on or off the input power supply with DC power supply

App. 5.1 Connection example

For the signals or wiring that are not described in this section, refer to section 3.1.



Note 1. When using a power supply of 1-phase 200 V AC to 240 V AC for MR-JE-10C to MR-JE-100C, connect the power supply to L1 and L3. Leave L2 open. When using a power supply of 1-phase 200 V AC to 240 V AC for MR-JE-200C, connect the power supply to L1 and L2. Leave L3 open. MR-JE-300C cannot be used with 1-phase 200 V AC to 240 V AC power supply.

2. Do not use the 24 V DC interface power supply for magnetic contactor. Always use the power supply designed exclusively for the magnetic contactor.
3. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
4. Controlling the on switch or off switch with DC power supply satisfies the requirements of IEC/EN 60204-1.
5. Configure a circuit to turn off EM2 when the power is turned off to prevent an unexpected restart of the servo amplifier.
6. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less. Depending on the power supply voltage and operation pattern, bus voltage can decrease. This can shift the mode to the dynamic brake deceleration during forced stop deceleration. When dynamic brake deceleration is not required, delay the time to turn off the magnetic contactor.

App. 5.2 Magnetic contactor

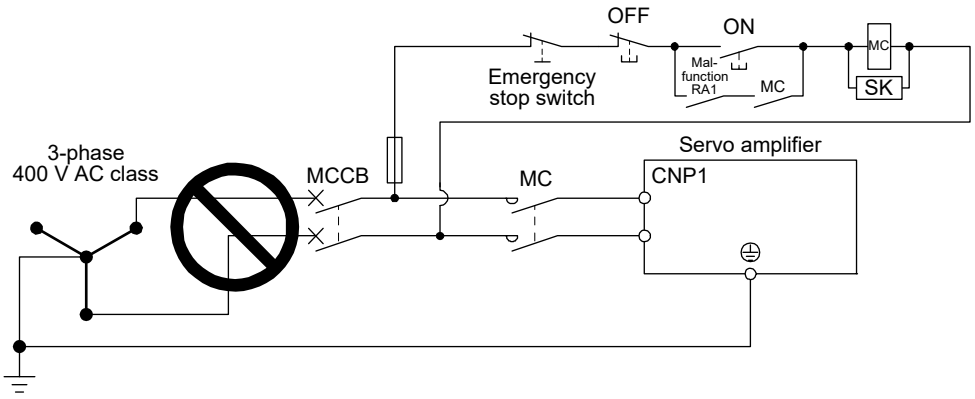
Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.

Servo amplifier	Magnetic contactor
MR-JE-10C	SD-N11
MR-JE-20C	
MR-JE-40C	
MR-JE-70C	
MR-JE-100C	
MR-JE-200C	SD-N21
MR-JE-300C	

App. 6 Using the neutral point of a 3-phase 400 V AC class power supply for inputting a 1-phase 200 V AC class power supply

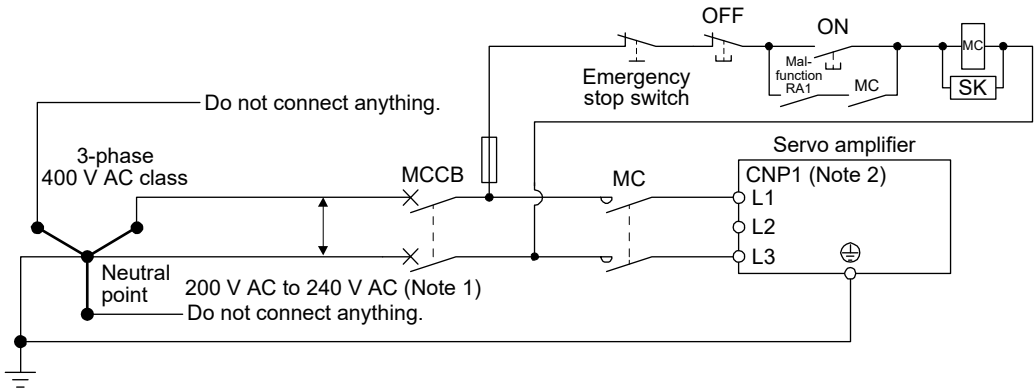
⚠CAUTION

●Do not input a 3-phase 400 V AC class power supply directly to the 200 V class servo amplifier. Otherwise, it may cause a malfunction.



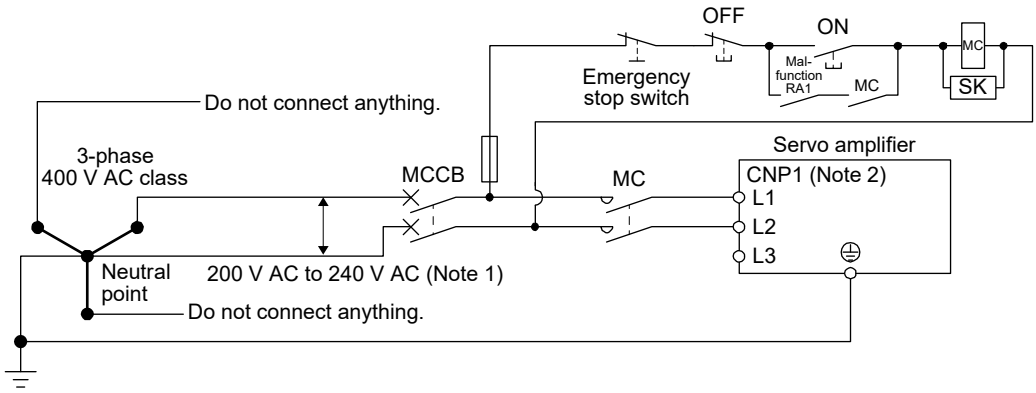
You can use the neutral point of a 3-phase 400 V AC class power supply to input a 1-phase 200 V AC class power supply to the servo amplifier.
If necessary, use a step-down transformer to decrease the power supply voltage to 200 V AC to 240 V AC.

(1) For MR-JE-10C to MR-JE-100C



Note 1. If necessary, use a step-down transformer to decrease the power supply voltage to 200 V AC to 240 V AC.
2. Connect the 1-phase 200 V AC to 240 V AC power supply to L1 and L3. One of the connecting destinations is different from MR-JE-200C servo amplifier's.

(2) For MR-JE-200C



Note 1. If necessary, use a step-down transformer to decrease the power supply voltage to 200 V AC to 240 V AC.

2. Connect the 1-phase 200 V AC to 240 V AC power supply to L1 and L2. One of the connecting destinations is different from MR-JE-100C or less servo amplifier's.

App. 7 Status of general-purpose AC servo products for compliance with the China RoHS directive

(1) Summary

The China RoHS directive: 电子信息产品污染控制管理办法 (Management Methods for Controlling Pollution by Electronic Information Products) came into effect on March 1, 2007. The China RoHS directive was replaced by the following China RoHS directive: 电器电子产品有害物质限制使用管理办法 (Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products). The succeeding China RoHS directive has been in effect since July 1, 2016.
The China RoHS directive restricts the use of six hazardous substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE)) and other hazardous substances specified by the State (currently no applicable substances). The EU RoHS directive (2011/65/EU) also restricts the use of the above six hazardous substances.

(2) Status of our products for compliance with the China RoHS directive

The following tables show the content of six hazardous substances in our products and Environment-Friendly Use Period marks. Table app. 1 is created based on the standard SJ/T11364.

Table app. 1 Names and the content of hazardous substances in the products

Part name / Substance name / Threshold standard		Hazardous substance (Note 1)						Environment-Friendly Use Period mark (Note 2)	Remark
		Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr(VI))	PBB	PBDE		
		Threshold of cadmium: 0.01 wt% (100 ppm), Threshold of substances other than cadmium: 0.1 wt% (1000 ppm)							
Servo amplifier Servo system controller	Mounting board	×	○	○	○	○	○		
	Heat sink	×	○	○	○	○	○		
	Resin cabinet	○	○	○	○	○	○		
	Plate and screw	○	○	○	○	○	○		
Servo motor	Bracket	×	○	○	○	○	○		
	Mounting board	×	○	○	○	○	○		
	Resin cabinet	○	○	○	○	○	○		
	Core and cable	○	○	○	○	○	○		
Cable product	Cable	○	○	○	○	○	○		Including connector set
	Connector	○	○	○	○	○	○		
Optional unit	Mounting board	×	○	○	○	○	○		
	Resin cabinet	○	○	○	○	○	○		
	Plate and screw	○	○	○	○	○	○		

Note 1. ○: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T26572.
×: Indicates that said hazardous substance contained in at least one of the homogeneous materials for this part is above the limit requirement of GB/T26572.

2. Indications based on "Marking for the restriction of the use of hazardous substances in electrical and electronic product" [SJ/T11364-2014]

Indicates that a certain hazardous substance is contained in the product manufactured or sold in China. Observe safety and usage precautions for the product, and use it within a limited number of years from the production date. Thereby, any of the hazardous substances in the product does not cause environmental pollution, or seriously affect human health or property.

Indicates that no certain hazardous substance is contained in the product.

(3) Difference between the China RoHS directive and the EU RoHS directive
The China RoHS directive allows no restriction exemption unlike the EU RoHS directive. Although a product complies with the EU RoHS directive, a hazardous substance in the product may be considered to be above the limit requirement (marked "×") in the China RoHS directive.
The following shows some restriction exemptions and their examples according to the EU RoHS directive.

- Lead as an alloying element in steel for machining purposes and in galvanized steel containing up to 0.35% lead by weight, lead as an alloying element in aluminum containing up to 0.4% lead by weight, and copper alloy containing up to 4% lead by weight, e.g. brass-made insert nuts
- Lead in high melting temperature type solders (i.e. lead-based alloys containing 85% by weight or more lead)
- Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices
- Electrical and electronic components containing lead in a glass or ceramic matrix compound, e.g. chip resistors

(4) Status of our products for compliance with the China RoHS directive (Chinese)
The following shows table app. 1 in Chinese according to "Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products".

表附.2 产品中所含有害物质的名称及含量

物质名称 阈值 基准 部件名称		有害物质 (注1) 铅 (Pb) 汞 (Hg) 镉 (Cd) 六价铬 (Cr(VI)) PBB PBDE 阈值：镉：0.01wt%(100ppm)、 镉以外：0.1wt%(1000ppm)、						环境保护使用期限标识 (注2)	备注
伺服放大器 伺服系统 控制器	电路板组件	×	○	○	○	○	○		
	散热片	×	○	○	○	○	○		
	树脂壳体	○	○	○	○	○	○		
	金属板、螺丝	○	○	○	○	○	○		
伺服电机	托架	×	○	○	○	○	○		
	电路板组件	×	○	○	○	○	○		
	树脂壳体	○	○	○	○	○	○		
	铁心、电线	○	○	○	○	○	○		
电缆 加工品	电线	○	○	○	○	○	○		包括连接器组件
	连接器	○	○	○	○	○	○		
选件 模块	电路板组件	×	○	○	○	○	○		
	树脂壳体	○	○	○	○	○	○		
	金属板、螺丝	○	○	○	○	○	○		

注 1. ○：表示该有害物质在该部件所有均质材料中的含量均在GB/T26572规定的限量要求以下。
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2. 根据“电子电气产品有害物质限制使用标识要求”、[SJ/T11364-2014]的表示

该标志表示在中国制造/销售的产品中含有特定有害物质。
只要遵守本产品的安全及使用方面的注意事项，从生产日算起的环保使用期限内不会造成环境污染或对人体、财产产生深刻的影响。

该标志表示制造的产品中不含有特定有害物质。

REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision Date	*Manual Number	Revision
Mar. 2017	SH(NA)030257ENG-A	First edition
Aug. 2017	SH(NA)030257ENG-B	MR-JE-200C and MR-JE-300C are added, and a maximum altitude of 2000 m above sea level is supported.
		3. To prevent injury, note the following — Partially changed.
		4. Additional instructions
		(1) Transportation and installation — Partially changed.
		(2) Wiring — Partially changed.
		(3) Test run and adjustment — Partially changed.
		(4) Usage — Partially changed.
		(5) Corrective actions — Partially changed.
		Section 1.2 — Partially changed. (2) is added.
		Section 1.3 — Partially added and partially changed.
		Section 1.4 — Partially added.
		Section 1.5 — Partially added and partially changed.
		Section 1.6 (2) — Partially added.
		Section 1.7.1 — Partially changed. (2) is added.
		Section 1.8 — Partially changed. (2) is added.
		Section 2.6 — Newly added.
		Section 3.1 — Partially changed. (3) and (4) are added.
		Section 3.3.1 — Partially added and partially changed.
		Section 3.3.3 (1) — Partially changed. (b) is added.
		Section 3.3.3 (2) — Partially changed.
		Section 4.1.2 (1) (c) — Partially changed. 2) is added.
		Section 4.5 — POINT is partially changed.
		Section 4.5.3 — Partially changed.
		Chapter 5 — POINT is partially added.
		Section 5.2.1 — [Pr. PA02] is partially changed.
		Section 5.2.2 — [Pr. PB07], [Pr. PB19], [Pr. PB20], [Pr. PB52], [Pr. PB53], [Pr. PB54], and [Pr. PB55] are partially changed.
		Chapter 6 — POINT is partially added.
		Section 9.1 (3) — Newly added.
		Section 10.2 (1) — Partially added.
		Section 10.3 — Partially added and partially changed.
		Section 10.5 — Partially added.
		Section 11.1.1 — Partially added and partially changed.
		Section 11.1.3 — Partially added and partially changed.
		Section 11.2.2 (2) — Partially added.
		Section 11.2.3 — Partially added.
		Section 11.2.4 — Partially added and partially changed.
		Section 11.2.5 — Partially changed. (3) is added.
		Section 11.4 — POINT is partially changed.
		Section 11.4.2 — Partially changed. (2) (b) is added.
		Section 11.5.2 (3) — Partially added.
		Section 11.6 — Partially added and partially changed.
		Section 11.7 — Partially added.
		Section 11.8 — Partially added.
		Section 11.11 — Partially added.
		Section 11.12 — Partially added.
		Section 12.3 — Partially added and partially changed.
		App. 1 (3) (b) — The diagram is added.
		App. 3 — Partially changed.

Revision Date	*Manual Number	Revision	
Aug. 2017	SH(NA)030257ENG-B	App. 6	Partially changed.
		App. 6.2	Partially added.
		App. 7	Partially changed. (2) is added.
Oct. 2018	SH(NA)030257ENG-C	Positioning operation and Modbus RTU are supported.	
		About the manuals	Partially changed.
		Section 1.1	Partially changed.
		Section 1.2	Partially changed.
		Section 1.3	Partially changed.
		Section 1.5	Partially changed.
		Section 1.7.1	Partially changed.
		Section 1.8	Partially changed.
		Section 3.2.1	Partially changed.
		Section 3.2.2	Partially changed.
		Section 3.2.3	Partially changed.
		Section 3.3.1	Partially changed.
		Section 3.4	Partially changed.
		Section 3.7	Partially changed.
		Section 3.7.1	Partially changed.
		Section 3.7.2	Partially changed.
		Section 3.7.3	Partially changed.
		Section 3.9.1	Partially changed.
		Section 3.10.1	Partially changed.
		Section 3.10.2	Partially changed.
		Section 4.1.1	Partially changed.
		Section 4.5	POINT is partially changed.
		Section 4.5.1	Partially changed.
		Section 4.5.3	Partially changed.
		Section 4.7	Partially changed.
		Section 5.1.1	Partially changed.
		Section 5.1.3	Partially changed.
		Section 5.1.6	Partially changed.
		Section 5.1.7	Newly added.
		Section 5.2.1	Partially changed.
		Section 5.2.2	Partially changed.
		Section 5.2.3	Partially changed.
		Section 5.2.6	Partially changed.
		Section 6.2	POINT is partially changed.
		Section 6.2.3	Partially changed.
		Section 8.2	Partially changed.
		Section 8.3	Partially changed.
		Section 10.5	Partially changed.
		Section 11.1.1	Partially changed.
		Section 11.2.2	Partially changed.
		Section 11.4	POINT is partially changed.
		Section 11.4.1	Partially changed.
		Section 11.8	Partially changed.
		Section 12.3.1	Partially changed.
		Section 12.3.2	Partially changed.
		App. 3.1.2	Partially changed.
		App. 3.1.3	Partially changed.

Revision Date	*Manual Number	Revision
Nov. 2025	SH(NA)-030257ENG-D	The back cover is changed. A note is added to the connection diagram of the servo motor with an electromagnetic brake. • Edited: Section 3.10.1

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Warranty

1. Warranty period and coverage

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit is repaired or replaced.

[Term]

For terms of warranty, please contact your original place of purchase.

[Limitations]

(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.

(2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.

(3) Even during the term of warranty, the repair cost will be charged on you in the following cases;

1. a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
2. a failure caused by any alteration, etc. to the Product made on your side without our approval
3. a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
4. a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
5. any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
6. a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
7. a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
8. any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.

(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product. However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product

(1) For the use of our AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in AC Servo, and a backup or fail-safe function should operate on an external system to AC Servo when any failure or malfunction occurs.

(2) Our AC Servo is designed and manufactured as a general purpose product for use at general industries.
Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

(3) Mitsubishi 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.

SH(NA)030257ENG-D(2511)MEE
MODEL:
MODEL CODE:

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