

General-Purpose AC Servo

MITSUBISHI SERVO AMPLIFIERS & MOTORS MELSERVO-J4

General-Purpose Interface AC Servo MODEL

MR-J4-_A_(-RJ) MR-J4-03A6(-RJ)

SERVO AMPLIFIER INSTRUCTION MANUAL

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".



Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.



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

MARNING MARNING

- Before wiring and inspections, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. 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.
- During power-on or operation, do not open the front cover of the servo amplifier. Otherwise, it may cause an electric shock.
- ■Do not operate the servo amplifier with the front cover removed. High-voltage terminals and charging area are exposed and you may get an electric shock.
- Except for wiring and periodic inspection, do not remove the front cover of the servo amplifier even if the power is off. The servo amplifier is charged and you may get 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

A 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 main circuit power supply (L1, L2, and 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.
- Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the regenerative resistor.
- ◆Always connect a molded-case circuit breaker, or a fuse to each servo amplifier between the power supply and the main circuit power supply (L1, L2, and 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 moldedcase 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.
- 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 voltage specified in the Instruction Manual should be applied to each terminal. Otherwise, a burst, damage, 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 fault, injury, electric shock, fire, etc.

(1) Transportation and installation

⚠ CAUTION

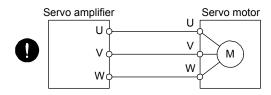
- Transport the products correctly according to their mass.
- Stacking in excess of the specified number of product packages is not allowed.
- Do not hold the front cover when transporting the servo amplifier. Otherwise, it may drop.
- ●Install the servo amplifier and the servo motor in a load-bearing place in accordance with the Instruction Manual.
- Do not get on or put heavy load on the equipment.
- ●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 strike the servo amplifier and servo motor. Isolate them from all impact loads.
- ■When you keep or use the equipment, please fulfill the following environment.

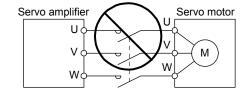
Items Environment		Environment		
Ambient	Operation	0 °C to 55 °C (non-freezing)		
temperature	Storage	-20 °C to 65 °C (non-freezing)		
Ambient	Operation	90 %RH or less (non-condensing)		
humidity	Storage	90 70RH of less (non-condensing)		
Ambie	nce	Indoors (no direct sunlight), free from corrosive gas, 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 equipment 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 the 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.

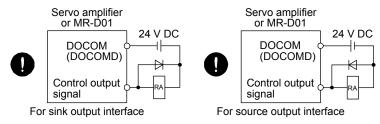
⚠ CAUTION

- •Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly.
- Do not install a power capacitor, surge killer, or radio noise filter (FR-BIF(-H) option) on the servo amplifier output side.
- ■To avoid a malfunction, connect the wires to the correct phase terminals (U, V, and W) of the servo amplifier and servo motor.
- ■Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and 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 for different axis to the U, V, W, or CN2 may cause a malfunction.
- Configure a circuit to turn off EM2 or EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.

(3) Test run and adjustment

A CAUTION

- •Before operation, check the parameter settings. Improper settings may cause some machines to perform unexpected operation.
- Never adjust or change the parameter values extremely as it will make operation unstable.
- Do not close to moving parts at servo-on status.

(4) Usage

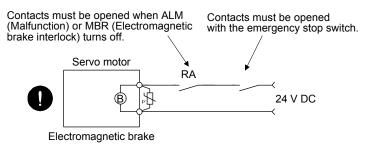
↑ CAUTION

- Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately.
- Do not disassemble, repair, or modify the equipment.
- ■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.
- ■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 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.

(5) Corrective actions

⚠ CAUTION

- Ensure safety by confirming the power off, etc. before performing corrective actions. Otherwise, it may cause an accident.
- When it is assumed that a hazardous condition may occur due to a power failure or product malfunction, use a servo motor with an electromagnetic brake or external brake to prevent the condition.
- Configure an electromagnetic brake circuit so that it is activated also by an external emergency stop switch.



- ●When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation.
- Provide an adequate protection to prevent unexpected restart after an instantaneous power failure.

(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 Specifications and Instruction Manual.

DISPOSAL OF WASTE

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



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
- Home position setting in the absolute position detection system

STO function of the servo amplifier

The servo amplifier complies with safety integrity level 3 (SIL 3) of the IEC 61508:2010 functional safety standard.

Refer to app. 12 for schedule.

When using the STO function of the servo amplifier, refer to chapter 13.

For the MR-J3-D05 safety logic unit, refer to app. 5.

Compliance with global standards

For the compliance with global standards, refer to app. 4.

«About the manuals»

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

When using the MR-J4-03A6(-RJ), refer to chapter 18.

Relevant manuals

Manual name	Manual No.
MR-J4ARJ Servo Amplifier Instruction Manual (Positioning Mode) (Note 5)	SH(NA)030143
MR-J4ARJ SERVO AMPLIFIER INSTRUCTION MANUAL (Modbus-RTU Protocol) (Note 7)	SH(NA)030175
MR-J4-DU_(-RJ)/MR-CR55K_ INSTRUCTION MANUAL (Note 6)	SH(NA)030153
MR-J4 Servo Amplifier Instruction Manual (Troubleshooting)	SH(NA)030109
MELSERVO Servo Motor Instruction Manual (Vol. 3) (Note 1)	SH(NA)030113
MELSERVO Linear Servo Motor Instruction Manual (Note 2)	SH(NA)030110
MELSERVO Direct Drive Motor Instruction Manual (Note 3)	SH(NA)030112
MELSERVO Linear Encoder Instruction Manual (Note 2, 4)	SH(NA)030111
EMC Installation Guidelines	IB(NA)67310
PARAMETER UNIT MR-PRU03 INSTRUCTION MANUAL (MR-J4)	SH(NA)030186
MR-D30 Instruction Manual (Note 8)	SH(NA)030132

Note 1. It is necessary for using a rotary servo motor.

- 2. It is necessary for using a linear servo motor.
- 3. It is necessary for using a direct drive motor.
- 4. It is necessary for using a fully closed loop system.
- 5. It is necessary for using an MR-J4-_A_-RJ servo amplifier in the positioning mode.
- 6. It is necessary for using an MR-J4-DU_A_(-RJ) drive unit and MR-CR55K_ converter unit.
- 7. It is necessary for using the Modbus-RTU communication function.
- 8. It is necessary for using an MR-D30 functional safety unit.

«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			

CONTENTS

1. FUNCTIONS AND CONFIGURATION	1- 1 to 1-54
Summary Function block diagram Servo amplifier standard specifications	1- 3
1.4 Combinations of servo amplifiers and servo motors	
1.5 Function list	
1.6 Model designation	
1.7 Structure	
1.7.1 Parts identification	
1.7.2 Removal and reinstallation of the front cover	1-39
1.8 Configuration including peripheral equipment	1-41
2. INSTALLATION	2- 1 to 2- 8
2.1 Installation direction and clearances	2- 2
2.2 Keeping out of foreign materials	2- 4
2.3 Encoder cable stress	2- 4
2.4 Inspection items	2- 5
2.5 Parts having service life	2- 6
2.6 Restrictions when using the servo amplifiers at altitude exceeding 1000 n	
above sea level	2- 7
3. SIGNALS AND WIRING	3- 1 to 3-76
3.1 Input power supply circuit	
3.1.1 200 V class	3- 3
3.1.1 200 V class	3- 3 3- 8
3.1.1 200 V class	3- 3 3- 8 3-11
3.1.1 200 V class	
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode	
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode	3- 3 3- 8 3-11 3-12 3-12 3-15
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.2.3 Torque control mode	3- 3 3- 8 3-11 3-12 3-12 3-15 3-18
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.2.3 Torque control mode 3.3.3 Explanation of power supply system	3- 3 3- 8 3-11 3-12 3-12 3-15 3-18 3-21
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.2.3 Torque control mode 3.3.1 Signal explanations	3- 3 3- 8 3-11 3-12 3-12 3-15 3-18 3-21
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.2.3 Torque control mode 3.3 Explanation of power supply system 3.3.1 Signal explanations 3.3.2 Power-on sequence	3- 3 3- 8 3-11 3-12 3-15 3-18 3-21 3-21 3-22
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.2.3 Torque control mode 3.3 Explanation of power supply system 3.3.1 Signal explanations 3.3.2 Power-on sequence 3.3.3 Wiring CNP1, CNP2, and CNP3	3- 3 3- 8 3-11 3-12 3-12 3-15 3-18 3-21 3-21 3-22 3-23
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.2.3 Torque control mode 3.3 Explanation of power supply system 3.3.1 Signal explanations 3.3.2 Power-on sequence 3.3.3 Wiring CNP1, CNP2, and CNP3 3.4 Connectors and pin assignment	3- 3 3- 8 3-11 3-12 3-15 3-15 3-18 3-21 3-21 3-22 3-23 3-23
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.2.3 Torque control mode 3.3 Explanation of power supply system 3.3.1 Signal explanations 3.3.2 Power-on sequence 3.3.3 Wiring CNP1, CNP2, and CNP3 3.4 Connectors and pin assignment 3.5 Signal (device) explanations	3- 3 3- 8 3-11 3-12 3-12 3-15 3-18 3-21 3-21 3-21 3-22 3-23 3-23 3-27 3-30
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.2.3 Torque control mode 3.3 Explanation of power supply system 3.3.1 Signal explanations 3.3.2 Power-on sequence 3.3.3 Wiring CNP1, CNP2, and CNP3 3.4 Connectors and pin assignment	3- 3 3- 8 3-11 3-12 3-12 3-15 3-18 3-21 3-21 3-22 3-23 3-27 3-30 3-40
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.2.3 Torque control mode 3.3 Explanation of power supply system 3.3.1 Signal explanations 3.3.2 Power-on sequence 3.3.3 Wiring CNP1, CNP2, and CNP3 3.4 Connectors and pin assignment 3.5 Signal (device) explanations 3.6 Detailed explanation of signals	3- 3 3- 8 3-11 3-12 3-12 3-15 3-15 3-18 3-21 3-21 3-22 3-23 3-23 3-27 3-30 3-40
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example. 3.2.1 Position control mode. 3.2.2 Speed control mode. 3.2.3 Torque control mode. 3.3 Explanation of power supply system. 3.3.1 Signal explanations. 3.3.2 Power-on sequence. 3.3.3 Wiring CNP1, CNP2, and CNP3. 3.4 Connectors and pin assignment. 3.5 Signal (device) explanations. 3.6 Detailed explanation of signals. 3.6.1 Position control mode.	3- 3 3- 8 3-11 3-12 3-12 3-15 3-18 3-21 3-21 3-21 3-22 3-23 3-23 3-27 3-30 3-40 3-40 3-45
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.3 Torque control mode 3.3 Explanation of power supply system 3.3.1 Signal explanations 3.3.2 Power-on sequence 3.3.3 Wiring CNP1, CNP2, and CNP3 3.4 Connectors and pin assignment 3.5 Signal (device) explanations 3.6 Detailed explanation of signals 3.6.1 Position control mode 3.6.2 Speed control mode	3- 3 3- 8 3-11 3-12 3-12 3-15 3-18 3-21 3-21 3-22 3-23 3-23 3-27 3-30 3-40 3-40 3-45 3-47
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example. 3.2.1 Position control mode. 3.2.2 Speed control mode. 3.2.3 Torque control mode. 3.3 Explanation of power supply system 3.3.1 Signal explanations. 3.2.2 Power-on sequence. 3.3.3 Wiring CNP1, CNP2, and CNP3. 3.4 Connectors and pin assignment. 3.5 Signal (device) explanations. 3.6 Detailed explanation of signals. 3.6.1 Position control mode. 3.6.2 Speed control mode. 3.6.3 Torque control mode. 3.6.4 Position/speed control switching mode. 3.6.5 Speed/torque control switching mode.	3- 3 3- 8 3-11 3-12 3-12 3-15 3-18 3-21 3-21 3-21 3-22 3-23 3-23 3-27 3-30 3-40 3-40 3-40 3-45 3-45 3-50 3-50
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.2.3 Torque control mode 3.3 Explanation of power supply system 3.3.1 Signal explanations 3.3.2 Power-on sequence 3.3.3 Wiring CNP1, CNP2, and CNP3 3.4 Connectors and pin assignment 3.5 Signal (device) explanations 3.6 Detailed explanation of signals 3.6.1 Position control mode 3.6.2 Speed control mode 3.6.3 Torque control mode 3.6.4 Position/speed control switching mode 3.6.5 Speed/torque control switching mode 3.6.6 Torque/position control switching mode	3- 3 3- 8 3-11 3-12 3-12 3-15 3-18 3-18 3-21 3-21 3-21 3-22 3-23 3-27 3-30 3-40 3-40 3-45 3-47 3-50 3-52 3-54
3.1.1 200 V class. 3.1.2 400 V class. 3.1.3 100 V class. 3.2 I/O signal connection example. 3.2.1 Position control mode. 3.2.2 Speed control mode. 3.3 Torque control mode. 3.3 Explanation of power supply system. 3.3.1 Signal explanations. 3.3.2 Power-on sequence. 3.3.3 Wiring CNP1, CNP2, and CNP3. 3.4 Connectors and pin assignment. 3.5 Signal (device) explanations. 3.6 Detailed explanation of signals. 3.6.1 Position control mode. 3.6.2 Speed control mode. 3.6.3 Torque control mode. 3.6.4 Position/speed control switching mode. 3.6.5 Speed/torque control switching mode. 3.6.6 Torque/position control switching mode. 3.7 Forced stop deceleration function.	3- 3 3- 8 3-11 3-12 3-12 3-15 3-15 3-18 3-21 3-21 3-21 3-22 3-23 3-27 3-30 3-40 3-40 3-45 3-45 3-50 3-52 3-54
3.1.1 200 V class 3.1.2 400 V class 3.1.3 100 V class 3.2 I/O signal connection example 3.2.1 Position control mode 3.2.2 Speed control mode 3.2.3 Torque control mode 3.3 Explanation of power supply system 3.3.1 Signal explanations 3.3.2 Power-on sequence 3.3.3 Wiring CNP1, CNP2, and CNP3 3.4 Connectors and pin assignment 3.5 Signal (device) explanations 3.6 Detailed explanation of signals 3.6.1 Position control mode 3.6.2 Speed control mode 3.6.3 Torque control mode 3.6.4 Position/speed control switching mode 3.6.5 Speed/torque control switching mode 3.6.6 Torque/position control switching mode	3- 3 3- 8 3-11 3-12 3-12 3-15 3-18 3-18 3-21 3-21 3-21 3-22 3-23 3-27 3-30 3-40 3-40 3-40 3-45 3-45 3-50 3-50 3-52

3.7.3 Vertical axis freefall prevention function	3-58
3.7.4 Residual risks of the forced stop function (EM2)	3-58
3.8 Alarm occurrence timing chart	3-59
3.8.1 When you use the forced stop deceleration function	3-59
3.8.2 When you do not use the forced stop deceleration function	3-60
3.9 Interfaces	3-61
3.9.1 Internal connection diagram	3-61
3.9.2 Detailed explanation of interfaces	3-63
3.9.3 Source I/O interfaces	3-67
3.10 Servo motor with an electromagnetic brake	3-69
3.10.1 Safety precautions	3-69
3.10.2 Timing chart	3-71
3.11 Grounding	3-75
4. STARTUP	4- 1 to 4-44
4. STARTOF	4- 1 10 4-44
4.1 Switching power on for the first time	4- 2
4.1.1 Startup procedure	
4.1.2 Wiring check	
4.1.3 Surrounding environment	
4.2 Startup in position control mode	
4.2.1 Power on and off procedures	
4.2.2 Stop	
4.2.3 Test operation	
4.2.4 Parameter setting	
4.2.5 Actual operation	
4.2.6 Trouble at start-up	
4.3 Startup in speed control mode	
4.3.1 Power on and off procedures	
4.3.2 Stop	
4.3.3 Test operation	
4.3.4 Parameter setting	
4.3.5 Actual operation	
4.3.6 Trouble at start-up	
4.4 Startup in torque control mode	
4.4.1 Power on and off procedures	
4.4.2 Stop	
4.4.3 Test operation	
4.4.4 Parameter setting	
4.4.5 Actual operation	
4.4.6 Trouble at start-up	
4.5 Display and operation sections	
4.5.1 Summary	
4.5.2 Display flowchart	
4.5.3 Status display mode	
4.5.4 Diagnostic mode	
4.5.5 Alarm mode	
4.5.6 Parameter mode	
4.5.7 External I/O signal display	
4.5.8 Output signal (DO) forced output	4-38 4-39
A S G LECTURE COURT TO THE	/I_ KU

5. PARAMETERS	5- 1 to 5-76
5.4. Developmentar liet	F 0
5.1 Parameter list	
5.1.1 Basic setting parameters ([Pr. PA_])	
· " ==:	
5.1.3 Extension setting parameters ([Pr. PC])	
5.1.4 I/O setting parameters ([Pr. PD_])	
5.1.5 Extension setting 2 parameters ([Pr. PE])	
5.1.6 Extension setting 3 parameters ([Pr. PF])	
5.1.7 Linear servo motor/DD motor setting parameters ([Pr. PL])	
5.1.8 Option setting parameters ([Pr. Po_])	
5.2 Detailed list of parameters	
5.2.1 Basic setting parameters ([Pr. PA_])	
5.2.2 Gain/filter setting parameters ([Pr. PB_])	
5.2.3 Extension setting parameters ([Pr. PC])	
5.2.4 I/O setting parameters ([Pr. PD_])	
5.2.5 Extension setting 2 parameters ([Pr. PE])	
5.2.6 Extension setting 3 parameters ([Pr. PF])	
5.2.7 Linear servo motor/DD motor setting parameters ([Pr. PL])	
5.2.8 Option setting parameters ([Pr. Po_])	5-71
O NORMAL CAIN AR HIGTMENT	0.44-0.00
6. NORMAL GAIN ADJUSTMENT	6- 1 to 6-32
6.1 Different adjustment methods	6- 1
6.1.1 Adjustment on a single servo amplifier	
6.1.2 Adjustment using MR Configurator2	
6.2 One-touch tuning	
6.2.1 One-touch tuning flowchart	
6.2.2 Display transition and operation procedure of one-touch tuning	
6.2.3 Caution for one-touch tuning	
6.3 Auto tuning	
6.3.1 Auto tuning mode	
6.3.2 Auto tuning mode basis	
š	
6.3.3 Adjustment procedure by auto tuning	
6.3.4 Response level setting in auto tuning mode	
6.4 Manual mode	
6.5 2 gain adjustment mode	
7. SPECIAL ADJUSTMENT FUNCTIONS	7- 1 to 7-40
7. Of EGINE NEGOCIMENT FOR THORS	7 1 10 7 40
7.1 Filter setting	7- 1
7.1.1 Machine resonance suppression filter	
7.1.2 Adaptive filter II	
7.1.3 Shaft resonance suppression filter	
7.1.4 Low-pass filter	
7.1.5 Advanced vibration suppression control II	
7.1.6 Command notch filter	
7.2 Gain switching function	
7.2.1 Applications	
7.2.2 Function block diagram	
7.2.3 Parameter	

7.2.4 Gain switching procedure	7-21
7.3 Tough drive function	7-25
7.3.1 Vibration tough drive function	7-25
7.3.2 Instantaneous power failure tough drive function	7-27
7.4 Compliance with SEMI-F47 standard	
7.5 Model adaptive control disabled	
7.6 Lost motion compensation function	
7.7 Super trace control	
8. TROUBLESHOOTING	8- 1 to 8-14
8.1 Explanation for the lists	8- 1
8.2 Alarm list	8- 2
8.3 Warning list	8-11
9. DIMENSIONS	9- 1 to 9-22
9.1 Servo amplifier	9- 1
9.2 Connector	9-20
10. CHARACTERISTICS	10- 1 to 10-14
10.1 Overload protection characteristics	
10.2 Power supply capacity and generated loss	10- 5
10.3 Dynamic brake characteristics	10- 8
10.3.1 Dynamic brake operation	10- 8
10.3.2 Permissible load to motor inertia when the dynamic brake is used	10-11
10.4 Cable bending life	10-12
10.5 Inrush currents at power-on of main circuit and control circuit	10-13
11. OPTIONS AND AUXILIARY EQUIPMENT	11- 1 to 11-120
11.1 Cable/connector cote	11 1
11.1 Cable/connector sets	
11.1.1 Combinations of cable/connector sets	
11.1.2 MR-D05UDL3M-B STO cable	
11.1.3 Battery cable/junction battery cable	
11.2 Regenerative options	
11.2.1 Combination and regenerative power	
11.2.2 Selection of regenerative option	
11.2.3 Parameter setting	
11.2.4 Connection of regenerative option	
11.2.5 Dimensions	
11.3 FR-BU2-(H) Brake unit	
11.3.1 Selection	
11.3.2 Brake unit parameter setting	
11.3.3 Connection example	
11.3.4 Dimensions	
11.4 FR-RC-(H) power regeneration converter	
11.5 FR-CV-(H) power regeneration common converter	
11.5.1 Model designation	
11.5.2 Selection example	

11.6 Junction terminal block MR-1850	
11.7 MR Configurator2	11-54
11.7.1 Specifications	11-54
11.7.2 System configuration	
·	
11.7.3 Precautions for using USB communication function	
11.8 Battery	
11.8.1 Selection of battery	11-57
11.8.2 MR-BAT6V1SET battery	11-58
11.8.3 MR-BAT6V1BJ battery for junction battery cable	
11.8.4 MR-BAT6V1SET-A battery	
•	
11.8.5 MR-BT6VCASE battery case	
11.8.6 MR-BAT6V1 battery	11-76
11.9 Selection example of wires	11-77
11.10 Molded-case circuit breakers, fuses, magnetic contactors	11-81
11.11 Power factor improving DC reactors	
11.12 Power factor improving AC reactors	
· · ·	
11.13 Relays (recommended)	
11.14 Noise reduction techniques	
11.15 Earth-leakage current breaker	11-99
11.16 EMC filter (recommended)	11-102
11.17 External dynamic brake	
11.18 Panel through attachment (MR-J4ACN15K/MR-J3ACN)	
11.10 1 and through attachment (with 047.01415141111-057.014)	11-110
12. ABSOLUTE POSITION DETECTION SYSTEM	12- 1 to 12-30
12.1 Summary	12- 1
12.1 Summary	
12.1.1 Features	12- 1
12.1.1 Features	12- 1 12- 2
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure	12- 1 12- 2 12- 2
12.1.1 Features	12- 1 12- 2 12- 2
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure	
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data	
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery	
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure. 12.1.4 Parameter setting. 12.1.5 Confirmation of absolute position detection data. 12.2 Battery	
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable	
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12.2.3 Using MR-BT6VCASE battery case	
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12.2.3 Using MR-BT6VCASE battery case	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12.2.3 Using MR-BT6VCASE battery case 12.3 Standard connection example 12.4 Signal explanation	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure. 12.1.4 Parameter setting. 12.1.5 Confirmation of absolute position detection data. 12.2 Battery. 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery. 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable. 12.2.3 Using MR-BT6VCASE battery case. 12.3 Standard connection example. 12.4 Signal explanation. 12.5 Startup procedure.	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7 12- 8 12- 9
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7 12- 8 12- 9 12- 10
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12.2.3 Using MR-BT6VCASE battery case 12.3 Standard connection example 12.4 Signal explanation 12.5 Startup procedure 12.6 Absolute position data transfer protocol 12.6.1 Data transfer procedure	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7 12- 8 12- 9 12-10
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12.2.3 Using MR-BT6VCASE battery case 12.3 Standard connection example 12.4 Signal explanation 12.5 Startup procedure 12.6 Absolute position data transfer protocol 12.6.1 Data transfer method	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7 12- 8 12- 9 12- 10 12- 10 12- 11
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12.2.3 Using MR-BT6VCASE battery case 12.3 Standard connection example 12.4 Signal explanation 12.5 Startup procedure 12.6 Absolute position data transfer protocol 12.6.1 Data transfer procedure 12.6.2 Transfer method 12.6.3 Home position setting	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7 12- 8 12- 9 12- 10 12- 10 12- 11 12- 20
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12.2.3 Using MR-BT6VCASE battery case 12.3 Standard connection example 12.4 Signal explanation 12.5 Startup procedure 12.6 Absolute position data transfer protocol 12.6.1 Data transfer method	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7 12- 8 12- 9 12- 10 12- 10 12- 11 12- 20
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12.2.3 Using MR-BT6VCASE battery case 12.3 Standard connection example 12.4 Signal explanation 12.5 Startup procedure 12.6 Absolute position data transfer protocol 12.6.1 Data transfer procedure 12.6.2 Transfer method 12.6.3 Home position setting	12- 1 12- 2 12- 2 12- 3 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7 12- 8 12- 9 12- 10 12- 10 12- 10 12- 11 12- 20 12- 22
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12.2.3 Using MR-BT6VCASE battery case 12.3 Standard connection example 12.4 Signal explanation 12.5 Startup procedure 12.6 Absolute position data transfer protocol 12.6.1 Data transfer procedure 12.6.2 Transfer method 12.6.3 Home position setting 12.6.4 Use of servo motor with an electromagnetic brake 12.6.5 How to process the absolute position data at detection of stroke end	12- 1 12- 2 12- 2 12- 3 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7 12- 8 12- 9 12- 10 12- 10 12- 11 12- 20 12- 22
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12.2.3 Using MR-BT6VCASE battery case 12.3 Standard connection example 12.4 Signal explanation 12.5 Startup procedure 12.6 Absolute position data transfer protocol 12.6.1 Data transfer procedure 12.6.2 Transfer method 12.6.3 Home position setting 12.6.4 Use of servo motor with an electromagnetic brake 12.6.5 How to process the absolute position data at detection of stroke end 12.7 Absolute position data transfer errors	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7 12- 8 12- 9 12- 10 12- 10 12- 11 12- 20 12- 23 12- 23
12.1.1 Features	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7 12- 8 12- 9 12- 10 12- 10 12- 10 12- 10 12- 20 12- 22 12- 23 12- 23 12- 23
12.1.1 Features 12.1.2 Restrictions 12.1.3 Structure 12.1.4 Parameter setting 12.1.5 Confirmation of absolute position detection data 12.2 Battery 12.2.1 Using MR-BAT6V1SET battery or MR-BAT6V1SET-A battery 12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12.2.3 Using MR-BT6VCASE battery case 12.3 Standard connection example 12.4 Signal explanation 12.5 Startup procedure 12.6 Absolute position data transfer protocol 12.6.1 Data transfer procedure 12.6.2 Transfer method 12.6.3 Home position setting 12.6.4 Use of servo motor with an electromagnetic brake 12.6.5 How to process the absolute position data at detection of stroke end 12.7 Absolute position data transfer errors	12- 1 12- 2 12- 2 12- 3 12- 3 12- 4 12- 4 12- 5 12- 6 12- 7 12- 8 12- 9 12- 10 12- 10 12- 11 12- 20 12- 22 12- 23 12- 23 12- 26

13. USING STO FUNCTION	13- 1 to 13-14
13.1 Introduction	13- 1
13.1.1 Summary	
13.1.2 Terms related to safety	
13.1.3 Cautions	
13.1.4 Residual risks of the STO function	
13.1.5 Specifications	
13.1.6 Maintenance	
13.2 STO I/O signal connector (CN8) and signal layouts	
13.2.1 Signal layouts	
13.2.2 Signal (device) explanations	
13.2.3 How to pull out the STO cable	
13.3 Connection example	
13.3.1 Connection example for CN8 connector	
13.3.2 External I/O signal connection example using an MR-J3-D05 safety logic unit	
13.3.3 External I/O signal connection example using an external safety relay unit	
13.4 Detailed description of interfaces	
13.4.1 Sink I/O interface	
13.4.2 Source I/O interface	
	1
14. COMMUNICATION FUNCTION (MITSUBISHI GENERAL-PURPOSE AC SERVO PROTOCOL)	14- 1 to 14-40
14.1 Structure	14- 2
14.1.1 Configuration diagram	
14.1.2 Precautions for using RS-422/RS-232C/USB communication function	
14.2 Communication specifications	
14.2.1 Outline of communication	
14.2.2 Parameter setting	
14.3 Protocol	
14.3.1 Transmission data configuration	
14.3.2 Character codes	
14.3.3 Error codes	
14.3.4 Checksum	
14.3.5 Time-out processing	
14.3.6 Retry processing	
14.3.7 Initialization	
14.3.8 Communication procedure example	
14.4 Command and data No. list	
14.4.1 Reading command	
14.4.2 Writing commands	
14.5 Detailed explanations of commands	
14.5.1 Data processing	
14.5.2 Status display mode	
14.5.3 Parameter	
14.5.4 External I/O signal status (DIO diagnosis)	
14.5.5 Input device on/off	
14.5.6 Disabling/enabling I/O devices (DIO)	
14.5.7 Input devices on/off (test operation)	
14.5.8 Test operation mode	
14.5.9 Output signal pin on/off (output signal (DO) forced output)	

14.5.10 Alarm history	
14.5.11 Current alarm	14-38
14.5.12 Other commands	14-39
15. USING A LINEAR SERVO MOTOR	15- 1 to 15-32
	4- 4
15.1 Functions and configuration	
15.1.1 Summary	
15.1.2 Configuration including peripheral equipment	
15.2 Signals and wiring	
15.3 Operation and functions	
15.3.1 Startup	
15.3.2 Magnetic pole detection	
15.3.3 Home position return	
15.3.4 Test operation mode in MR Configurator2	
15.3.5 Function	
15.3.6 Absolute position detection system	
15.4 Characteristics	
15.4.1 Overload protection characteristics	15-28
15.4.2 Power supply capacity and generated loss	15-29
15.4.3 Dynamic brake characteristics	15-30
15.4.4 Permissible load to motor mass ratio when the dynamic brake is used	15-31
16. USING A DIRECT DRIVE MOTOR	16- 1 to 16-20
40.4 5 "	10.1
16.1 Functions and configuration	
16.1.1 Summary	
16.1.2 Configuration including peripheral equipment	
16.2 Signals and wiring	
16.3 Operation and functions	
16.3.1 Startup procedure	
16.3.2 Magnetic pole detection	
16.3.3 Function	16-12
16.4 Absolute position detection system	
16.5 Characteristics	
16.5.1 Overload protection characteristics	
16.5.2 Power supply capacity and generated loss	16-17
16.5.3 Dynamic brake characteristics	16-18
47. FULLY OLDOED LOOD OVOTEM	47.44.47.04
17. FULLY CLOSED LOOP SYSTEM	17- 1 to 17-24
17.1 Eunotions and configuration	17.0
17.1 Functions and configuration	
17.1.1 Function block diagram	
17.1.2 Selecting procedure of control mode	
17.1.3 System configuration	
17.2 Load-side encoder	
17.2.1 Linear encoder	1/6
Trial Hotomy oppositor	
17.2.2 Rotary encoder.	17- 6
17.2.3 Configuration diagram of encoder cable	17- 6 17- 7
	17- 6 17- 7

17.3.1	Startup	17-10
17.3.2	Home position return	17-17
17.3.3	Fully closed loop control error detection functions	17-19
17.3.4	Auto tuning function	17-20
17.3.5	Machine analyzer function	17-20
17.3.6	Test operation mode	17-20
17.3.7	Absolute position detection system under fully closed loop system	17-21
17.3.8	About MR Configurator2	17-22
18. MR-J4	-03A6(-RJ) SERVO AMPLIFIER	18- 1 to 18-84
18.1 Fur	nctions and configuration	18- 1
	Summary	
	Function block diagram	
	Servo amplifier standard specifications	
	Combinations of servo amplifiers and servo motors	
	Function list	
	Model definition	
18.1.7	Parts identification	18- 9
18.1.8	Configuration including peripheral equipment	18-10
	allation	
18.2.1	Installation direction and clearances	18-12
18.2.2	Installation by DIN rail	18-14
18.3 Sig	nals and wiring	18-16
18.3.1	Input power supply circuit	18-17
18.3.2	Explanation of power supply system	18-19
18.3.3	Selection of main circuit power supply/control circuit power supply	18-22
18.3.4	Power-on sequence	18-22
18.3.5	I/O signal connection example	18-23
18.3.6	Connectors and pin assignment	18-31
18.3.7	Signal (device) explanations	18-34
	Alarm occurrence timing chart	
18.3.9	Interfaces (Internal connection diagram)	18-40
18.3.10	Grounding	18-42
18.4 Sta	rtup	18-43
	Startup procedure	
18.4.2	Troubleshooting when "24 V ERROR" lamp turns on	18-45
18.4.3	Wiring check	18-46
18.4.4	Surrounding environment	18-47
18.5 Dis	play and operation sections	18-47
	Summary	
	Display flowchart	
18.5.3	Status display mode	18-49
	One-touch tuning	
	Diagnostic mode	
	Alarm mode	
	Parameter mode	
	External I/O signal display	
	Output signal (DO) forced output	
	Test operation mode	
18.6 Dim	nensions	18-74

18.7 Characteristics	18-75
18.7.1 Overload protection characteristics	18-75
18.7.2 Power supply capacity and generated loss	18-76
18.7.3 Dynamic brake characteristics	
18.7.4 Inrush currents at power-on of main circuit and control circuit	18-78
18.8 Options and peripheral equipment	18-79
18.8.1 Cable/connector sets	18-79
18.8.2 Combinations of cable/connector sets	18-80
18.8.3 Selection example of wires	18-81
18.8.4 Circuit protector	18-81
18.9 Communication function (Mitsubishi general-purpose AC servo protocol)	18-82
19. MR-D01 EXTENSION I/O UNIT	19- 1 to 19-48
19.1 Function block diagram	19- 2
19.2 Structure	
19.2.1 Parts identification	
19.2.2 Installation and removal of the MR-D01 extension I/O unit	
19.3 Configuration including peripheral equipment	
19.4 Installation direction and clearances	
19.5 Signals and wiring	
19.5.1 I/O Signal Connection Example	
19.5.2 Connectors and pin assignment	
19.5.3 Signal (device) explanations	
19.5.4 Interface	
19.6 Monitor display with MR Configurator2	
19.7 Dimensions	
19.7.1 MR-D01 extension I/O unit	
19.7.2 When an MR-D01 extension IO unit is connected to a servo amplifier	
19.8 Options peripheral equipment	
19.8.1 Combinations of cable/connector sets	
19.8.2 PS7DW-20V14B-F (Junction terminal block) (recommended)	
19.8.3 MR-TB50 (Junction terminal block)	19-47
APPENDIX	App 1 to App64
App. 1 Peripheral equipment manufacturer (for reference)	App 1
App. 2 Handling of AC servo amplifier batteries for the United Nations Recommendation	ations on the
Transport of Dangerous Goods	App 1
App. 3 Symbol for the new EU Battery Directive	App 4
App. 4 Compliance with global standards	App 5
App. 5 MR-J3-D05 Safety logic unit	App21
App. 6 EC declaration of conformity	App39
App. 7 Analog monitor	App42
App. 8 Two-wire type encoder cable for HG-MR/HG-KR	App49
App. 9 How to replace servo amplifier without magnetic pole detection	App50
App. 10 Special specification	
App. 11 Driving on/off of main circuit power supply with DC power supply	App56
App. 12 STO function with SIL 3 certification	
App. 13 When using the servo amplifier with the DC power supply input	• • • • • • • • • • • • • • • • • • • •

MEMO

POINT

●In MELSERVO-J4 series, ultra-small capacity servo amplifiers compatible with 48 V DC and 24 V DC power supplies are available as MR-J4-03A6(-RJ). Refer to chapter 18 for details of MR-J4-03A6(-RJ) servo amplifiers.

1.1 Summary

The Mitsubishi MELSERVO-J4 series general-purpose AC servo has further higher performance and higher functions compared to the previous MELSERVO-J3 series.

The MELSERVO-J4 series compatible rotary servo motor is equipped with 22-bit (4194304 pulses/rev) high-resolution absolute encoder. In addition, speed frequency response is increased to 2.5 kHz. Thus, faster and more accurate control is enabled as compared to the MELSERVO-J3 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.

With one-touch tuning and real-time auto tuning, you can automatically adjust the servo gains according to the machine.

The tough drive function and the drive recorder function, which are well-received in the MELSERVO-JN series, have been improved. The MR-J4 servo amplifier supports the improved functions. Additionally, the preventive maintenance support function detects an error in the machine parts. This function provides strong support for the machine maintenance and inspection.

The MR-J4-_A_ servo amplifier supports the Safe Torque Off (STO) function. By combining with optional MR-J3-D05, the servo amplifier supports Safe stop 1 (SS1) function.

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.

In the MELSERVO-J4 series, servo amplifiers with the CN2L connector are also available as MR-J4-_A_-RJ. By using the CN2L connector, an A/B/Z-phase differential output method external encoder can be connected to the servo amplifier. In a fully closed loop system, a four-wire type external encoder is connectable as well. The following table indicates the communication method of the external encoder compatible with the MR-J4-_A_ and MR-J4-_A_-RJ servo amplifiers.

Table 1.1 Connectors to connect from external encoders

Operation	External encoder	Connector				
mode	communication method	MR-J4A_	MR-J4ARJ			
	Two-wire type	CN2	CN2			
Linear servo	Four-wire type	(Note 1, 4)	(Note 1)			
motor system	A/B/Z-phase differential output method		CN2L (Note 5)			
	Two-wire type	CN2 (Note 2, 3, 4)				
Fully closed	Four-wire type		CN2I			
loop system	A/B/Z-phase differential output method		J.142L			

- Note 1. The MR-J4THCBL03M branch cable is necessary.
 - 2. The MR-J4FCCBL03M branch cable is necessary.
 - 3. When the communication method of the servo motor encoder is four-wire type, MR-J4-_A_ cannot be used. Use an MR-J4-_A_-RJ.
 - 4. This is used with software version A5 or later.
 - 5. Connect a thermistor to CN2.

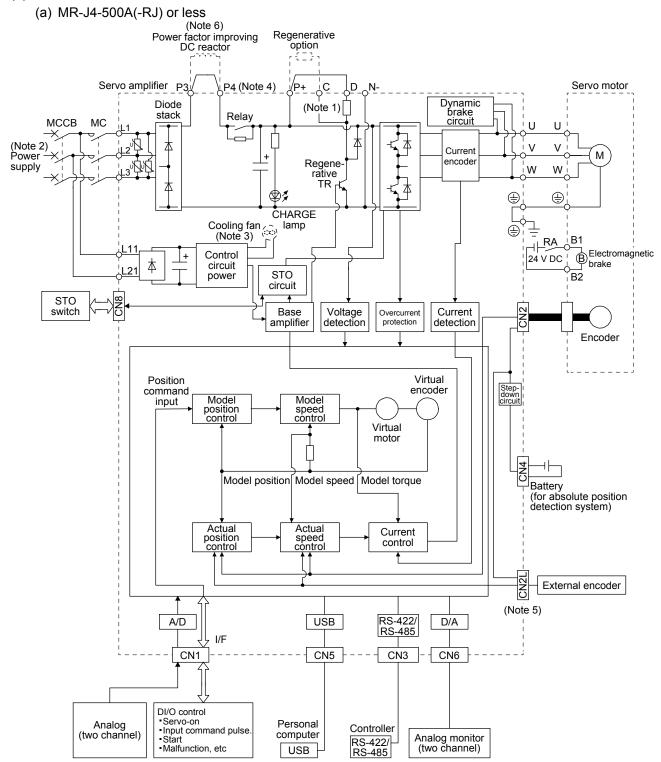
1.2 Function block diagram

The function block diagram of this servo is shown below.

POINT

●The diagram shows MR-J4-_A_-RJ as an example. The MR-J4-_A_ servo amplifier does not have the CN2L connector.

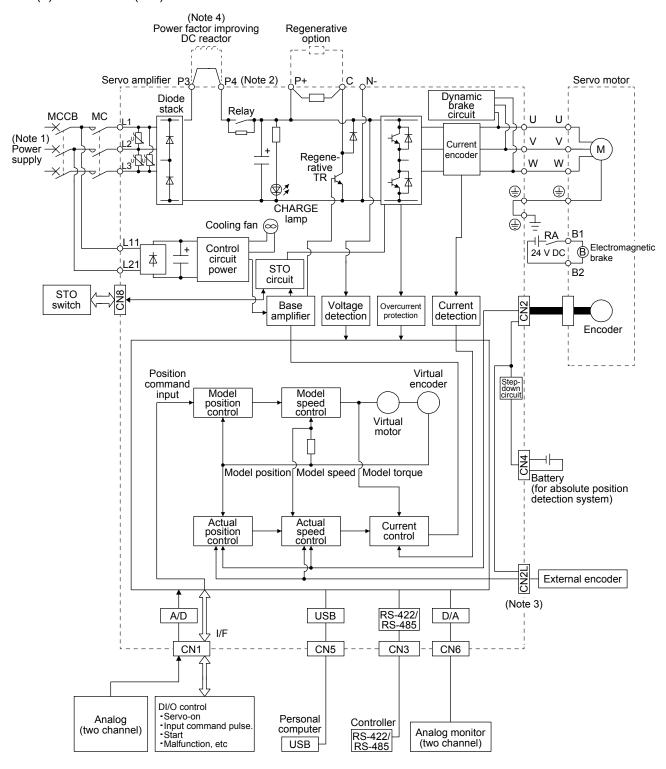
(1) 200 V class



Note 1. The built-in regenerative resistor is not provided for MR-J4-10A(-RJ).

- 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.
- 3. Servo amplifiers MR-J4-70A(-RJ) or more have a cooling fan.
- 4. The MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of the MR-J3 servo amplifiers.
- 5. This is for the MR-J4-_A-RJ servo amplifier. The MR-J4-_A servo amplifier does not have the CN2L connector.
- 6. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

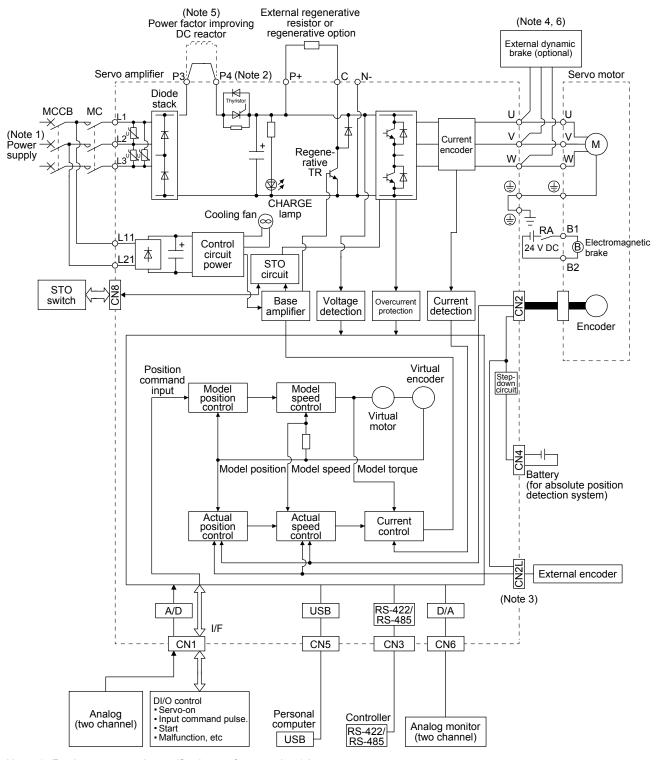
(b) MR-J4-700A(-RJ)



Note 1. For the power supply specifications, refer to section 1.3.

- 2. The MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of MR-J3 servo amplifiers.
- $3. \ \, \text{This is for the MR-J4-} \\ \text{A-RJ servo amplifier. The MR-J4-} \\ \text{A servo amplifier does not have the CN2L connector.} \\$
- 4. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

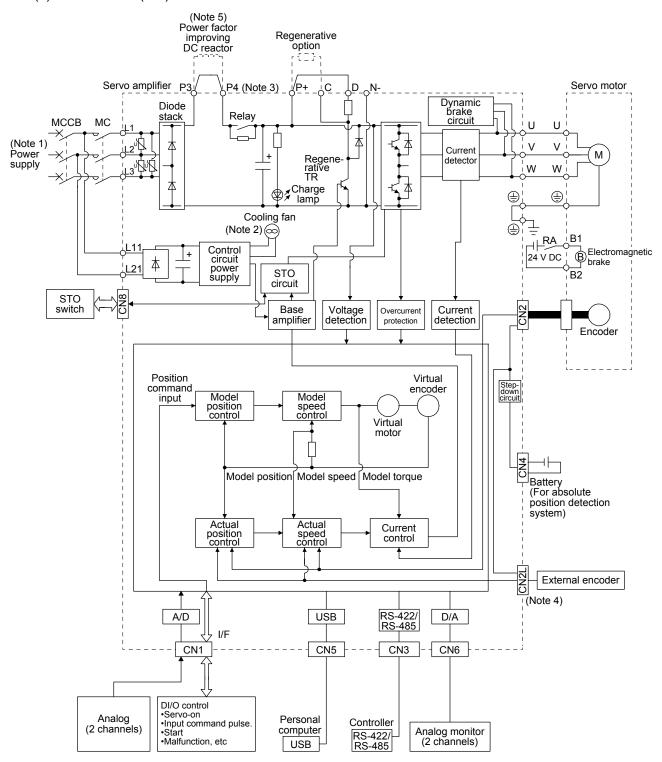
(c) MR-J4-11KA(-RJ)/MR-J4-15KA(-RJ)/MR-J4-22KA(-RJ)



- Note 1. For the power supply specifications, refer to section 1.3.
 - 2. The MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of the MR-J3 servo amplifiers.
 - 3. This is for the MR-J4-_A-RJ servo amplifier. The MR-J4-_A servo amplifier does not have the CN2L connector.
 - 4. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at an alarm occurrence for which the servo motor does not decelerate to stop. Ensure the safety in the entire equipment. For alarms for which the servo motor does not decelerate to stop, refer to chapter 8.
 - 5. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
 - 6. The external dynamic brake cannot be used for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs.

(2) 400 V class

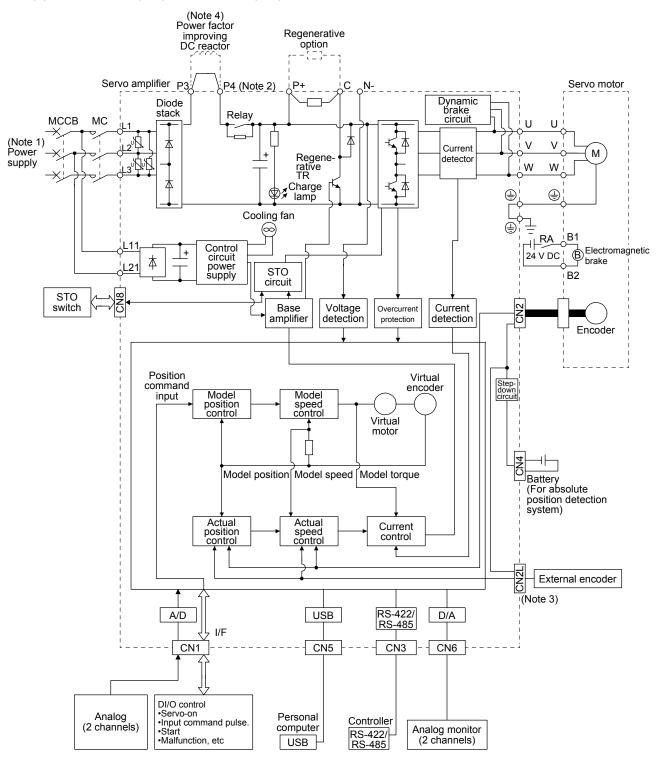
(a) MR-J4-350A4(-RJ) or less



Note 1. Refer to section 1.3 for the power supply specification.

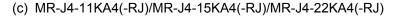
- 2. Servo amplifiers MR-J4-200A4(-RJ) or more have a cooling fan.
- 3. MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of MR-J3 servo amplifiers.
- 4. This is for MR-J4-_A4-RJ servo amplifier. MR-J4-_A4 servo amplifier does not have CN2L connector.
- 5. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

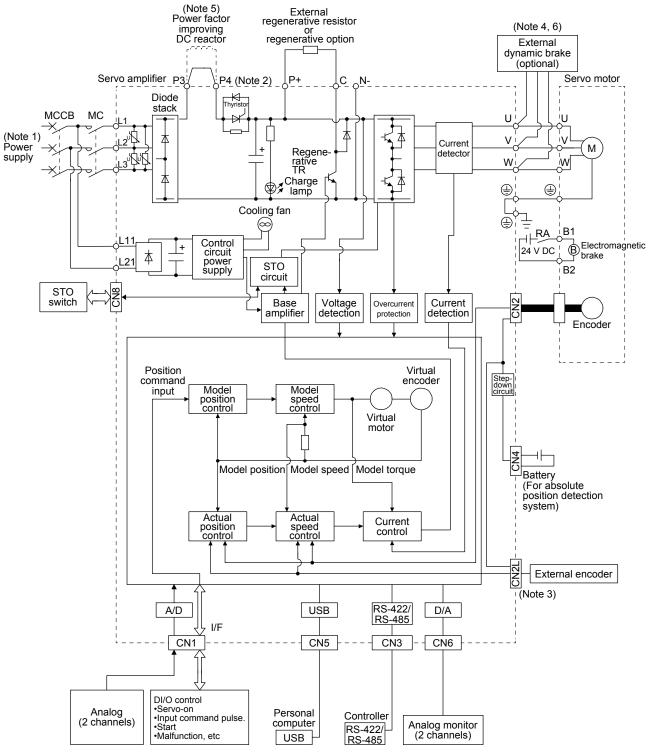
(b) MR-J4-500A4(-RJ)/MR-J4-700A4(-RJ)



Note 1. Refer to section 1.3 for the power supply specification.

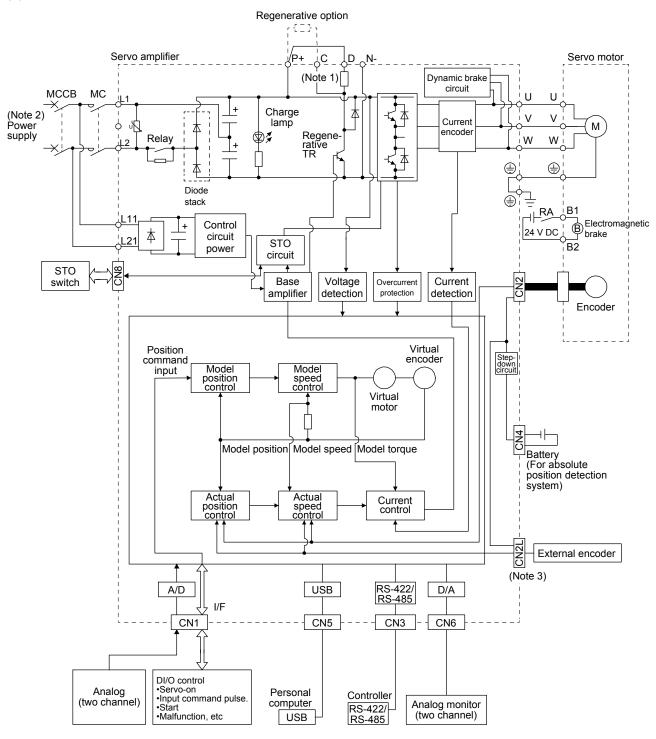
- 2. MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of MR-J3 servo amplifiers.
- 3. This is for MR-J4-_A4-RJ servo amplifier. MR-J4-_A4 servo amplifier does not have CN2L connector.
- 4. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.





- Note 1. Refer to section 1.3 for the power supply specification.
 - 2. MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of MR-J3 servo amplifiers.
 - 3. This is for MR-J4-_A4-RJ servo amplifier. MR-J4-_A4 servo amplifier does not have CN2L connector.
 - 4. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at an alarm occurrence for which the servo motor does not decelerate to stop. Ensure the safety in the entire equipment. For alarms for which the servo motor does not decelerate to stop, refer to chapter 8.
 - The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
 - The external dynamic brake cannot be used for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs.

(3) 100 V class



Note 1. The built-in regenerative resistor is not provided for MR-J4-10A1(-RJ).

- 2. Refer to section 1.3 for the power supply specifications.
- 3. This is for MR-J4-_A1-RJ servo amplifier. MR-J4-_A1 servo amplifier does not have CN2L connector.

1.3 Servo amplifier standard specifications

(1) 200 V class

Model: MR-J4(-RJ)		10A	20A	40A	60A	70A	100A	200A	350A	500A	700A	11KA	15KA	22KA
Rated voltage				3-phase 170 V AC											
Output	Rated current [A]		1.1	1.5	2.8	3.2	5.8	6.0	11.0	17.0	28.0	37.0	68.0	87.0	126.0
	Voltage/ Frequency	At AC input		3-phase or 1- phase 200 V								o 240 V AC, 50 Hz/60 Hz			
		At DC input (Note 17)		283 V DC to 340 V DC									T		
Main circuit	Rated current (Note 11)	[A]	0.9	1.5	2.6	3.2 (Note 5)	3.8	5.0	10.5	16.0	21.7	28.9	46.0	64.0	95.0
power supply input	Permissible voltage fluctuation	At AC input			ase or 1- AC to 26	-phase 64 V AC		phase AC to	se or 1- 170 V 264 V ote 14)		3-phas	se 170 V	' AC to 26	64 V AC	
	iluctuation	input (Note 17)		241 V DC to 374 V DC											
	Permissible freque	iency	Within ±5%												
	Power supply capacity	[kVA]		Refer to section 10.2.											
	Inrush current	[A]	Refer to section 10.5.												
	Voltage/	At AC input	1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz												
	Frequency	At DC input (Note 17)	283 V DC to 340 V DC												
	Rated current	[A]	0.2												
Control circuit power supply	Permissible	At AC input		1-phase 170 V AC to 264 V AC											
input	voltage fluctuation	At DC input (Note 17)	241 V DC to 374 V DC												
	Permissible freque		Within ±5%												
	Power consumpt	ion [W]	30 45												
	Inrush current	[A]	Refer to section 10.5.												
Interface power	Voltage							24	V DC ±	10%					
supply	Current capacity	[A]				(No	e 1) 0.5	(includir	ng the Cl	N8 conn	ector sig	gnals)			
Control method						Sir	e-wave	PWM co	ontrol, cu	rrent co	ntrol me	thod	1		
Dynamic brake							Bui	lt-in						ernal opti lote 8, 12	
Fully closed loop		Compatible (Note 9)													
Load-side encode	10)	Mitsubishi high-speed serial communication													
Communication f	unction			US		nection to S-422/RS								ble)	
Encoder output pulses						- ILLIIN						1,1010 7,	, 10,		
Analog monitor			Compatible (A/B/Z-phase pulse) Two channels												
,aiog illollitol									. J Gridill	. 510					

Model: MR-J4(-RJ)		10A	20A	40A	60A	70A	100A	200A	350A	500A	700A	11KA	15KA	22KA
	4 Mpulses/s (for differential receiver) (Note 6), 200 kpulses/s (for open collector)														
	Positioning fe pulse	edback	Encoder resolution (resolution per servo motor revolution): 22 bits												
Position control mode	Command pu multiplying fac		Electronic gear A:1 to 16777215, B:1 to 16777215, 1/10 < A/B < 4000												
	In-position rar	nge setting				0	pulse to :	±65535 p	oulses (c	ommano	d pulse ι	ınit)			
	Error excessiv								revolution			•			
	Torque limit			Set by	/ parame	eter settir	ng or exte	ernal ana	aloa inpu	t (0 V D	C to +10	V DC/m	aximum	torque)	
	Speed control	l range					ed comm							11 -7	
Speed control	Analog speed input			(<u> </u>	ed speed							2].)	
mode	Speed fluctua	ation ratio					load fluct							•	
	Torque limit			Set by	/ parame	eter setti	ng or exte	ernal ana	alog inpu	t (0 V D	C to +10	V DC/m	aximum	torque)	
Torque control	Analog torque	command			0 V D	C to ±8	√ DC/ma	ximum to	orque (in	put impe	edance 1	10 kΩ to	12 kΩ)		
mode	Speed limit			Se	t by para	ameter s	etting or	external	analog ir	nput (0 V	/ DC to 1	10 V DC	rated sp	eed)	
Danista di				Refer to	"MR-J	1ARJ	Servo A	mplifier l	Instructio	n Manu	al (Posit	ioning M	ode)" se	ction 1.1.	
Positioning mode)											-		B3 or lat	
			(Overcur	rent shu	t-off, reg	enerative	overvol	tage shu	t-off, ove	erload sh	nut-off (e	lectronic	thermal)	,
Protective function	ons		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,												
Eupotional cafety	,		error excessive protection, magnetic pole detection protection, and linear servo control fault protection STO (IEC/EN 61800-5-2)												
T unctional salety	Functional safety Standards certified by OR (New 15)			EN ISO 13849-1 category 3 PL e, IEC 61508 SIL 3, EN 62061 SIL CL3, and EN 61800-5-2											
	CB (Note15) Response performance					8	ms or le	ss (STO	input off	- ener	av shut	off)			
		Hormance						t pulse ir				OII)			
	(Note 3) Test pulse input (STO)							•							
Safety performance	Mean time to dangerous failure (MTTFd)		Test pulse off time: Up to 1 ms MTTFd ≥ 100 [years] (314a)												
	Diagnostic co		DC = Medium, 97.6 [%]												
	Average prob dangerous fai hour (PFH)	,	PFH = 6.4 × 10 ⁻⁹ [1/h]												
								LVD:	EN 6180	00-5-1					
Compliance to	CE marking							EMC	: EN 618	800-3					
global standards						M	D: EN IS	O 13849	-1, EN 6	1800-5-2	2, EN 62	:061			
	UL standard								UL 5080)					
Structure (IP ratio	ng)		Natur	al coolin	ıg, open	(IP20)	Force	e cooling	, open (IP20)	Forc	e coolin	g, open (IP20) (No	ote 4)
Close mounting	3-phase power input	er supply				Pos	sible					-	mpossib	le	
(Note 2)	1-phase power input	er supply			Possible	е		Impo	ssible						
	Ambient	Operation					C	°C to 55	5 °C (nor	n-freezin	g)				
	temperature	Storage					-2	0 °C to 6	35 °C (no	n-freezii	ng)				
	Ambient humidity	Operation Storage					90 %	%RH or I	ess (non	-conden	sing)				
Environment	,	Julia					ı	ndoors (no direct	sunliah	t).				
	Ambience				1	free from	corrosiv	•		•	, .	ist, and d	dirt		
	Altitude							or less a							
	Altitude Vibration resistance					5.9 m/s				,		,)		
Mass	auon 103k	[kg]	0	8	4		i		· `				í	3 4	18.2
Mass		0.	8	1	5.9 m/s	² , at 10 H			,		,	í	3.4	18.2	

- Note 1. 0.5 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 of 3.5 kW or less, operate them at the ambient temperatures of 0 °C to 45 °C or at 75% or smaller effective load ratio.
 - Test pulse is a signal which instantaneously turns off a signal to the servo amplifier at a constant period for external circuit to self-diagnose.
 - 4. Except for the terminal block.
 - 5. The rated current is 2.9 A when the servo amplifier is used with a UL or CSA compliant servo motor.
 - 6. 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].
 - 7. RS-422 communication is supported by servo amplifier with software version A3.
 - 8. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment.
 - 9. For the compatible version for the fully closed loop system, refer to table 1.1. Check the software version of the servo amplifier with MR Configurator2.
 - 10. The MR-J4-_A servo amplifier is compatible only with the two-wire type.
 The MR-J4-_A-RJ servo amplifier is compatible with the two-wire type, four-wire type, and A/B/Z-phase differential output method. Refer to table 1.1 for details.
 - 11. This value is applicable when a 3-phase power supply is used.
 - 12. The external dynamic brake cannot be used for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs.
 - 13. RS-485 communication is available with servo amplifiers manufactured in November 2014 or later.
 - 14. When using 1-phase 200 V AC to 240 V AC power supply, operate the servo amplifier at 75% or smaller effective load ratio.
 - 15. The safety level depends on the setting value of [Pr. PF18 STO diagnosis error detection time] and whether STO input diagnosis by TOFB output is performed or not. For details, refer to the Function column of [Pr. PF18] in section 5.2.6.
 - 16. Follow the restrictions in section 2.6 when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level.
 - 17. The DC power supply input is available only with MR-J4-_A-RJ servo amplifiers. For the connection example of the power circuit when a DC input is used, refer to app. 13.

(2) 400 V class

Model: MR-J4(-RJ)	60A4	100A4	200A4	350A4	500A4	700A4	11KA4	15KA4	22KA4		
Output	Rated voltage				3-p	hase 323 V	AC					
Output	Rated current [A]	1.5 2.8 5.4 8.6 14.0 17.0 32.0 41.0 63.0										
	Voltage/Frequency			3-ph	ase 380 V A	AC to 480 V	AC, 50 Hz/6	60 Hz				
	Rated current [A]	1.4	2.5	5.1	7.9	10.8	14.4	23.1	31.8	47.6		
Main circuit	Permissible voltage fluctuation		3-phase 323 V AC to 528 V AC									
power supply input	Permissible frequency fluctuation					Within ±5%						
	Power supply capacity [kVA]		Refer to section 10.2.									
	Inrush current [A]				Refe	er to section	10.5.					
	Voltage/Frequency			1-ph	ase 380 V A	AC to 480 V	AC, 50 Hz/6	60 Hz				
	Rated current [A]		0.1				0	.2				
Control circuit power supply	Permissible voltage fluctuation				1-phase	323 V AC to	528 V AC					
input	Permissible frequency fluctuation					Within ±5%						
	Power consumption [W]		30				2	15				
	Inrush current [A]				Refe	er to section	10.5.					
Interface power	Voltage				2	4 V DC ± 10	%					
supply	Current capacity [A]			(Note	1) 0.5 (incl	uding CN8 c	connector si	gnals)				
Control method				Sine-v	vave PWM	control, curre	ent control r	nethod				
Dynamic brake		Built-in External option (Note 6								ote 6, 7)		
Fully closed loop	control	Compatible										
Load-side encode	er interface (Note 5)	Mitsubishi high-speed serial communication										
Communication f	function	USB: connection to a personal computer or others (MR Configurator2-compatible)										
Communication f	unction	RS-422/RS-485: 1: n communication (up to 32 axes) (Note 8)										
Encoder output p	oulses	Compatible (A/B/Z-phase pulse)										
Analog monitor		Two channels										
	Max. input pulse frequency		4 Mpulses	s/s (for differ	ential receiv	er) (Note 4)	, 200 kpulse	s/s (for oper	n collector)			
	Positioning feedback pulse	Encoder resolution (resolution per servo motor revolution): 22 bits										
Position control	Command pulse multiplying factor		Elect	ronic gear A	:1 to 16777	215, B:1 to	16777215, 1	I/10 < A/B <	4000			
mode	In-position range setting	0 pulse to ±65535 pulses (command pulse unit)										
	Error excessive	±3 revolutions										
	Torque limit	Set by parameter setting or external analog input (0 V DC to +10 V DC/maximum torque)										
	Speed control range		Ana	alog speed o	ommand 1:	2000, intern	nal speed co	mmand 1: 5	5000			
Speed control	Analog speed command input		0 to ±10 \	/ DC/rated s	speed (The	speed at 10	V is change	eable with [P	r. PC12].)			
mode	Speed fluctuation ratio	±0.01%	•			%), 0% (pow when using		,		(ambient		
	Torque limit	Se	t by parame	ter setting o	r external a	nalog input (0 V DC to +	-10 V DC/ma	aximum toro	lue)		
Torque control	Analog torque command input		0 V D	C to ±8 V D	C/maximum	torque (inpu	ut impedanc	e 10 kΩ to 1	2 kΩ)			
mode	Speed limit	Set by parameter setting or external analog input (0 V DC to 10 V DC/rated speed)										
Positioning		Refe	er to "MR-J4	ARJ Se	rvo Amplifie	r Instruction	Manual (Po	sitioning Mo	ode)" section	n 1.1.		
Positioning mode	-	The po	sitioning mo	ode is used	by MR-J4	ARJ servo	amplifier w	ith software	version B3	or later.		
Protective function	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, error excessive protection, magnetic pole detection protection, and linear servo control fault protection											
Functional safety				STO (IEC/EN 618	00-5-2)						

Model: MR-J4	60A4	100A4	200A4	350A4	500A4	700A4	11KA4	15KA4	22KA4					
	Standards certi (Note 9)	fied by CB	EN ISO 13849-1 category 3 PL e, IEC 61508 SIL 3, EN 62061 SIL CL3, and EN 61800-5-2											
	Response perfe	ormance	8 ms or less (STO input off \rightarrow energy shut off)											
	(Note 2)			Test pulse interval: 1 Hz to 25 Hz										
Safety	Test pulse inpu	it (STO)				Test pulse	e off time: U	p to 1 ms						
performance	Mean time to d failure (MTTFd)	•		MTTFd ≥ 100 [years] (314a)										
	Diagnostic cove	erage (DC)				DC =	Medium, 97	.6 [%]						
	Average probable dangerous failu (PFH)	•		PFH = 6.4 × 10 ⁻⁹ [1/h]										
			LVD: EN 61800-5-1											
Compliance to	CE marking		EMC: EN 61800-3											
standards			MD: EN ISO 13849-1, EN 61800-5-2, EN 62061											
	UL standard		UL 508C											
Structure (IP rat	ing)		Natural cooling, open (IP20) Force cooling, open (IP20) Force cooling, open (IP20) (Note 3)											
Close mounting			Impossible											
	Ambient	Operation	0 °C to 55 °C (non-freezing)											
	temperature	Storage				-20 °C to	65 °C (non-	freezing)						
	Ambient	Operation				00 0/ DLL								
Environment	humidity	Storage				90 %RH or	less (non-c	ondensing)						
Environment	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt											
	Altitude					00 m or less								
	Vibration resist	ance	5.9 m/s ² , at 10 Hz to 55 Hz (directions of X, Y and Z axes)											
Mass	•	[kg]	1	.7	2.1	3.6	4.3	6.5		3.4	18.2			

Note 1. 0.5 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. Test pulse is a signal which instantaneously turns off a signal to the servo amplifier at a constant period for external circuit to self-diagnose.
- 3. Except for the terminal block.
- 4. 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].
- 5. MR-J4-_A4 servo amplifier is compatible only with two-wire type. MR-J4-_A4-RJ servo amplifier is compatible with two-wire type, four-wire type, and A/B/Z-phase differential output method. Refer to table 1.1 for details.
- 6. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment.
- 7. The external dynamic brake cannot be used for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs.
- 8. RS-485 communication is available with servo amplifiers manufactured in November 2014 or later.
- 9. The safety level depends on the setting value of [Pr. PF18 STO diagnosis error detection time] and whether STO input diagnosis by TOFB output is performed or not. For details, refer to the Function column of [Pr. PF18] in section 5.2.6.
- 10. Follow the restrictions in section 2.6 when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level.

(3) 100 V class

Model: MR-J4((-RJ)	10A1	20A1	40A1						
Output	Rated voltage		3-phase 170 V AC							
Output	Rated current [A]	1.1	1.5	2.8						
	Voltage/Frequency	1-pl	nase 100 V AC to 120 V AC, 50 Hz/	60 Hz						
	Rated current [A]	3.0	5.0	9.0						
Main circuit	Permissible voltage fluctuation	1-phase 85 V AC to 132 V AC								
power supply input	Permissible frequency fluctuation	Within ±5%								
	Power supply capacity [kVA]		Refer to section 10.2.							
	Inrush current [A]		Refer to section 10.5.							
	Voltage/Frequency	1-p	hase 100 V AC to 120 V AC, 50Hz/	60Hz						
	Rated current [A]		0.4							
Control circuit power supply	Permissible voltage fluctuation		1-phase 85 V AC to 132 V AC							
input	Permissible frequency fluctuation		Within ±5%							
	Power consumption [W]		30							
	Inrush current [A]		Refer to section 10.5.							
Interface power	Voltage		24 V DC ± 10%							
supply	Current capacity [A]		(Note 1) 0.5							
	Current capacity [74]		(including the CN8 connector signal	•						
Control method		Sine-	wave PWM control, current control r	nethod						
Dynamic brake		Built-in								
Fully closed loop		Compatible (Note 5)								
Load-side encod	ler interface (Note 6)	Mitsubishi high-speed serial communication								
Communication f	function	USB: Connection to a personal computer or others (MR Configurator2-compatible)								
		RS-422/RS-485: 1:n communication (up to 32 axes) (Note 7)								
Encoder output p	oulses	Compatible (A/B/Z-phase pulse)								
Analog monitor		Two channels								
	Max. input pulse frequency	4 Mpulses/s (for differential receiver) (Note 4), 200 kpulses/s (for open collector)								
Position control	Positioning feedback pulse	Encoder resolution (resolution per servo motor revolution): 22 bits								
mode	Command pulse multiplying factor	Electronic gear 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		or external analog input (0 V DC to							
	Speed control range	Analog speed	command 1: 2000, Internal speed co	ommand 1: 5000						
Speed control	Analog speed command input		speed (The speed at 10 V is change							
mode	Speed fluctuation ratio		d fluctuation: 0% to 100%), 0% (pov mperature: 25 °C ± 10 °C) when usi	-						
	Torque limit	Set by parameter setting	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 k Ω to 12 k Ω)								
540	Speed limit	Set by parameter setting or external analog input (0 V DC to 10 V DC/rated speed)								
Positioning mode	Э		ervo Amplifier Instruction Manual (Po by MR-J4ARJ servo amplifier w	- ·						
				off (electronic thermal), servo motor						
Protective function	ons		erative error protection, undervoltage allure protection, overspeed protection							
		error excessive protection, magnetic pole detection protection, and linear servo control fault protection								
Functional safety	1	STO (IEC/EN 61800-5-2)								

Model: MR-J4(-RJ)			10A1	20A1	40A1					
	Standards cer CB (Note 8)	tified by	EN ISO 13849-1 category 3 PL e, IEC 61508 SIL 3, EN 62061 SIL CL3, and EN 61800-5-2							
	Response per	formance	8 ms or less (STO input off \rightarrow energy shut off)							
	(Note 3)		Test pulse interval: 1 Hz to 25 Hz							
	Test pulse inp	out (STO)		Test pulse off time: Up to 1 ms						
Safety performance	Mean time to failure (MTTF)		MTTFd ≥ 100 [years] (314a)							
	Diagnostic co	verage		DC = Medium, 97.6 [%]						
	Average proba dangerous fail hour (PFH)	,		PFH = 6.4 × 10 ⁻⁹ [1/h]						
			LVD: EN 61800-5-1							
Compliance to global	CE marking		EMC: EN 61800-3							
standards			MD: EN ISO 13849-1, EN 61800-5-2, EN 62061							
otaridardo	UL standard		UL 508C							
Structure (IP rat	ing)		Natural cooling, open (IP20)							
Close mounting	(Note 2)		Possible							
	Ambient	Operation		0 °C to 55 °C (non-freezing)						
	temperature	Storage		-20 °C to 65 °C (non-freezing)						
	Ambient	Operation		90 %RH or less (non-condensing)						
Environment	humidity	Storage		90 %KH of less (non-condensing)						
Limioilliell	Ambience		Indoors (no direct sunlight),							
	Ambience		free from corrosive gas, flammable gas, oil mist, dust, and dirt							
	Altitude		2000 m or less above sea level (Note 9)							
	Vibration resis	stance	5.9 m/s ² , at 10 Hz to 55 Hz (directions of X, Y and Z axes)							
Mass		[kg]	0	.8	1.0					

Note 1. 0.5 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 of 3.5 kW or less, operate them at the ambient temperatures of 0 °C to 45 °C or at 75% or smaller effective load ratio.
- 3. Test pulse is a signal which instantaneously turns off a signal to the servo amplifier at a constant period for external circuit to self-diagnose.
- 4. 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].
- 5. For the compatible version for the fully closed loop system, refer to table 1.1. Check the software version of the servo amplifier with MR Configurator2.
- 6. The MR-J4-_A servo amplifier is compatible only with the two-wire type.

 The MR-J4-_A-RJ servo amplifier is compatible with the two-wire type, four-wire type, and A/B/Z-phase differential output method. Refer to table 1.1 for details.
- 7. RS-485 communication is available with servo amplifiers manufactured in November 2014 or later.
- 8. The safety level depends on the setting value of [Pr. PF18 STO diagnosis error detection time] and whether STO input diagnosis by TOFB output is performed or not. For details, refer to the Function column of [Pr. PF18] in section 5.2.6.
- 9. Follow the restrictions in section 2.6 when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level.

1.4 Combinations of servo amplifiers and servo motors

POINT

- ●When you use it with the 1-phase 200 V AC input, an HG-JR series servo motor cannot be used on the assumption that the maximum torque is 400%.
- ■When you use the MR-J4-100A or MR-J4-200A with the 1-phase 200 V AC input, contact your local sales office for the torque characteristics of the HG-UR series, HG-RR series, and HG-JR series servo motors.

(1) 200 V class

				Rotary se	rvo moto	r			
Servo amplifier		HG-MR	HG-SR	HG-UR	HG-RR	HG-JR	HG-JR (When the maximum torque is 400%)	Linear servo motor (primary side)	Direct drive motor
MR-J4-10A(-RJ)	053 13	053 13							
MR-J4-20A(-RJ)	23	23						LM-U2PAB-05M-0SS0 LM-U2PBB-07M-1SS0	TM-RFM002C20
MR-J4-40A(-RJ)	43	43						LM-H3P2A-07P-BSS0 LM-H3P3A-12P-CSS0 LM-K2P1A-01M-2SS1 LM-U2PAD-10M-0SS0 LM-U2PAF-15M-0SS0	TM-RFM004C20
MR-J4-60A(-RJ)			51 52			53		LM-U2PBD-15M-1SS0	TM-RFM006C20 TM-RFM006E20
MR-J4-70A(-RJ)	73	73		72		73		LM-H3P3B-24P-CSS0 LM-H3P3C-36P-CSS0 LM-H3P7A-24P-ASS0 LM-K2P2A-02M-1SS1 LM-U2PBF-22M-1SS0	TM-RFM012E20 TM-RFM012G20 TM-RFM040J10
MR-J4-100A(-RJ)			81 102			103	53		TM-RFM018E20
MR-J4-200A(-RJ)			121 201 152 202	152	103 153	153 203	73 103	LM-H3P3D-48P-CSS0 LM-H3P7B-48P-ASS0 LM-H3P7C-72P-ASS0 LM-FP2B-06M-1SS0 LM-K2P1C-03M-2SS1 LM-U2P2B-40M-2SS0	
MR-J4-350A(-RJ)			301 352	202	203	353	153 203	LM-H3P7D-96P-ASS0 LM-K2P2C-07M-1SS1 LM-K2P3C-14M-1SS1 LM-U2P2C-60M-2SS0	TM-RFM048G20 TM-RFM072G20 TM-RFM120J10
MR-J4-500A(-RJ)			421 502	352 502	353 503	503	353	LM-FP2D-12M-1SS0 LM-FP4B-12M-1SS0 LM-K2P2E-12M-1SS1 LM-K2P3E-24M-1SS1 LM-U2P2D-80M-2SS0	TM-RFM240J10
MR-J4-700A(-RJ)			702			601 701M 703	503	LM-FP2F-18M-1SS0 LM-FP4D-24M-1SS0	
MR-J4-11KA(-RJ)						801 12K1 11K1M 903		LM-FP4F-36M-1SS0	
MR-J4-15KA(-RJ)						15K1 15K1M		LM-FP4F-48M-1SS0	
MR-J4-22KA(-RJ)						20K1 25K1 22K1M			

(2) 400 V class

		Rotary servo motor		
Servo amplifier	HG-SR	HG-JR	HG-JR (When the maximum torque is 400%)	Linear servo motor (primary side)
MR-J4-60A4(-RJ)	524	534		N
MR-J4-100A4(-RJ)	1024	734 1034	534	
MR-J4-200A4(-RJ)	1524	1534	734	1 \
	2024	2034	1034	
MR-J4-350A4(-RJ)	3524	3534	1534 2034	
MR-J4-500A4(-RJ)	5024	5034	3534	1
MR-J4-700A4(-RJ)	7024	6014 701M4 7034	5034	
MR-J4-11KA4(-RJ)		8014 12K14 11K1M4 9034		
MR-J4-15KA4(-RJ)		15K14 15K1M4		
MR-J4-22KA4(-RJ)		20K14 25K14 22K1M4		LM-FP5H-60M-1SS0

(3) 100 V class

Servo amplifier	Rotary se	rvo motor	Linear servo motor	Direct drive motor	
Servo ampliller	HG-KR	HG-MR	(primary side)	Direct drive motor	
MR-J4-10A1(-RJ)	053	053			
	13	13			
MR-J4-20A1(-RJ)	23	23	LM-U2PAB-05M-0SS0	TM-RFM002C20	
	23	25	LM-U2PBB-07M-1SS0		
MR-J4-40A1(-RJ)			LM-H3P2A-07P-BSS0	TM-RFM004C20	
			LM-H3P3A-12P-CSS0		
	43	43	LM-K2P1A-01M-2SS1		
			LM-U2PAD-10M-0SS0		
			LM-U2PAF-15M-0SS0		

1.5 Function list

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
Model adaptive control	This realizes a high response and stable control following the ideal model. The two-degrees-of-freedom-model model adaptive control enables you to set a response to the command and response to the disturbance separately. Additionally, this function can be disabled. Refer to section 7.5 for disabling this function. This is used with servo amplifiers with software version B4 or later. Check the software version of the servo amplifier with MR Configurator2.	
Position control mode	This servo amplifier is used as a position control servo.	Section 3.2.1 Section 3.6.1 Section 4.2
Speed control mode	This servo amplifier is used as a speed control servo.	Section 3.2.2 Section 3.6.2 Section 4.3
Torque control mode	This servo amplifier is used as a torque control servo.	Section 3.2.3 Section 3.6.3 Section 4.4
Positioning mode	Used when you use an MR-J4ARJ servo amplifier in the positioning mode under the point table/program/indexer method. The positioning mode is used by MR-J4ARJ servo amplifier with software version B3 or later.	MR-J4A RJ Servo Amplifier Instruction Manual (POSITIONING MODE)
Position/speed control change mode	Using an input device, control can be switched between position control and speed control.	Section 3.6.4
Speed/torque control change mode	Using an input device, control can be switched between speed control and torque control.	Section 3.6.5
Torque/position control change mode	Using an input device, control can be switched between torque control and position control.	Section 3.6.6
High-resolution encoder	High-resolution encoder of 4194304 pulses/rev is used as the encoder of the rotary servo motor compatible with the MELSERVO-J4 series.	
Absolute position detection system	Merely setting a home position once makes home position return unnecessary at every power-on.	Chapter 12
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 at the arm end or residual vibration.	Section 7.1.5
Machine resonance suppression filter	This is a filter function (notch filter) which 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 at high frequency. The shaft resonance suppression filter suppresses the vibration.	Section 7.1.3
Adaptive filter II	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 servo system response is increased.	Section 7.1.4
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system by simply connecting an MR Configurator2 installed personal computer and servo amplifier. MR Configurator2 is necessary for this function.	
Robust filter	This function provides better disturbance response in case low response level that load to motor inertia ratio is high for such as roll send axis.	[Pr. PE41]
Slight vibration suppression control	Suppresses vibration of ±1 pulse produced at a servo motor stop.	[Pr. PB24]
Electronic gear	Input pulses can be multiplied by 1/10 to 4000.	[Pr. PA06] [Pr. PA07]
S-pattern acceleration/ deceleration time constant	Speed can be increased and decreased smoothly.	[Pr. PC03]

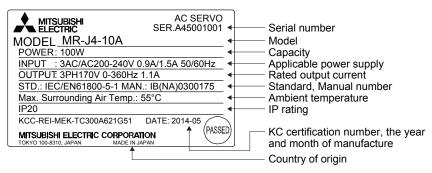
Function	Description	Detailed explanation
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	Section 6.3
Brake unit	Used when the regenerative option cannot provide enough regenerative power. Can be used for the 5 kW or more servo amplifier.	Section 11.3
Power regeneration converter	Used when the regenerative option cannot provide enough regenerative power. Can be used for the 5 kW or more servo amplifier.	Section 11.4
Regenerative option	Used when the built-in regenerative resistor of the servo amplifier does not have sufficient regenerative capability for the large regenerative power generated.	Section 11.2
Alarm history clear	Alarm history is cleared.	[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 any pins.	[Pr. PD03] to [Pr. PD22]
Output signal selection (device settings)	The output devices including MBR (Electromagnetic brake interlock) can be assigned to certain pins of the CN1 connector.	[Pr. PD23] to [Pr. PD26] [Pr. PD28] [Pr. PD47]
Output signal (DO) forced output	Output signal can be forced on/off independently of the servo status. Use this function for checking output signal wiring, etc.	Section 4.5.8
Restart after instantaneous power failure	If the input power supply voltage had reduced to cause an alarm but has returned to normal, the servo motor can be restarted by merely switching on the start signal. (available in the future)	
Command pulse selection	Command pulse train form can be selected from among three different types.	[Pr. PA13]
Torque limit	Servo motor torque can be limited to any value.	Section 3.6.1 (5) [Pr. PA11] [Pr. PA12]
Speed limit	Servo motor speed can be limited to any value.	Section 3.6.3 (3) [Pr. PC05] to [Pr. PC11]
Status display	Servo status is shown on the 5-digit, 7-segment LED display	Section 4.5
External I/O signal display	On/off statuses of external I/O signals are shown on the display.	Section 4.5.7
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) or VLA (Analog speed limit) is 0 V.	Section 4.5.4
Alarm code output	If an alarm has occurred, the corresponding alarm number is outputted in 3-bit code.	Chapter 8
Test operation mode	Jog operation, positioning operation, motor-less operation, DO forced output, and program operation MR Configurator2 is required to perform positioning operation or program operation.	Section 4.5.9
Analog monitor output	Servo status is output in terms of voltage in real time.	[Pr. PC14], [Pr. PC15]
MR Configurator2	Using a personal computer, you can perform the parameter setting, test operation, monitoring, and others.	Section 11.7
Linear servo system	Linear servo system can be configured using a linear servo motor and linear encoder. This is used with servo amplifiers with software version A5 or later. Check the software version of the servo amplifier with MR Configurator2.	Chapter 15
Direct drive servo system	The direct drive servo system can be configured to drive a direct drive motor. This is used with servo amplifiers with software version A5 or later. Check the software version of the servo amplifier with MR Configurator2.	Chapter 16
Fully closed loop system	Fully closed loop system can be configured using the load-side encoder. This is used with servo amplifiers with software version A5 or later. Check the software version of the servo amplifier with MR Configurator2.	Chapter 17
One-touch tuning	Gain adjustment is performed just by one click on a certain button on MR Configurator2 or operation section.	Section 6.2
SEMI-F47 function	Enables to avoid triggering [AL. 10 Undervoltage] using the electrical energy charged in the capacitor in case that an instantaneous power failure occurs during operation. Use a 3-phase for the input power supply of the servo amplifier. Using a 1-phase 100 V AC/200 V AC for the input power supply will not comply with SEMI-F47 standard.	[Pr. PA20] [Pr. PE25] Section 7.4
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

Fur	nction	Description	Detailed explanation
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 on the drive recorder window on MR Configurator2 by clicking the "Graph" button. However, the drive recorder will not operate on the following conditions. 1. You are using the graph function of MR Configurator2. 2. You are using the machine analyzer function. 3. [Pr. PF21] is set to "-1".	[Pr. PA23]
STO function		This function is a functional safety that complies with IEC/EN 61800-5-2. You can create a safety system for the equipment easily.	Chapter 13
Servo amplifie function	er life diagnosis	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. MR Configurator2 is necessary for this function.	
Power monitor	ring 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.	
Machine diagr	nosis 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. MR Configurator2 is necessary for this function.	
Lost motion co	ompensation	This function improves the response delay occurred when the machine moving direction is reversed. This is used with servo amplifiers with software version B4 or later. Check the software version of the servo amplifier with MR Configurator2.	Section 7.6
Super trace co	ontrol	This function sets constant and uniform acceleration/deceleration droop pulses to almost 0. This is used with servo amplifiers with software version B4 or later. Check the software version of the servo amplifier with MR Configurator2.	Section 7.7
Mark	Current position latch function	When the mark detection signal is turned on, the current position is latched. The latched data can be read with communication commands.	MR-J4A RJ Servo Amplifier
detection	Interrupt positioning function	When MSD (Mark detection) turns on, this function converts the remaining distance to the travel amount set in [Pr. PT30] and [Pr. PT31] (Mark sensor stop travel distance). This is available with MR-J4ARJ servo amplifiers with software version B7 or later.	Instruction Manual (POSITIONING MODE)
MR-D01 extension I/O unit		MR-D01 is an extension I/O unit that can extend the input/output signals of MR-J4ARJ servo amplifiers. MR-D01 is available with MR-J4ARJ servo amplifiers with software version B7 or later. MR-D01 cannot be used with MR-J4-03A6(-RJ) servo amplifiers.	Chapter 19 MR-J4A RJ Servo Amplifier Instruction Manual (Modbus-RTU Protocol)
Modbus-RTU communication function		The Modbus protocol uses dedicated message frames for the serial communication between a master and slaves. The dedicated message frames have functions for reading and writing data, and you can write parameters from servo amplifiers and check the operation status of the servo amplifiers by using this function. When the indexer method is used, there are functional restrictions. This function is supported by MR-J4ARJ servo amplifiers with a capacity of 100 W or more manufactured in November, 2014 or later. This function will be available with MR-J4-03A6-RJ servo amplifiers in the future.	MR-J4A RJ Servo Amplifier Instruction Manual (Modbus-RTU Protocol)
High-resolution analog input (VC)		The analog input resolution can be increased to 16 bits. This function is available with servo amplifiers manufactured in November 2014 or later. This is not available with MR-J4-03A6-RJ servo amplifiers.	[Pr. PC60]

1.6 Model designation

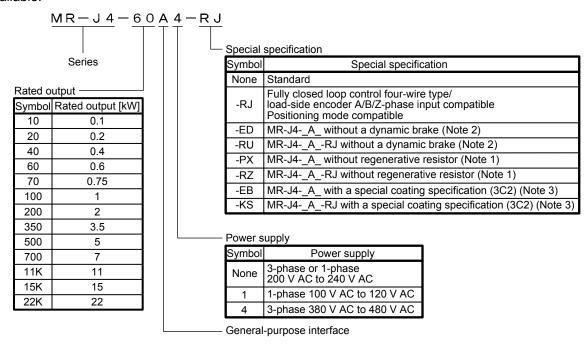
(1) Rating plate

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. Not all combinations of the symbols are available.



Note 1. Indicates a servo amplifier of 11 kW to 22 kW that does not use a regenerative resistor as standard accessory. Refer to app. 10.2 for details.

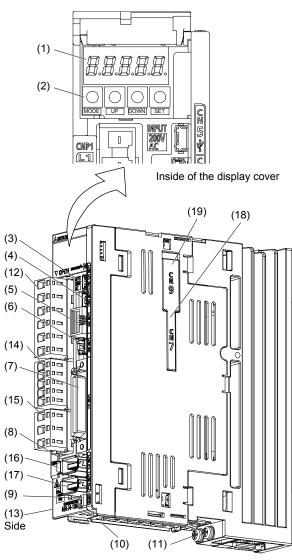
- 2. Dynamic brake which is built in 7 kw or smaller servo amplifiers is removed. Refer to app. 10.1 for details.
- 3. Type with a specially-coated servo amplifier board (IEC 60721-3-3 Class 3C2). Refer to app. 11.3 for details.

1.7 Structure

1.7.1 Parts identification

(1) 200 V class

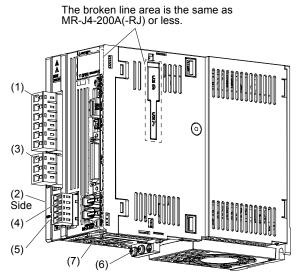
(a) MR-J4-200A(-RJ) or less The diagram is for MR-J4-10A-RJ.



No.	Name/Application	Detailed explanation
(1)	Display The 5-digit, 7-segment LED shows the servo status and the alarm number.	Section 4.5
(2)	Operation section Used to perform status display, diagnostic, alarm, and parameter setting operations. Push the "MODE" and "SET" buttons at the same time for 3 s or more to switch to the one-touch tuning mode. MODE UP DOWN SET Used to set data. Push this button together with the "MODE" button for 3 s or more to switch to the one-touch tuning mode. Used to change the display or data in each mode. Used to change the mode. Push this button together with the "SET"	Section 4.5
	button for 3 s or more to switch to the one-touch tuning mode.	Castian
(3)	USB communication connector (CN5) Connect with the personal computer.	Section 11.7
(4)	Analog monitor connector (CN6) Outputs the analog monitor.	Section 3.2
(5)	RS-422/RS-485 communication connector (CN3) Connect with the RS-422/RS-485 communication controller, parameter unit, etc.	Chapter 14
(6)	STO input signal connector (CN8) Used to connect the MR-J3-D05 safety logic unit and external safety relay.	Chapter 13 App. 5
(7)	I/O signal connector (CN1) Used to connect digital I/O signals.	Section 3.2 Section 3.4
(8) (Note 2)	Encoder connector (CN2) Used to connect the servo motor encoder or external encoder. Refer to table 1.1 for the compatible external encoders.	Section 3.4 "Servo Motor Instruction Manual (Vol. 3)"
(9)	Battery connector (CN4) Used to connect the battery for absolute position data backup.	Chapter 12
(10)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(11)	Protective earth (PE) terminal	Section 3.1
(12)	Main circuit power connector (CNP1) Connect the input power supply.	Section 3.3
(13)	Rating plate	Section 1.6
(14)	Control circuit power connector (CNP2) Connect the control circuit power supply and regenerative option.	Section 3.1 Section 3.3
(15)	Servo motor power output connector (CNP3) Connect the servo motor.	Occilon 6.5
(16)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(17) (Note 1, 2)	External encoder connector (CN2L) Refer to table 1.1 for the compatible external encoders.	Section 3.4 "Linear Encoder Instruction Manual"
(18)	Optional unit connector (CN7) Connect the optional unit. It is available with MR-J4A-RJ servo amplifiers manufactured in November 2014 or later. The MR-J4A servo amplifier does not have this connector.	
(19)	Optional unit connector (CN9) Connect the optional unit. It is available with MR-J4A-RJ servo amplifiers manufactured in November 2014 or later. The MR-J4A servo amplifier does not have this connector.	

- Note 1. This is for the MR-J4-_A-RJ servo amplifier. The MR-J4-_A servo amplifier does not have the CN2L connector.
 - 2. "External encoder" is a term for linear encoder used in the linear servo system and load-side encoder used in the fully closed loop system in this manual.

(b) MR-J4-350A(-RJ)

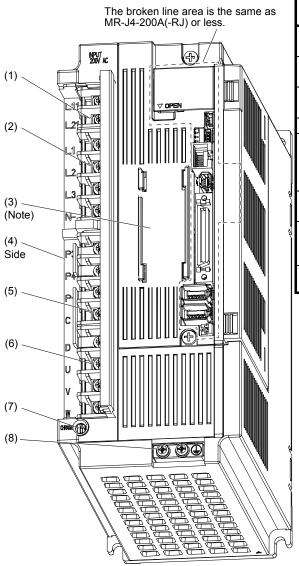


No.	Name/Application	Detailed explanation
(1)	Main circuit power connector (CNP1)	Section 3.1
(1)	Connect the input power supply.	Section 3.3
(2)	Rating plate	Section 1.6
(2)	Servo motor power connector (CNP3)	
(3)	Connect the servo motor.	Coation 2.1
	Control circuit power connector (CNP2)	Section 3.1 Section 3.3
(4)	Connect the control circuit power supply and	0000011 0.0
	regenerative option.	
	Charge lamp	
(5)	When the main circuit is charged, this will light up.	
	While this lamp is lit, do not reconnect the cables.	
(6)	Protective earth (PE) terminal	Section 3.1
(0)		Section 3.3
(7)	Battery holder	Section
(1)	Install the battery for absolute position data backup.	12.2

(c) MR-J4-500A(-RJ)

POINT

●The servo amplifier is shown with the front cover open. The front cover cannot be removed.

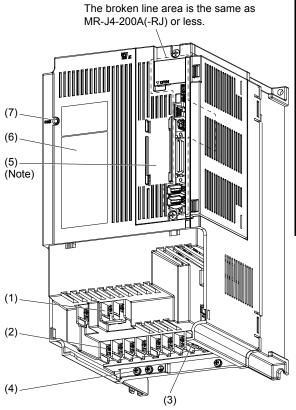


No.	Name/Application	Detailed explanation
(1)	Control circuit terminal block (TE2)	
(1)	Used to connect the control circuit power supply.	Section 3.1
(0)	Main circuit terminal block (TE1)	Section 3.3
(2)	Connect the input power supply.	
(2)	Battery holder	Section
(3)	Install the battery for absolute position data backup.	12.2
(4)	Rating plate	Section 1.6
	Regenerative option/power factor improving reactor	
(5)	terminal block (TE3)	
(5)	Used to connect a regenerative option or a power	Section 3.1
	factor improving DC reactor.	Section 3.3
(6)	Servo motor power supply terminal block (TE4)	
(0)	Connect the servo motor.	
	Charge lamp	
(7)	When the main circuit is charged, this will light up.	
	While this lamp is lit, do not reconnect the cables.	
(8)	Protective earth (PE) terminal	Section 3.1
(5)		Section 3.3

(d) MR-J4-700A(-RJ)

POINT

●The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.

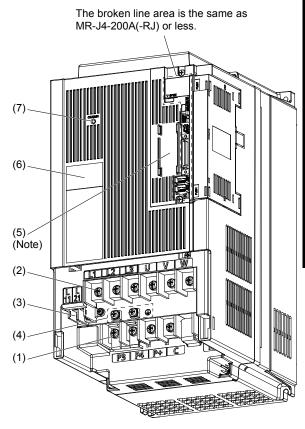


No.	Name/Application	Detailed explanation
(1)	Power factor improving reactor terminal block (TE3)	
(1)	Used to connect the DC reactor.	
	Main circuit terminal block (TE1)	
(2)	Used to connect the input power supply,	Section 3.1
	regenerative option, and servo motor.	Section 3.3
(3)	Control circuit terminal block (TE2)	
(3)	Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal	
(E)	Battery holder	Section
(5)	Install the battery for absolute position data backup.	12.2
(6)	Rating plate	Section 1.6
	Charge lamp	
(7)	When the main circuit is charged, this will light up.	
, ,	While this lamp is lit, do not reconnect the cables.	

(e) MR-J4-11KA(-RJ)/MR-J4-15KA(-RJ)

POINT

■The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.

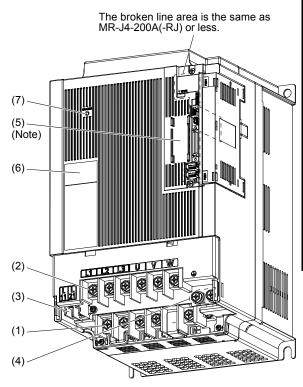


No.	Name/Application	Detailed explanation
(1)	Power factor improving reactor terminal block (TE1-2) Used to connect a power factor improving DC reactor and a regenerative option.	
(2)	Main circuit terminal block (TE1-1) Used to connect the input power supply and servo motor.	Section 3.1 Section 3.3
(3)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal	
(5)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(6)	Rating plate	Section 1.6
(7)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	

(f) MR-J4-22KA(-RJ)

POINT

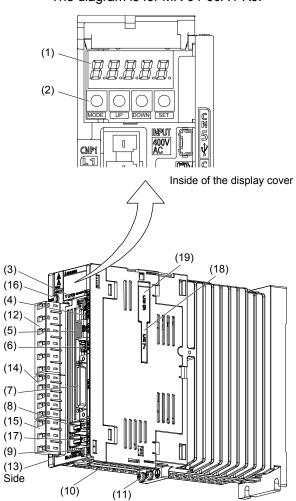
●The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.



No.	Name/Application	Detailed explanation
(1)	Power factor improving reactor terminal block (TE1-2) Used to connect a power factor improving DC reactor and a regenerative option.	
(2)	Main circuit terminal block (TE1-1) Used to connect the input power supply and servo motor.	Section 3.1 Section 3.3
(3)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal	
(5)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(6)	Rating plate	Section 1.6
(7)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	

(2) 400 V class

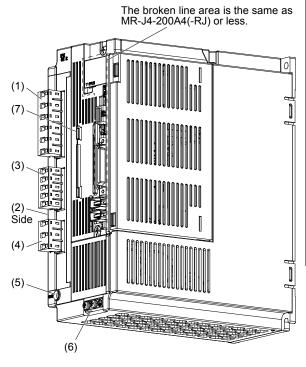
(a) For MR-J4-200A4(-RJ) or less The diagram is for MR-J4-60A4-RJ.



No.	Name/Application	Detailed explanation
(1)	Display The 5-digit, seven-segment LED shows the servo status and the alarm number.	p - 1011011
	Operation section Used to perform status display, diagnostic, alarm, and parameter setting operations. Push the "MODE" and "SET" buttons at the same time for 3 s or more to switch to the one-touch tuning mode. MODE UP DOWN SET	Section 4.5
(2)	Used to set data. Push this button together with the "MODE" button for 3 s or more to switch to the one-touch tuning mode. Used to change the display or data in each mode.	Section 4.5
	Used to change the mode. Push this button together wish the "SET" button for 3 s or more to switch to the one-touch tuning mode.	
(3)	USB communication connector (CN5) Connect with the personal computer.	Section 11.7
(4)	Analog monitor connector (CN6) Outputs the analog monitor.	Section 3.2
(5)	RS-422/RS-485 communication connector (CN3) Connect with the RS-422/RS-485 communication controller, parameter unit, etc.	Chapter 14
(6)	STO input signal connector (CN8) Used to connect MR-J3-D05 safety logic unit and external safety relay.	Chapter 13 App. 5
(7)	I/O signal connector (CN1) Used to connect digital I/O signals.	Section 3.2 Section 3.4
(8) (Note 2)	Encoder connector (CN2) Used to connect the servo motor encoder or external encoder. Refer to table 1.1 for the compatible external encoders.	Section 3.4 "Servo Motor Instruction Manual (Vol. 3)"
(9)	Battery connector (CN4) Used to connect the battery for absolute position data backup.	Chapter 12
(10)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(11)	Protective earth (PE) terminal Main circuit power connector (CNP1)	Section 3.1 Section 3.3
(13)	Connect the input power supply. Rating plate	Section 1.6
(14)	Control circuit power connector (CNP2) Connect the control circuit power supply and regenerative option.	Section 3.1
(15)	Servo motor power output connector (CNP3) Connect the servo motor.	Section 3.3
(16)	Charge lamp When the main circuit is charged, this will light. While this lamp is lit, do not reconnect the cables.	
(17) (Note 1)	External encoder connector (CN2L) Used to connect the external encoder. Refer to table 1.1 for the compatible external encoders.	Section 3.4 "Linear Encoder Instruction Manual"
(18)	Optional unit connector (CN7) Connect the optional unit. It is available with MR-J4-A4-RJ servo amplifiers manufactured in November 2014 or later. MR-J4-A4 servo amplifier does not have this connector.	
(19)	Optional unit connector (CN9) Connect the optional unit. It is available with MR- J4A4-RJ servo amplifiers manufactured in November 2014 or later. The MR-J4A4 servo amplifier does not have this connector.	

- Note 1. This is for MR-J4-_A4-RJ servo amplifier. MR-J4-_A4 servo amplifier does not have CN2L connector.
 - 2. "External encoder" is a term for linear encoder used in the linear servo system and load-side encoder used in the fully closed loop system in this manual.

(b) MR-J4-350A4(-RJ)

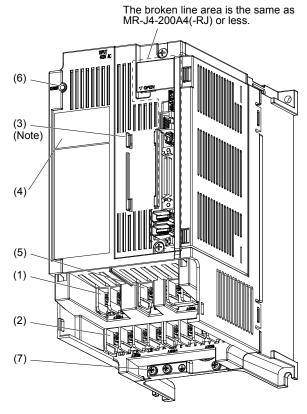


No.	Name/Application	Detailed explanation
(1)	Main circuit power connector (CNP1)	Section 3.1
(1)	Connect the input power supply.	Section 3.3
(2)	Rating plate	Section 1.6
	Control circuit power connector (CNP2)	
(3)	Connect the control circuit power supply and	Section 3.1
	regenerative option.	Section 3.1
(4)	Servo motor power output connector (CNP3)	Section 5.5
(+)	Connect the servo motor.	
	Charge lamp	
(5)	When the main circuit is charged, this will light.	
	While this lamp is lit, do not reconnect the cables.	
(6)	Protective earth (PE) terminal	Section 3.1
(0)		Section 3.3
	Battery holder	
(7)	Install the battery for absolute position data	Section 12.2
	backup.	

(c) MR-J4-500A4(-RJ)

POINT

■The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.

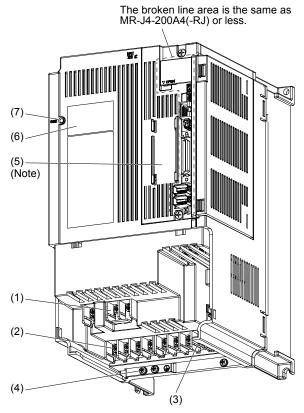


No.	Name/Application	Detailed explanation
(1)	Control circuit terminal block (TE2)	
(1)	Used to connect the control circuit power supply.	Section 3.1
	Main circuit terminal block (TE1)	Section 3.1
(2)	Used to connect the input power supply,	Section 5.5
	regenerative option and servo motor.	
	Battery holder	
(3)	Install the battery for absolute position data	Section 12.2
	backup.	
(4)	Rating plate	Section 1.6
	Power factor improving reactor terminal block	
(5)	(TE3)	Section 3.1
(-)	Used to connect a power factor improving DC	Section 3.3
	reactor.	
(6)	Charge lamp	
	When the main circuit is charged, this will light.	
	While this lamp is lit, do not reconnect the cables.	
(7)	Protective earth (PE) terminal	Section 3.1
		Section 3.3

(d) MR-J4-700A4(-RJ)

POINT

●The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.

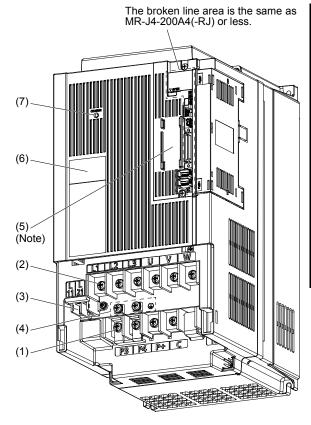


	İ	1
No.	Name/Application	Detailed
	.,	explanation
	Power factor improving reactor terminal block	
(1)	(TE3)	
	Used to connect the DC reactor.	
	Main circuit terminal block (TE1)	0 4: 0 4
(2)	Used to connect the input power supply,	Section 3.1
	regenerative option, and servo motor.	Section 3.3
(2)	Control circuit terminal block (TE2)	
(3)	Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal	
	Battery holder	
(5)	Install the battery for absolute position data	Section 12.2
	backup.	
(6)	Rating plate	Section 1.6
	Charge lamp	
(7)	When the main circuit is charged, this will light.	
	While this lamp is lit, do not reconnect the cables.	

(e) MR-J4-11KA4(-RJ)/MR-J4-15KA4(-RJ)

POINT

● The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.

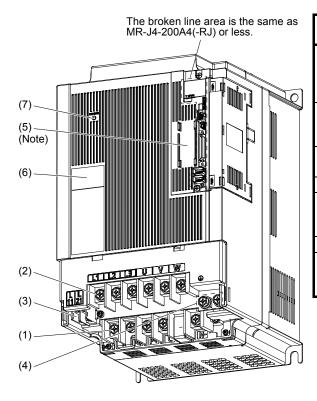


No.	Name/Application	Detailed explanation
(1)	Power factor improving reactor terminal block (TE1-2) Used to connect a power factor improving DC reactor and a regenerative option.	
(2)	Main circuit terminal block (TE1-1) Used to connect the input power supply and servo motor.	Section 3.1 Section 3.3
(3)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal	
(5)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(6)	Rating plate	Section 1.6
(7)	Charge lamp When the main circuit is charged, this will light. While this lamp is lit, do not reconnect the cables.	

(f) MR-J4-22KA4(-RJ)

POINT

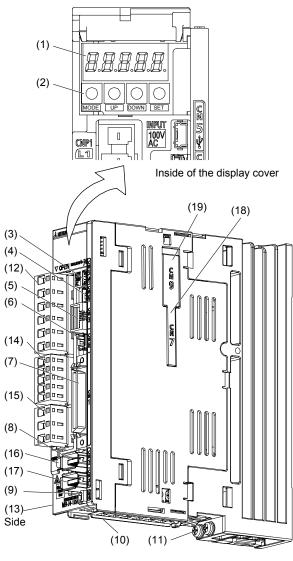
●The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.



No.	Name/Application	Detailed explanation
(1)	Power factor improving reactor terminal block (TE1-2) Used to connect a power factor improving DC reactor and a regenerative option.	
(2)	Main circuit terminal block (TE1-1) Used to connect the input power supply and servo motor.	Section 3.1 Section 3.3
(3)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal	
(5)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(6)	Rating plate	Section 1.6
(7)	Charge lamp When the main circuit is charged, this will light. While this lamp is lit do not reconnect the cables	

(3) 100 V class

The diagram is for MR-J4-10A1-RJ.



ı	NI.	No. of April 2015	Detailed
	No.	Name/Application	explanation
	(1)	Display The 5-digit, 7-segment LED shows the servo status and the alarm number.	Section 4.5
Ţ	(2)	Operation section Used to perform status display, diagnostic, alarm, and parameter setting operations. Push the "MODE" and "SET" buttons at the same time for 3 s or more to switch to the one-touch tuning mode. MODE UP DOWN SET Used to set data. Push this button together with the "MODE" button for 3 s or more to switch to the one-touch tuning mode. Used to change the display or data in each mode. Used to change the mode. Push this button together with the "SET" button for 3 s or more to switch to the one-touch tuning mode.	Section 4.5
	(3)	USB communication connector (CN5) Connect with the personal computer.	Section 11.7
	(4)	Analog monitor connector (CN6) Outputs the analog monitor.	Section 3.2
	(5)	RS-422/RS-485 communication connector (CN3) Connect with the RS-422/RS-485 communication controller, parameter unit, etc.	Chapter 14
	(6)	STO input signal connector (CN8) Used to connect the MR-J3-D05 safety logic unit and external safety relay.	Chapter 13 App. 5
	(7)	I/O signal connector (CN1) Used to connect digital I/O signals.	Section 3.2 Section 3.4
	(8) (Note 2)	Encoder connector (CN2) Used to connect the servo motor encoder or external encoder. Refer to table 1.1 for the compatible external encoders.	Section 3.4 "Servo Motor Instruction Manual (Vol. 3)"
	(9)	Battery connector (CN4) Used to connect the battery for absolute position data backup.	Chapter 12
	(10)	Battery holder Install the battery for absolute position data backup.	Section 12.2
٦	(11)	Protective earth (PE) terminal	Section 3.1
	(12)	Main circuit power connector (CNP1) Connect the input power supply.	Section 3.3
1	(13)	Rating plate	Section 1.6
	(14)	Control circuit power connector (CNP2) Connect the control circuit power supply and regenerative option.	Section 3.1 Section 3.3
	(15)	Servo motor power output connector (CNP3) Connect the servo motor.	
	(16)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	Section 2.4
	(17) (Note 1, 2)	External encoder connector (CN2L) Refer to table 1.1 for the compatible external encoders.	Section 3.4 "Linear Encoder Instruction Manual"
	(18)	Optional unit connector (CN7) Connect the optional unit. It is available with MR-J4A1-RJ servo amplifiers manufactured in November 2014 or later. The MR-J4A1 servo amplifier does not have this connector.	
	(19)	Optional unit connector (CN9) Connect the optional unit. It is available with MR-J4A1-RJ servo amplifiers manufactured in November 2014 or later. The MR-J4A1 servo amplifier does not have this connector.	

Note 1. This is for the MR-J4-_A1-RJ servo amplifier. The MR-J4-_A1 servo amplifier does not have the CN2L connector.

^{2. &}quot;External encoder" is a term for linear encoder used in the linear servo system and load-side encoder used in the fully closed loop system in this manual.

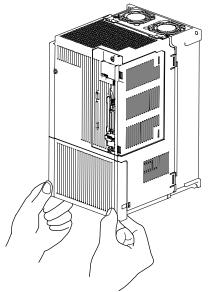
1.7.2 Removal and reinstallation of the front cover

∕•WARNING

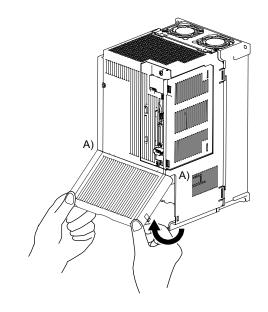
• Before removing or installing the front cover, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

The following shows how to remove and reinstall the front cover of MR-J4-700A(-RJ) to MR-J4-22KA(-RJ) and MR-J4-500A4(-RJ) to MR-J4-22KA4(-RJ). The diagram shows MR-J4-700A.

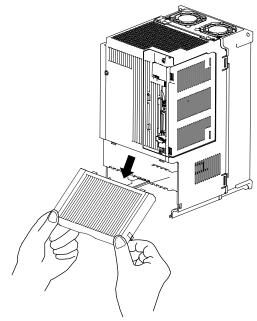
(1) Removal of the front cover



1) Hold the ends of lower side of the front cover with both hands.

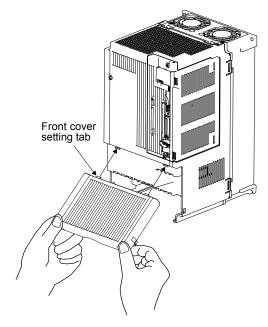


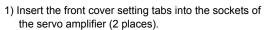
2) Pull up the cover, supporting at point A).

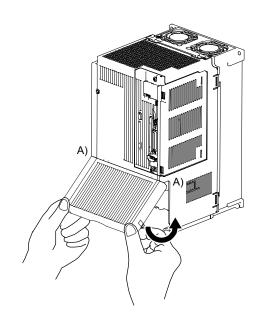


3) Pull out the front cover to remove.

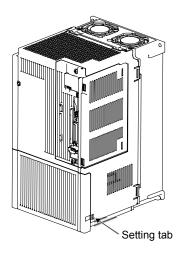
(2) Reinstallation of the front cover







2) Push down the cover, supporting at point A).



3) Press the cover against the terminal box until the setting tabs click.

1.8 Configuration including peripheral equipment

ACAUTION

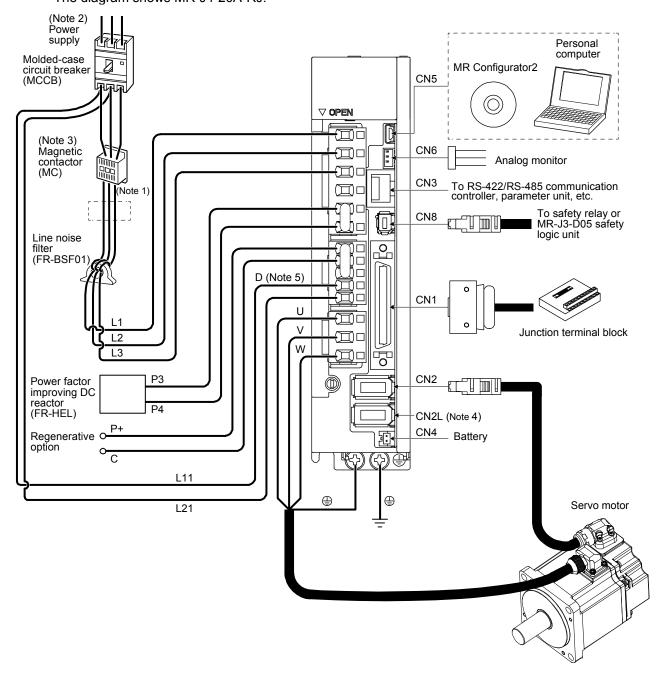
●Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

POINT

- ●Equipment other than the servo amplifier and servo motor are optional or recommended products.
- ●When using the MR-J4-_A-RJ servo amplifier with the DC power supply input, refer to app. 13.

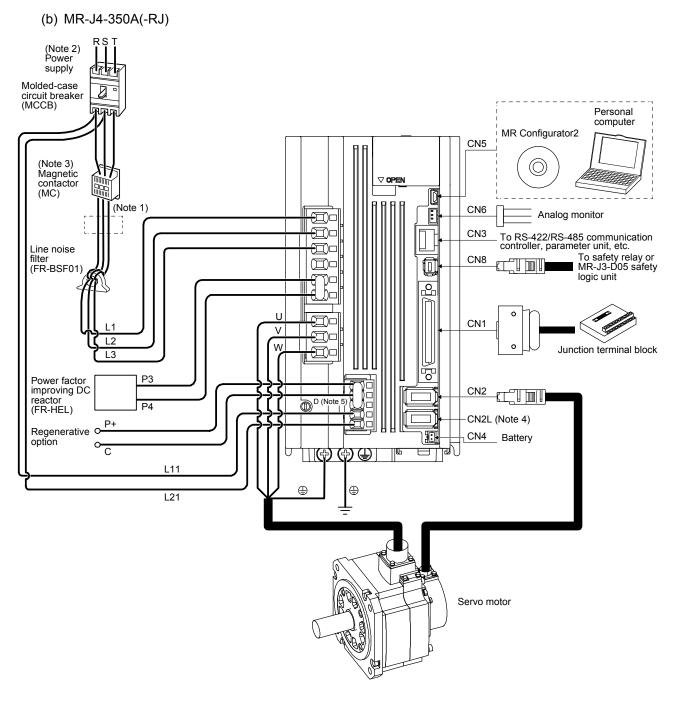
(1) 200 V class

(a) MR-J4-200A(-RJ) or less
The diagram shows MR-J4-20A-RJ.



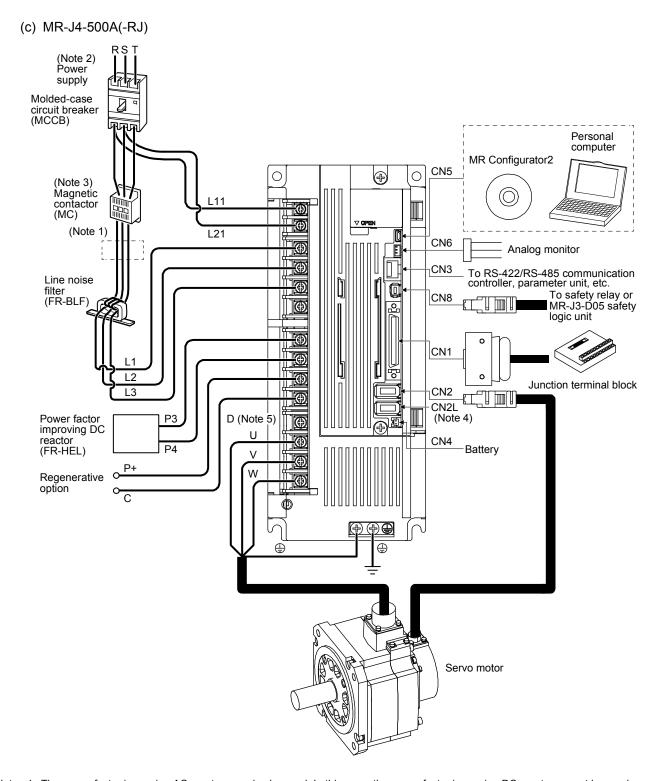
Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

- 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.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for the MR-J4-_A-RJ servo amplifier. The MR-J4-_A servo amplifier does not have the CN2L connector. When using an MR-J4-_A-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.



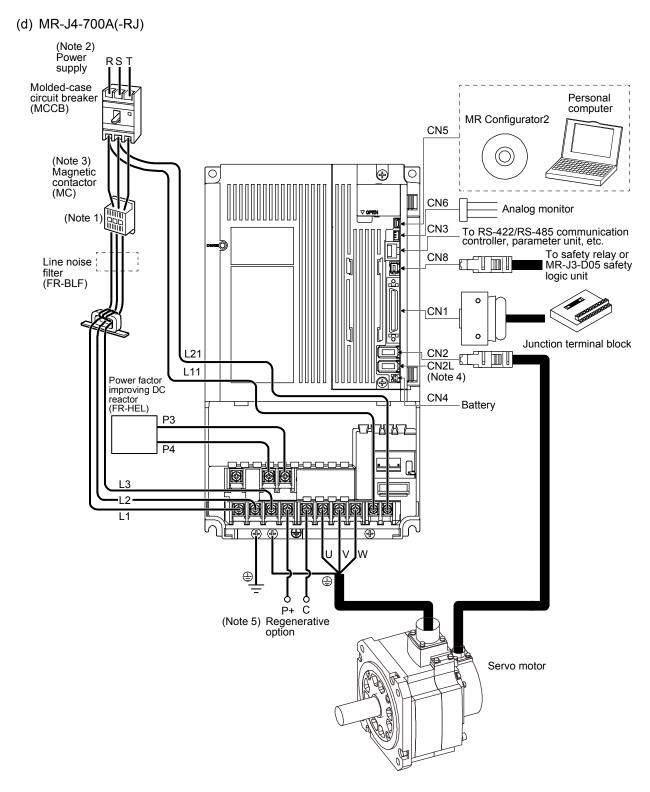
Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

- 2. For the power supply specifications, refer to section 1.3.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for the MR-J4-_A-RJ servo amplifier. The MR-J4-_A servo amplifier does not have the CN2L connector. When using MR-J4-_A-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

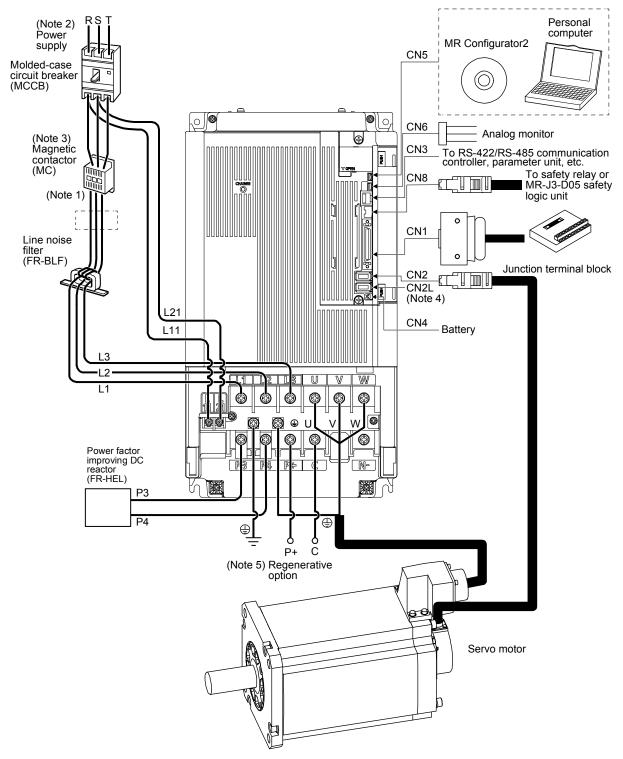
- 2. For the power supply specifications, refer to section 1.3.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for the MR-J4-_A-RJ servo amplifier. The MR-J4-_A servo amplifier does not have the CN2L connector. When using an MR-J4-_A-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

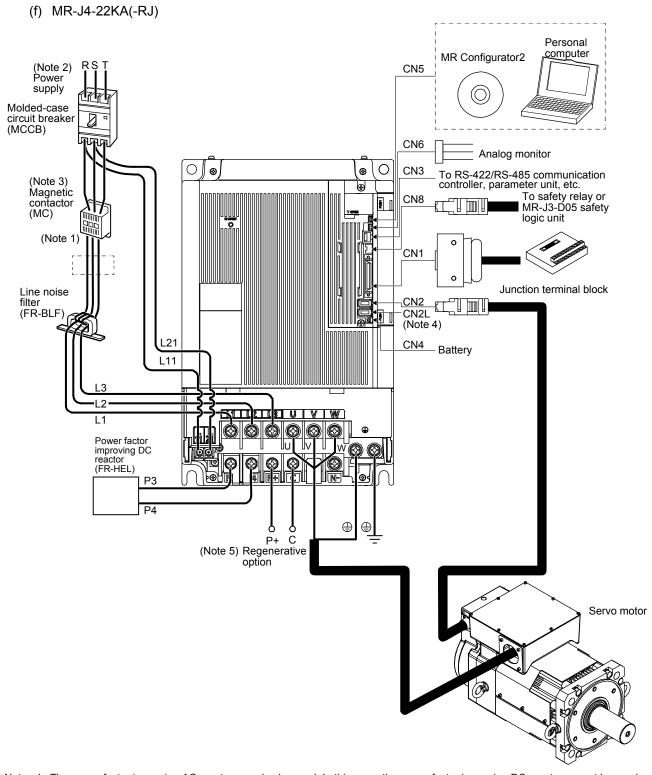
- 2. For the power supply specifications, refer to section 1.3.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for the MR-J4-_A-RJ servo amplifier. The MR-J4-_A servo amplifier does not have the CN2L connector. When using an MR-J4-_A-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. When using the regenerative option, refer to section 11.2.

(e) MR-J4-11KA(-RJ)/MR-J4-15KA(-RJ)



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

- 2. For the power supply specifications, refer to section 1.3.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for the MR-J4-_A-RJ servo amplifier. The MR-J4-_A servo amplifier does not have the CN2L connector. When using an MR-J4-_A-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. When using the regenerative option, refer to section 11.2.



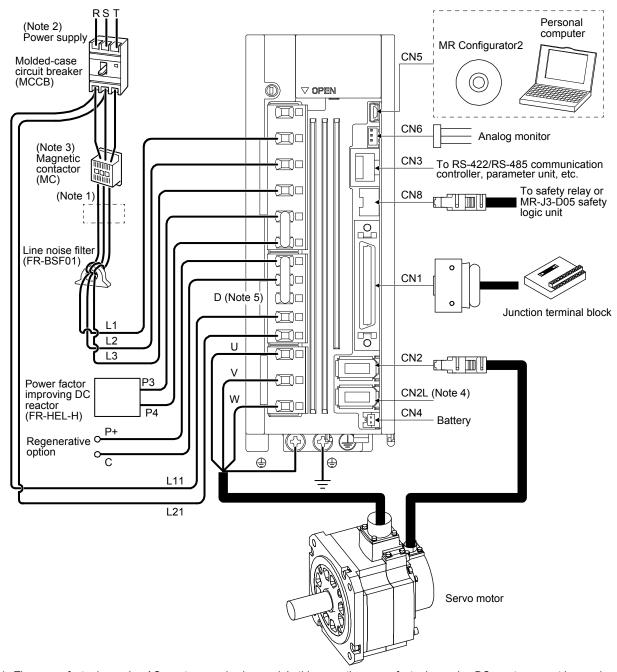
Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

- 2. For the power supply specifications, refer to section 1.3.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for the MR-J4-_A-RJ servo amplifier. The MR-J4-_A servo amplifier does not have the CN2L connector. When using an MR-J4-_A-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. When using the regenerative option, refer to section 11.2.

(2) 400 V class

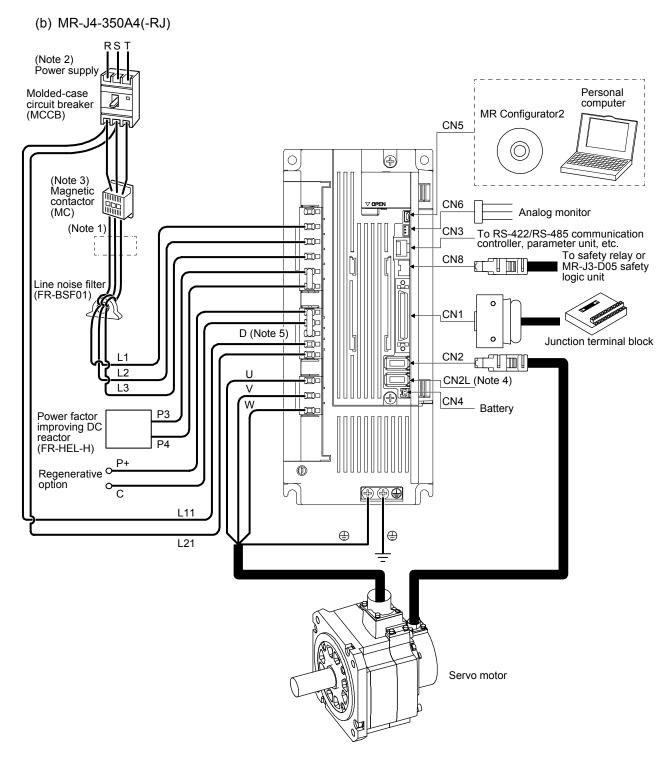
(a) MR-J4-200A4(-RJ) or less

The diagram is for MR-J4-60A4-RJ and MR-J4-100A4-RJ.



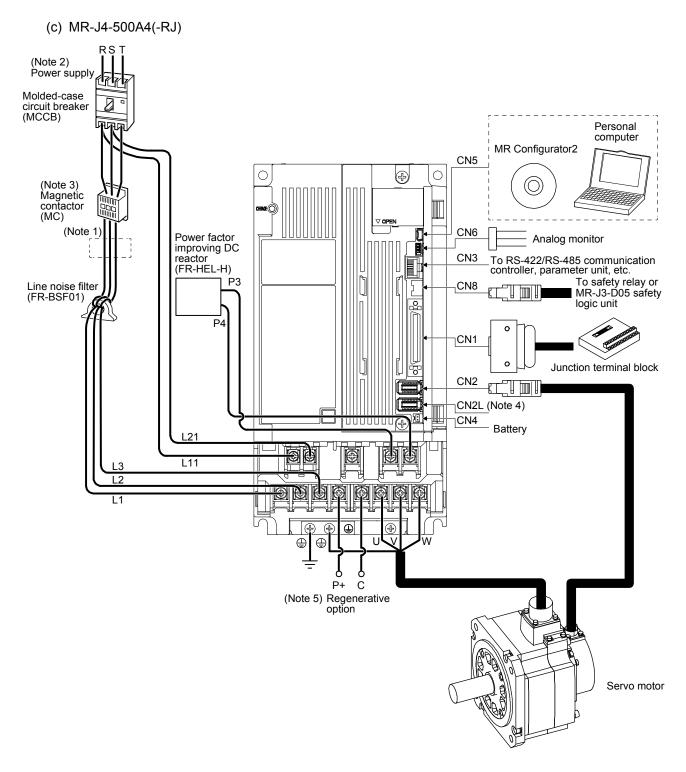
Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

- 2. Refer to section 1.3 for the power supply specification.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for MR-J4-_A4-RJ servo amplifier. MR-J4-_A4 servo amplifier does not have CN2L connector. When using MR-J4-_A4-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to Table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.



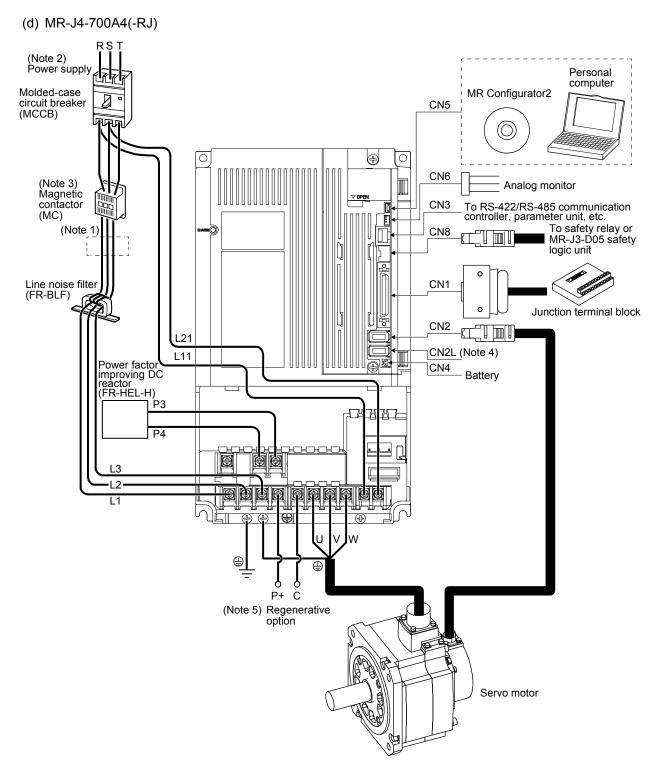
Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

- 2. Refer to section 1.3 for the power supply specification.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for MR-J4-_A4-RJ servo amplifier. MR-J4-_A4 servo amplifier does not have CN2L connector. When using MR-J4-_A4-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to Table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

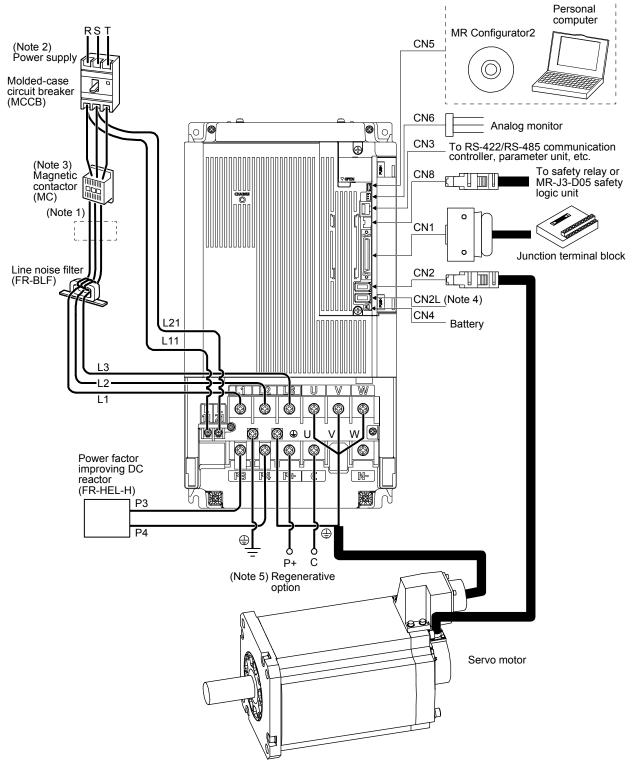
- 2. Refer to section 1.3 for the power supply specification.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for MR-J4-_A4-RJ servo amplifier. MR-J4-_A4 servo amplifier does not have CN2L connector. When using MR-J4-_A4-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to Table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. When using the regenerative option, refer to section 11.2.



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

- 2. Refer to section 1.3 for the power supply specification.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for MR-J4-_A4-RJ servo amplifier. MR-J4-_A4 servo amplifier does not have CN2L connector. When using MR-J4-_A4-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to Table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. When using the regenerative option, refer to section 11.2.

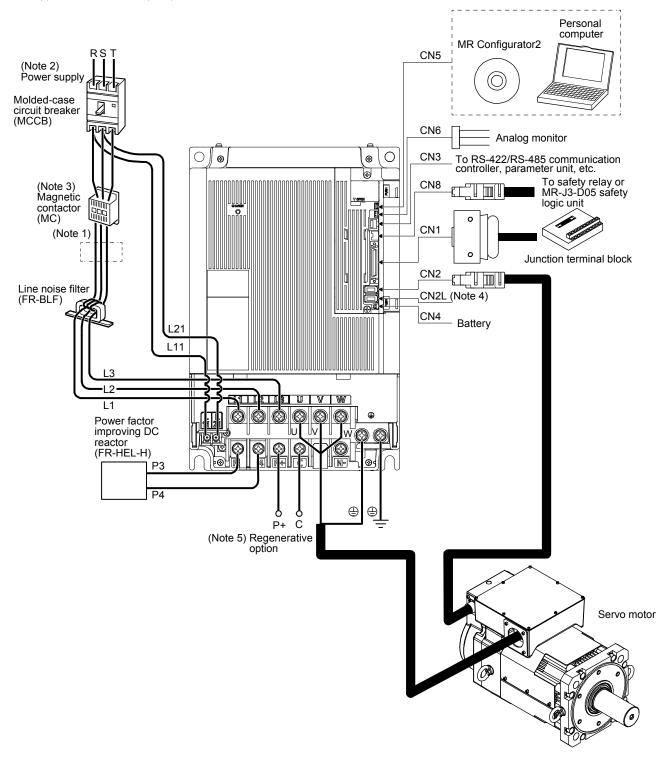
(e) MR-J4-11KA4(-RJ)/MR-J4-15KA4(-RJ)



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

- 2. Refer to section 1.3 for the power supply specification.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for MR-J4-_A4-RJ servo amplifier. MR-J4-_A4 servo amplifier does not have CN2L connector. When using MR-J4-_A4-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to Table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. When using the regenerative option, refer to section 11.2.

(f) MR-J4-22KA4(-RJ)

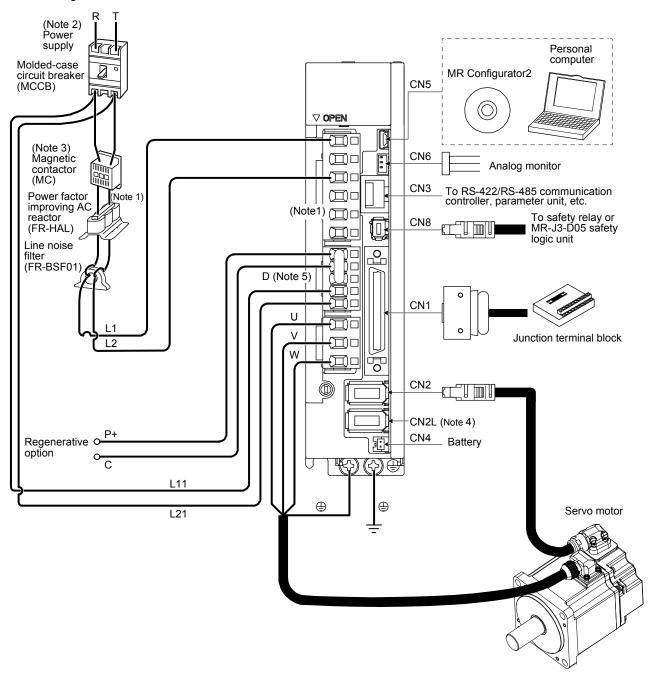


Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

- 2. Refer to section 1.3 for the power supply specification.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for MR-J4-_A4-RJ servo amplifier. MR-J4-_A4 servo amplifier does not have CN2L connector. When using MR-J4-_A4-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to Table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
- 5. When using the regenerative option, refer to section 11.2.

(3) 100 V class

The diagram shows MR-J4-20A1-RJ.



Note 1. The power factor improving DC reactor cannot be used.

- 2. For power supply specifications, refer to section 1.3.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. This is for MR-J4-_A1-RJ servo amplifier. MR-J4-_A1 servo amplifier does not have CN2L connector. Refer to Table 1.1 and Linear Encoder Instruction Manual for the compatible external encoders.
- 5. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.

2. INSTALLATION

WARNING ●To prevent electric shock, ground each equipment securely.

- Stacking in excess of the specified number of product packages is not allowed.
- ●Install the equipment on incombustible material. Installing it directly or close to combustibles will lead to 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 equipment. 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 strike the servo amplifier. Isolate it from all impact loads.

- ↑ CAUTION Do not install or operate the servo amplifier which have been damaged or have any parts missing.
 - ●When the equipment 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 the 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.

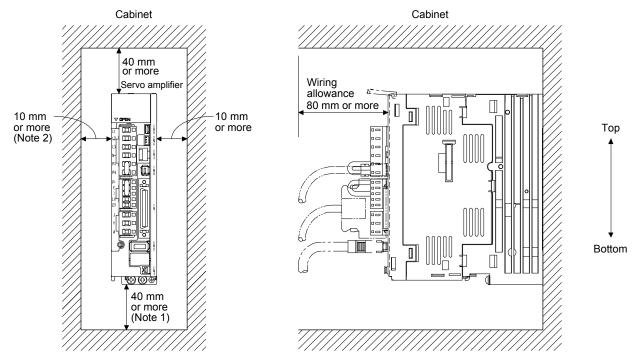
POINT

■When pulling out CNP1, CNP2, and CNP3 connectors of 100 V class/600 W or lower 200 V class servo amplifier, pull out CN3 and CN8 connectors beforehand.

2.1 Installation direction and clearances



- 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.
- (1) Installation clearances of the servo amplifier
 - (a) Installation of one servo amplifier



Note 1. For 11 kW to 22 kW servo amplifiers, the clearance between the bottom and ground will be 120 mm or more.

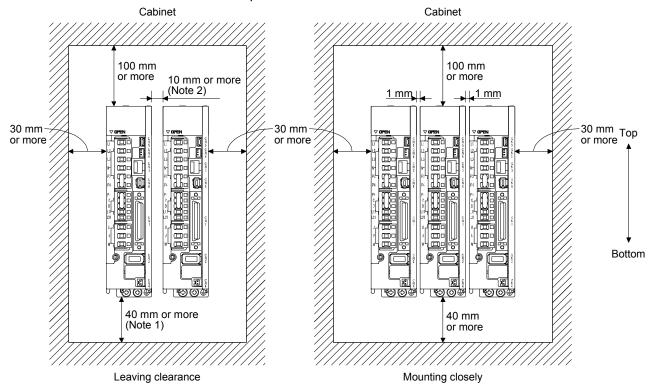
2. For the MR-J4-500A(-RJ), the clearance between the left side and wall will be 25 mm or more.

(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.
- •When mounting the servo amplifiers closely, do not install the servo amplifier whose depth is larger than that of the left side servo amplifier since CNP1, CNP2, and CNP3 connectors cannot be disconnected.

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.



Note 1. For 11 kW to 22 kW servo amplifiers, the clearance between the bottom and ground will be 120 mm or more.

2. When you install the MR-J4-500A(-RJ) on the right side, the clearance between the left side and wall will be 25 mm or more.

(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. INSTALLATION

2.2 Keeping out of 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 bending 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. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. 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.



- 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 vary 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 sales representative.

Part name	Life guideline
Smoothing capacitor	10 years
Relay	Number of power-on and forced stop by EM1 (Forced stop 1) times: 100,000 times Number of on and off for STO: 1,000,000 times
Cooling fan	10,000 hours to 30,000 hours (2 years to 3 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 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 reach the end of their lives when the power has been turned on and forced stop by EM1 (Forced stop 1) has occurred 100,000 times in total, or when the STO has been turned on and off 1,000,000 times while the servo motor is stopped under servo-off state. However, the lives of relays may depend on the power supply capacity.

(3) Servo amplifier cooling fan

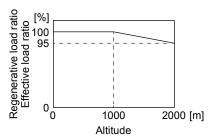
The cooling fan bearings reach the end of their life in 10,000 hours to 30,000 hours. Normally, therefore, the cooling fan must be replaced in a few years of continuous operation as a guideline. It must also be changed if unusual noise or vibration is found during inspection.

The life indicates under the yearly average ambient temperature of 40 °C, free from corrosive gas, flammable gas, oil mist, dust and dirt.

2. INSTALLATION

- 2.6 Restrictions when using the servo amplifiers at altitude exceeding 1000 m and up to 2000 m above sea level
- (1) Effective load ratio and regenerative load ratio

Heat dissipation effects decrease in proportion to decreasing air density, and hence use the servo amplifiers with the effective load ratio and the regenerative load ratio within the following range.



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

(2) Input voltage

Generally, withstand voltage decreases as increasing altitude; 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) Relays

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.)

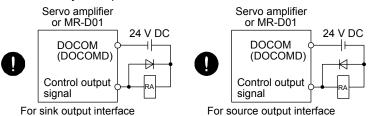
2. INSTALLATION

MEMO		

3. SIGNALS AND WIRING

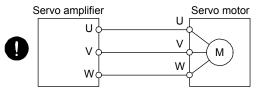
- Any person who is involved in wiring should be fully competent to do the work.
- Before wiring, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

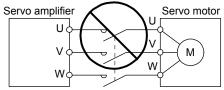
- MARNING ●Ground the servo amplifier and servo motor securely.
 - Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, it may cause an electric shock.
 - ●The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
 - ■To avoid an electric shock, insulate the connections of the power supply terminals.
 - 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
 - ●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.





- •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 (-H)) 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, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.





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

POINT

●When you use a linear servo motor, replace the following left words to the right words.

Load to motor inertia ratio → Load to motor mass ratio

Torque \rightarrow Thrust

(Servo motor) speed → (Linear servo motor) speed

3.1 Input power supply circuit

- ◆Always connect a magnetic contactor between the power supply and the main circuit power supply (L1, L2, and 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 main circuit power supply off. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat 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.
- ●The N- terminal is not a neutral point of the power supply. Incorrect wiring will cause a burst, damage, etc.

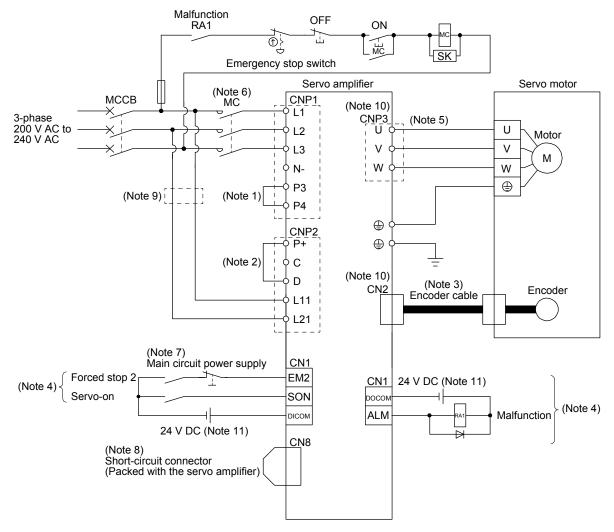
POINT

- ●EM2 has the same function as EM1 in the torque control mode.
- 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-J3 Series Servo Amplifier's. When using MR-J4 as a replacement for MR-J3, be careful not to connect the power to L2.
- ●When using the MR-J4-_A-RJ servo amplifier with the DC power supply input, refer to app. 13.

Configure the wirings so that the main circuit 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 main circuit power supply.

3.1.1 200 V class

(1) For 3-phase 200 V AC to 240 V AC power supply of MR-J4-10A(-RJ) to MR-J4-350A(-RJ)



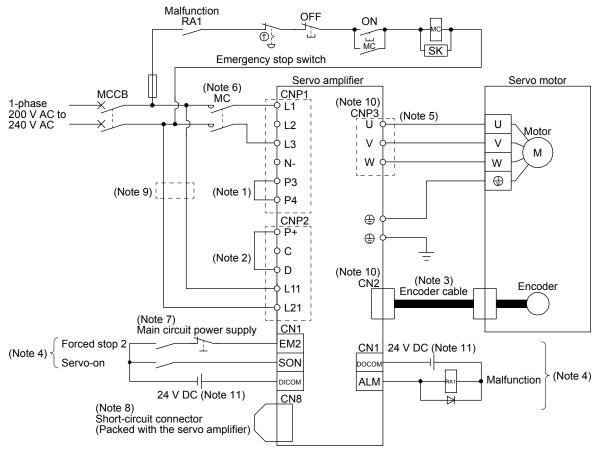
Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

- 2. Always connect between P+ and D terminals (factory-wired). When using the regenerative option, refer to section 11.2.
- 3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 4. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 5. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 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 main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 7. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 8. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 9. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
- 10. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- 11. 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) For 1-phase 200 V AC to 240 V AC power supply of MR-J4-10A(-RJ) to MR-J4-200A(-RJ)

POINT

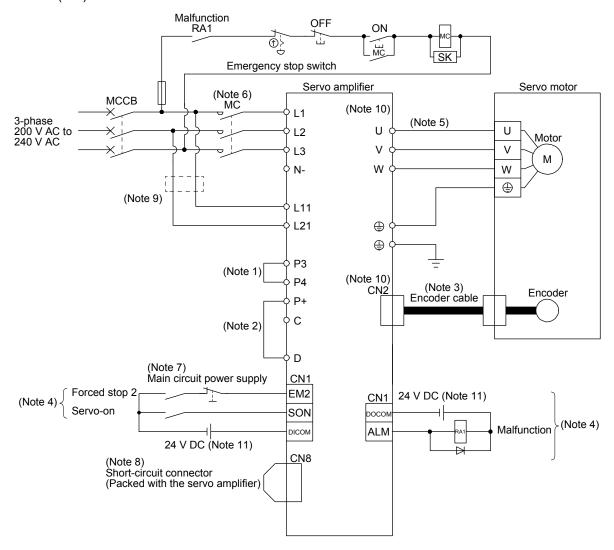
Connect the 1-phase 200 V AC to 240 V AC power supply to L1 and L3. One of the connecting destinations is different from MR-J3 Series Servo Amplifier's. When using MR-J4 as a replacement for MR-J3, be careful not to connect the power to L2.



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

- 2. Always connect between P+ and D terminals (factory-wired). When using the regenerative option, refer to section 11.2.
- 3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 4. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 5. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 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 main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 7. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 8. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 9. When wires used for L11 and L21 are thinner than wires used for L1, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
- 10. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- 11. 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.

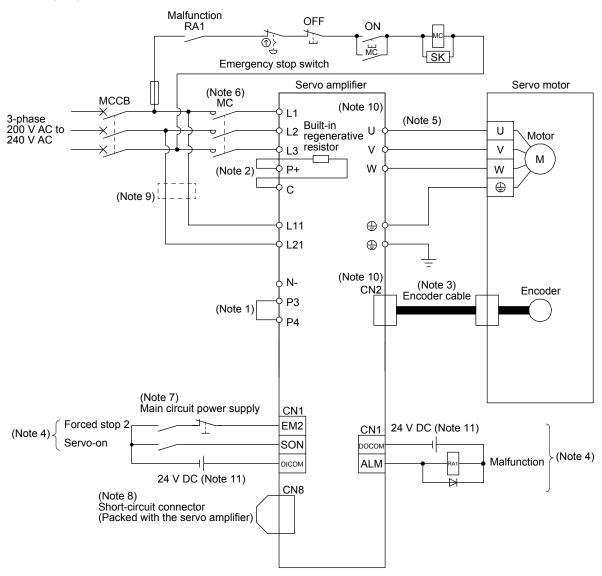
(3) MR-J4-500A(-RJ)



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

- 2. Always connect between P+ and D terminals (factory-wired). When using the regenerative option, refer to section 11.2.
- 3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 4. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 5. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 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 main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 8. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
- 10. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- 11. 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.

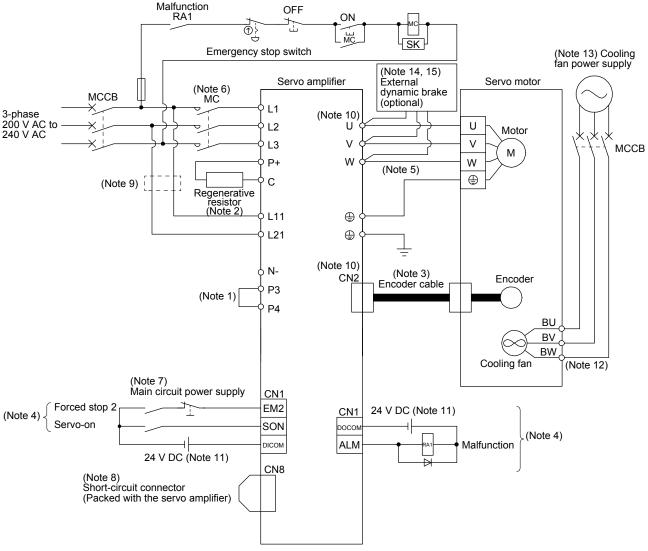
(4) MR-J4-700A(-RJ)



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

- 2. When using the regenerative option, refer to section 11.2.
- 3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 4. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 5. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 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 main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 8. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 9. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
- 10. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- 11. 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) MR-J4-11KA(-RJ)/MR-J4-15KA(-RJ)/MR-J4-22KA(-RJ)



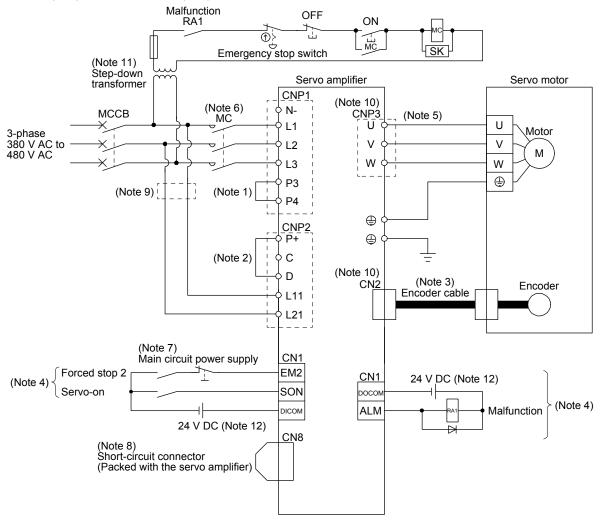
- Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
 - 2. When using the regenerative option, refer to section 11.2.
 - 3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
 - This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
 - For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)"
 - 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 main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required. slow the time to turn off the magnetic contactor.
 - 7. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier
 - When not using the STO function, attach the short-circuit connector came with a servo amplifier.
 - When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)

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

 11. 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.
 - 12. For the servo motor with a cooling fan.
 - 13. For the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)".
 - 14. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at an alarm occurrence for which the servo motor does not decelerate to stop. Ensure the safety in the entire equipment. For alarms for which the servo motor does not decelerate to stop, refer to chapter 8. For wiring of the external dynamic brake, refer to section 11.17.
 - The external dynamic brake cannot be used for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs

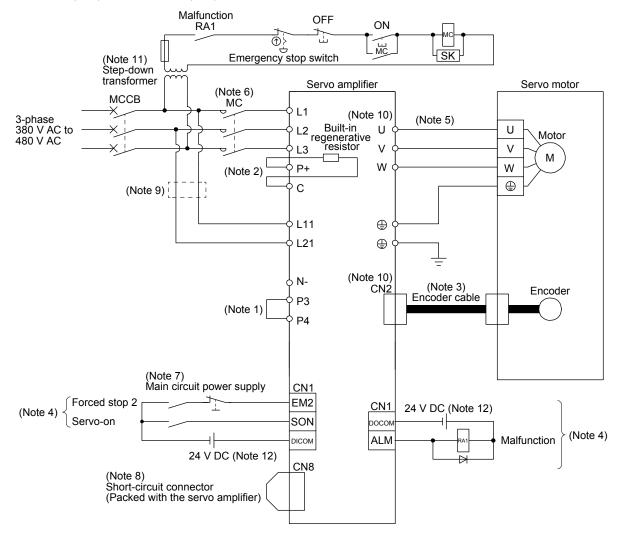
3.1.2 400 V class

(1) MR-J4-60A4(-RJ) to MR-J4-350A4(-RJ)



- Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
 - 2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
 - 3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
 - 4. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
 - 5. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
 - 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 main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
 - 7. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
 - 8. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
 - 9. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
 - 10. Connecting a servo motor for different axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
 - 11. Stepdown transformer is required when the coil voltage of the magnetic contactor is 200 V class.
 - 12. 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.

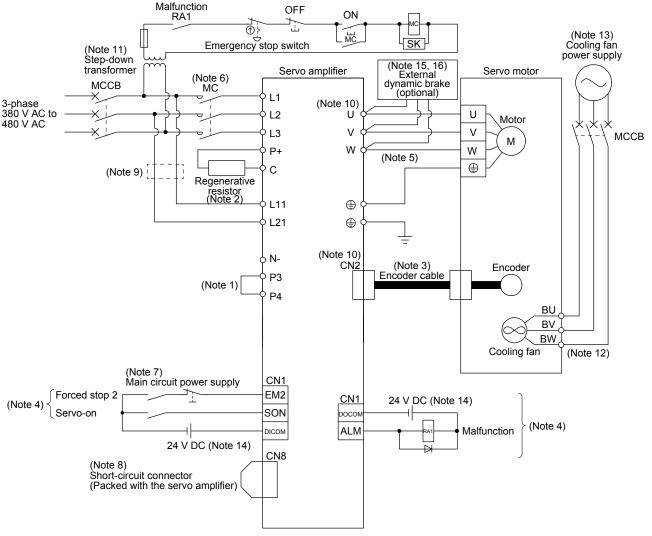
(2) MR-J4-500A4(-RJ)/MR-J4-700A4(-RJ)



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

- 2. When using the regenerative option, refer to section 11.2.
- For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 4. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 5. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 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 main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the serve amplifier.
- 8. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 9. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
- 10. Connecting a servo motor for different axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- 11. Stepdown transformer is required when the coil voltage of the magnetic contactor is 200 V class.
- 12. 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.

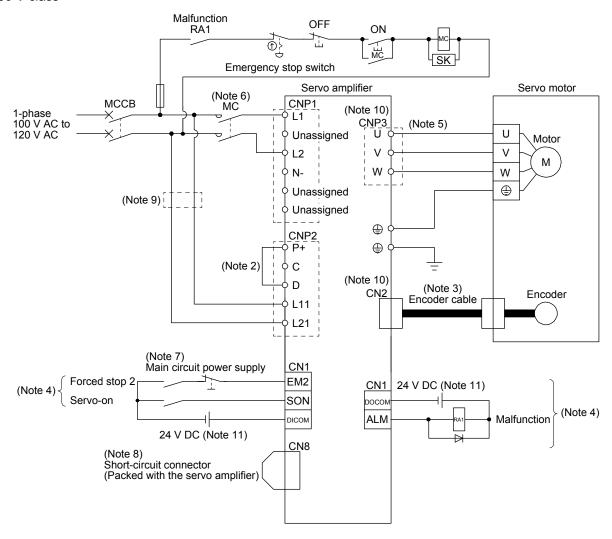
(3) MR-J4-11KA4(-RJ) to MR-J4-22KA4(-RJ)



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

- 2. When using the regenerative option, refer to section 11.2.
- 3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 4. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 5. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 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 main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 8. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
- 10. Connecting a servo motor for different axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- 11. Stepdown transformer is required when the coil voltage of the magnetic contactor is 200 V class.
- 12. For the servo motor with a cooling fan.
- 13. For the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)"
- 14. 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.
- 15. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at an alarm occurrence for which the servo motor does not decelerate to stop. Ensure the safety in the entire equipment. For alarms for which the servo motor does not decelerate to stop, refer to chapter 8. For wiring of the external dynamic brake, refer to section 11.17.
- 16. The external dynamic brake cannot be used for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs.

3.1.3 100 V class



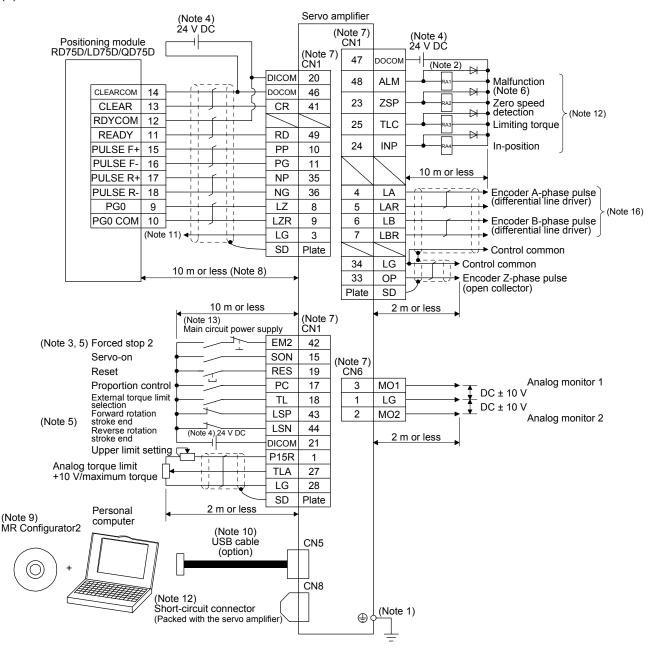
Note 1. The power factor improving DC reactor cannot be used.

- 2. Always connect between P+ and D terminals (factory-wired). When using the regenerative option, refer to section 11.2.
- 3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 4. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 5. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 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 main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 7. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 8. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 9. When wires used for L11 and L21 are thinner than wires used for L1 and L2, use a molded-case circuit breaker. (Refer to section 11.10.)
- 10. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- 11. 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.

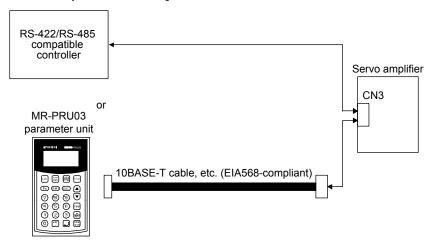
3.2 I/O signal connection example

3.2.1 Position control mode

(1) 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 500 mA. 500 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. When this signal (normally closed contact) 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 11.7.)
 - 10. Controller or parameter units can also be connected via the CN3 connector, enabling RS-422/RS-485 communication. Note that using the USB communication function (CN5 connector) prevents the RS-422/RS-485 communication function (CN3 connector) from being used, and vice versa. They cannot be used together.

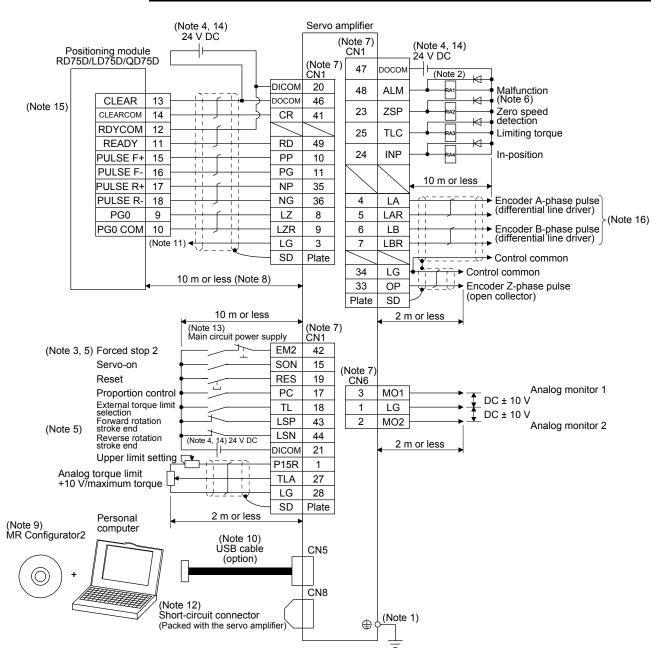


- 11. This connection is not required forRD75D, LD75D and QD75D. However, to enhance noise tolerance, it is recommended to connect LG of servo amplifier and control common depending on the positioning module.
- 12. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 13. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier
- 14. Plus and minus of the power of source interface are the opposite of those of sink interface.
- 15. CLEAR and CLEARCOM of source interface are interchanged to sink interface.
- 16. When a command cable for connection with the controller side malfunctions due to disconnection or noise, a position mismatch can occur. To avoid position mismatch, it is recommended that Encoder A-phase pulse and Encoder B-phase pulse be checked.

(2) Source I/O interface

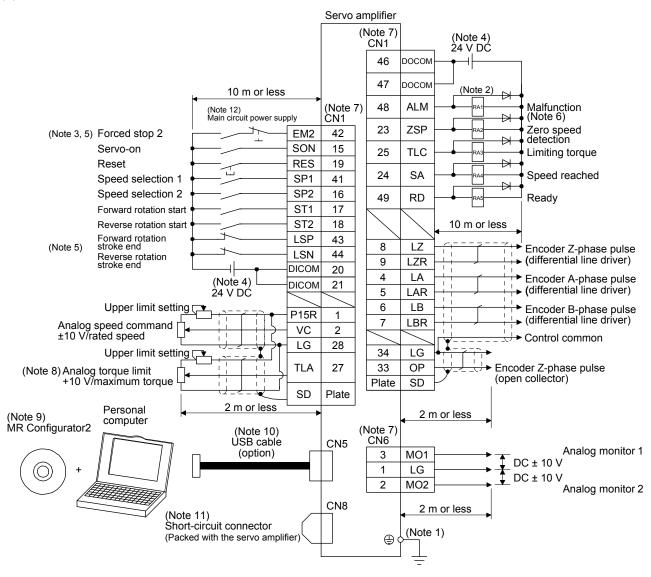
POINT

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

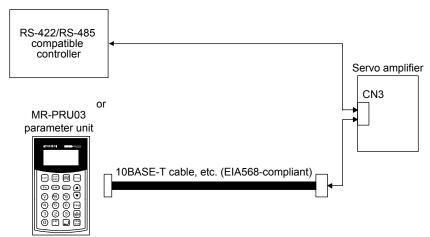


3.2.2 Speed control mode

(1) 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 500 mA. 500 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 24 V DC power supply can be used both for input signals and output signals.
 - 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. PD03] to [Pr. PD22]. (Refer to section 3.6.1 (5).)
 - 9. Use SW1DNC-MRC2-_. (Refer to section 11.7.)
 - 10. Controller or parameter units can also be connected via the CN3 connector, enabling RS-422/RS-485 communication. Note that using the USB communication function (CN5 connector) prevents the RS-422/RS-485 communication function (CN3 connector) from being used, and vice versa. They cannot be used together.

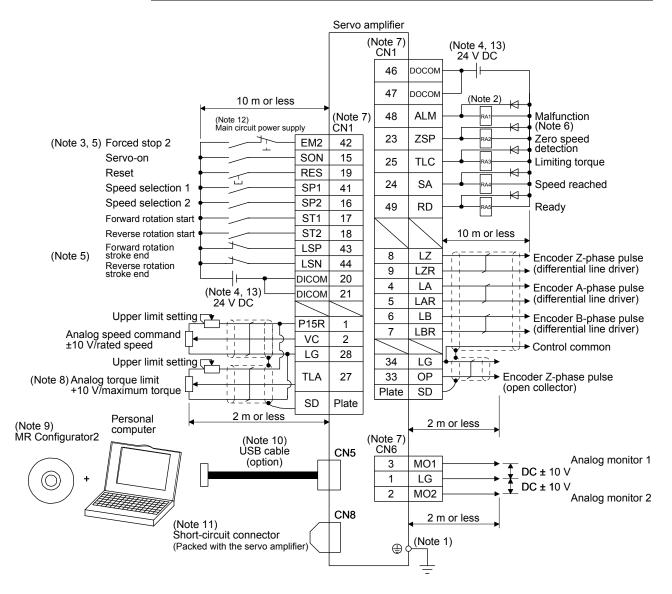


- 11. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 12. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 13. Plus and minus of the power of source interface are the opposite of those of sink interface.

(2) Source I/O interface

POINT

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

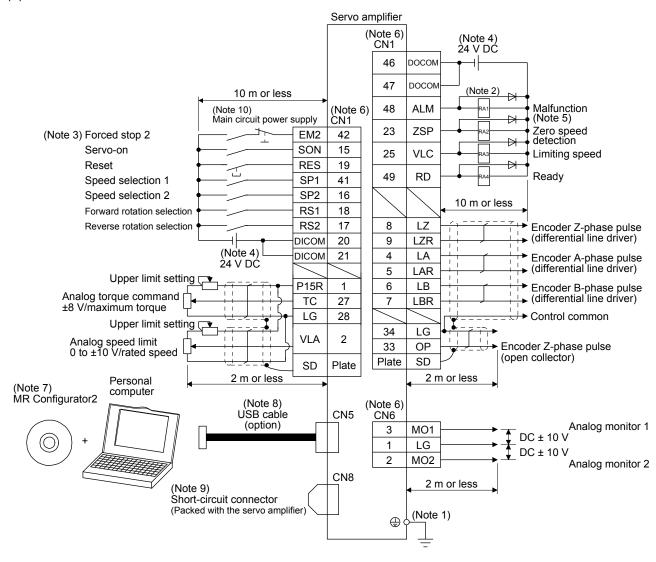


3.2.3 Torque control mode

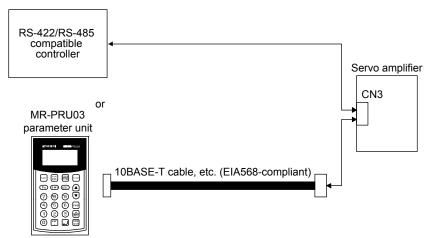
POINT

●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 500 mA. 500 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 24 V DC power supply can be used both for input signals and output signals.
 - 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 11.7.)
 - 8. Controller or parameter units can also be connected via the CN3 connector, enabling RS-422/RS-485 communication. Note that using the USB communication function (CN5 connector) prevents the RS-422/RS-485 communication function (CN3 connector) from being used, and vice versa. They cannot be used together.

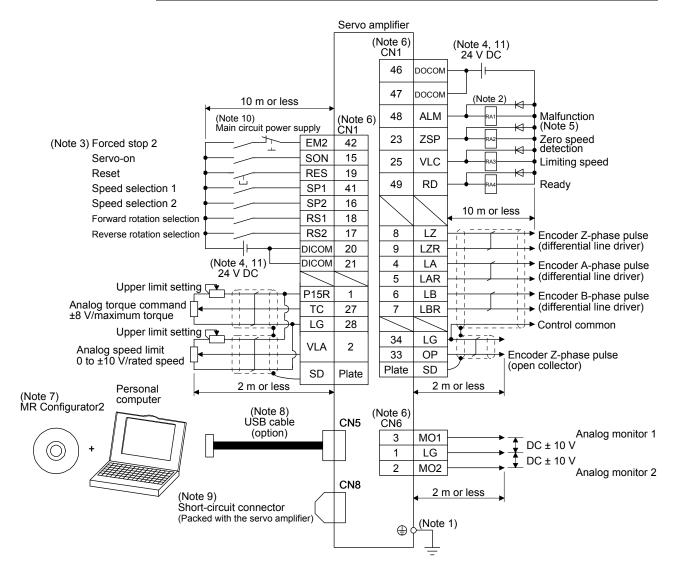


- 9. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 10. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 11. Plus and minus of the power of source interface are the opposite of those of sink interface.

(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.
- ●When using the MR-J4-_A-RJ servo amplifier with the DC power supply input, refer to app. 13.

Symbol	Connection target (application)		[Description			
	, , ,	Supply the following power to L1, L2, and L3. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open.					
		Servo amplifier Power	MR-J4-10A (-RJ) to MR-J4-200A (-RJ)	MR-J4-350A (-RJ) to MR-J4-22KA (-RJ)	MR-J4-60A4 (-RJ) to MR-J4-22KA4 (-RJ)	MR-J4-10A1 to MR-J4-40A1	
L1/L2/L3	Main circuit power supply	3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz	L1/L2/L3				
		1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz	L1/L3				
		3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz			L1/L2/L3		
		1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz				L1/L2	
P3/P4	Power factor improving DC reactor	When not using the power factor improving DC reactor, connect P3 and P4 (factory-wired). When using the power factor improving DC reactor, disconnect P3 and P4, and connect the power factor improving DC reactor to P3 and P4. Additionally, the power factor improving DC reactor cannot be used for the 100 V class servo amplifiers. Refer to section 11.11 for details.					
P+/C/D	Regenerative option	reactor cannot be used for the 100 V class servo amplifiers.					

Symbol	Connection target (application)	Description				
		Supply the following powe	r to L11 and L21.			
	.11/L21 Control circuit power supply	Servo amplifier Power	MR-J4-10A(-RJ) to MR-J4-22KA(-RJ)	MR-J4-60A4(-RJ) to MR-J4-22KA4(-RJ)	MR-J4-10A1 to MR-J4-40A1	
L11/L21		1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz	L11/L21			
		1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz		L11/L21		
		1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz			L11/L21	
U/V/W	Servo motor power output	Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.				
	Power regeneration converter	This terminal is used for a power regeneration converter, power regeneration common converter and brake unit.				
N-	Power regeneration common converter Brake unit	Refer to section 11.3 to 11	l.5 for details.			
+	Protective earth (PE)	Connect it to the grounding cabinet for grounding.	g terminal of the servo	motor and to the protect	ive earth (PE) of the	

3.3.2 Power-on sequence

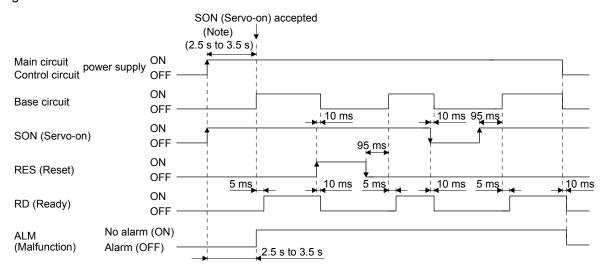
POINT

●The voltage of analog monitor output, output signal, etc. may be unstable at power-on.

(1) Power-on procedure

- Always use a magnetic contactor for the main circuit power supply wiring (L1/L2/L3) as shown in above section 3.1. Configure up an external sequence to switch off the magnetic contactor as soon as an alarm occurs.
- 2) Switch on the control circuit power supply (L11 and L21) simultaneously with the main circuit power supply or before switching on the main circuit power supply. If the main circuit power supply is not on, the display shows the corresponding warning. However, by switching on the main circuit power supply, the warning disappears and the servo amplifier will operate properly.
- 3) The servo amplifier receives the SON (Servo-on) 2.5 s to 3.5 s after the main circuit power supply is switched on. Therefore, when SON (Servo-on) is switched on simultaneously with the main circuit 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) of this section.)
- 4) When RES (Reset) is switched on, the base circuit is shut off and the servo motor shaft coasts.

(2) Timing chart



Note. The time will be longer during the magnetic pole detection of a linear servo motor and direct drive motor.

3.3.3 Wiring CNP1, CNP2, and CNP3

POINT

- For the wire sizes used for wiring, refer to section 11.9.
- ●MR-J4-500A(-RJ) or more and MR-J4-500A4(-RJ) or more do not have these connectors.

Use the servo amplifier power connector for wiring CNP1, CNP2, and CNP3.

(1) Connector

(a) MR-J4-10A(-RJ) to MR-J4-100A(-RJ)

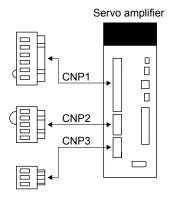
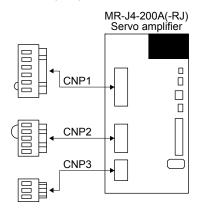


Table 3.1 Connector and applicable wire

Connector	Pagantagle assambly	Applica	ble wire	Stripped	Open tool	Manufa
Connector	Receptacle assembly	Size	Insulator OD	length [mm]	Open tool	cturer
CNP1	06JFAT-SAXGDK-H7.5				L FAT OT (N) or	
CNP2	05JFAT-SAXGDK-H5.0	AWG18 to 14	3.9 mm or shorter	9	J-FAT-OT (N) or J-FAT-OT	JST
CNP3	03JFAT-SAXGDK-H7.5				0-1 A1-01	

(b) MR-J4-200A(-RJ)/MR-J4-350A(-RJ)



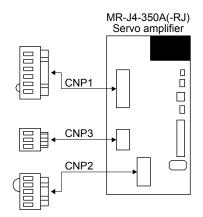
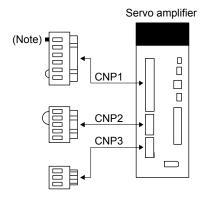


Table 3.2 Connector and applicable wire

Connector	Receptacle assembly	Applica	ble wire	Stripped	Open tool	Manufa
Connector	Receptacle assembly	Size	Insulator OD	length [mm]		cturer
CNP1	06JFAT-SAXGFK-XL	AWG16 to 10	4.7 mm or shorter	11.5		
CNP3	03JFAT-SAXGFK-XL	AVVG10 to 10	4.7 mm or shorter	11.5	J-FAT-OT-EXL	JST
CNP2	05JFAT-SAXGDK-H5.0	AWG18 to 14	3.9 mm or shorter	9		

(c) MR-J4-60A4(-RJ) to MR-J4-350A4(-RJ)



Note. A pin for preventing improper connection is inserted to N- of CNP1 connector.

Table 3.3 Connector and applicable wire

Connector	Decentagle assembly	Applica	ble wire	Stripped	oped Open tool	
Connector	Receptacle assembly	Size	Insulator OD	length [mm]	Open tool	cturer
CNP1	06JFAT-SAXGDK-HT10.5					
CNP2	05JFAT-SAXGDK-HT7.5	AWG 16 to 14	3.9 mm or shorter	10	J-FAT-OT-XL	JST
CNP3	03JFAT-SAXGDK-HT10.5					

(d) MR-J4-10A1(-RJ) to MR-J4-40A1(-RJ)

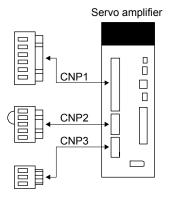


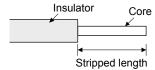
Table 3.4 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire		Stripped	Open tool	Manufa
Connector	Receptable assembly	Size	Insulator OD	length [mm]	Open tool	cturer
CNP1	06JFAT-SAXGDK-H7.5				LEAT OT (N) an	
CNP2	05JFAT-SAXGDK-H5.0	AWG18 to 14	3.9 mm or shorter	9	J-FAT-OT (N) or J-FAT-OT	JST
CNP3	03JFAT-SAXGDK-H7.5				0-1741-01	

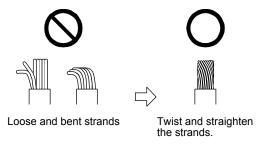
(2) Cable connection procedure

(a) Fabrication on cable insulator

Refer to table 3.1 to 3.4 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.



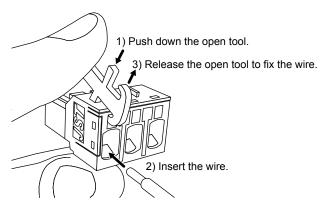
You can also use a ferrule to connect with the connectors. When you use a ferrule, use the following ferrules and crimp terminal.

Servo amplifier	Wire size	Ferrule model	Crimp terminal		
Servo ampililer	vviie size	For one	For two	(Phoenix Contact)	
MR-J4-10A(-RJ)	AWG16	AI1.5-10BK	AI-TWIN2×1.5-10BK		
to MR-J4-100A(-RJ)	AWG14	AI2.5-10BU			
MR-J4-200A(-RJ)	AWG16	AI1.5-10BK	AI-TWIN2×1.5-10BK		
to	AWG14	AI2.5-10BU	AI-TWIN2×2.5-10BU		
MR-J4-350A(-RJ)	AWG12	AI4-10GY		CRIMPFOX-ZA3	
MR-J4-60A4(-RJ)	AWG 16	AI1.5-10BK	AI-TWIN2×1.5-10BK	CRIMPFOX-ZAS	
to MR-J4-350A4(-RJ)	AWG 14	AI2.5-10BU			
MR-J4-10A1(-RJ)	AWG16	AI1.5-10BK	AI-TWIN2×1.5-10BK		
to MR-J4-40A1(-RJ)	AWG14	AI2.5-10BU			

(b) Inserting wire

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 insertion depth so that the wire insulator does not get caught by the spring.

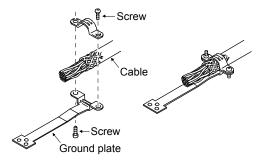
Release the open tool to fix the wire. Pull the wire lightly to confirm that the wire is surely connected. The following shows a connection example of the CNP3 connector for MR-J4-200A(-RJ) and MR-J4-350A(-RJ).



3.4 Connectors and pin assignment

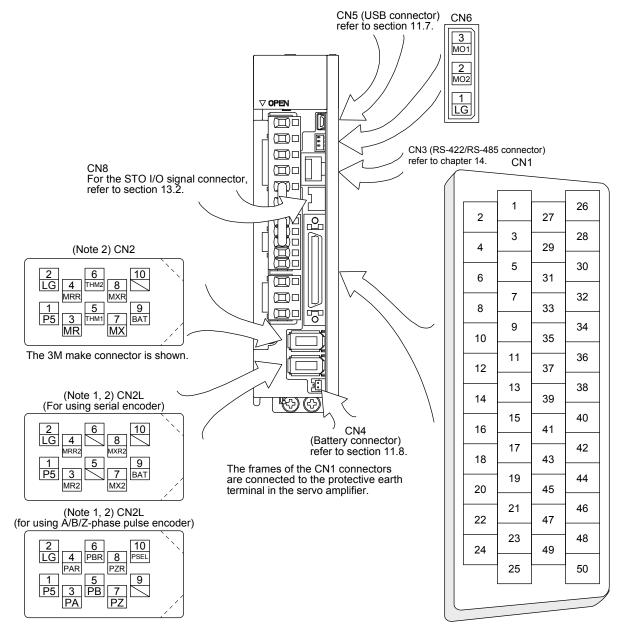
POINT

- ■The pin assignment of the connectors is as viewed from the cable connector wiring section.
- For the STO I/O signal connector (CN8), refer to chapter 13.
- For the CN1 connector, securely connect the external conductive portion of the shielded cable to the ground plate and fix it to the connector shell.



●PP (CN1-10 pin)/NP (CN1-35 pin) and PP2 (CN1-37 pin)/NP2 (CN1-38 pin) are exclusive. They cannot be used together.

The servo amplifier front view shown is that of the MR-J4-20A-RJ or less. Refer to chapter 9 DIMENSIONS for the appearances and connector layouts of the other servo amplifiers.



Note 1. The MR-J4-_A_-RJ servo amplifiers have CN2L connectors. This CN2L is a connector of 3M. When using any other connector, refer to each servo motor instruction manual.

2. Refer to table 1.1 for connections of external encoders.

The device assignment of the CN1 connector pins changes depending on the control mode. For the pins which are given parameters in the related parameter column, their devices will be changed using those parameters.

	(Note 1)		(Note	2) I/O signal	s in control n	nodes		
Pin No.	I/O	Р	P/S	S	S/T	T	T/P	Related parameter
1		P15R	P15R	P15R	P15R	P15R	P15R	
2			-/VC	VC	VC/VLA	VLA	VLA/-	
3		LG	LG	LG	LG	LG	LG	
4	0	LA	LA	LA	LA	LA	LA	
5	0	LAR	LAR	LAR	LAR	LAR	LAR	
6	0	LB	LB	LB	LB	LB	LB	
7	0	LBR	LBR	LBR	LBR	LBR	LBR	
8	0	LZ	LZ	LZ	LZ	LZ	LZ	
9	0	LZR	LZR	LZR	LZR	LZR	LZR	
10	I	PP	PP/-	(Note 6)	(Note 6)	(Note 6)	-/PP	Pr. PD43/Pr. PD44 (Note 5)
11	I	PG	PG/-				-/PG	
12		OPC	OPC/-				-/OPC	
13	0	(Note 4)	(Note 4)	(Note 4)	(Note 4)	(Note 4)	(Note 4)	Pr. PD47 (Note 5)
14	0	(Note 4)	(Note 4)	(Note 4)	(Note 4)	(Note 4)	(Note 4)	Pr. PD47 (Note 5)
15	1	SON	SON	SON	SON	SON	SON	Pr. PD03/Pr. PD04
16	1		-/SP2	SP2	SP2/SP2	SP2	SP2/-	Pr. PD05/Pr. PD06
17	I	PC	PC/ST1	ST1	ST1/RS2	RS2	RS2/PC	Pr. PD07/Pr. PD08
18	1	TL	TL/ST2	ST2	ST2/RS1	RS1	RS1/TL	Pr. PD09/Pr. PD10
19	1	RES	RES	RES	RES	RES	RES	Pr. PD11/Pr. PD12
20		DICOM	DICOM	DICOM	DICOM	DICOM	DICOM	
21		DICOM	DICOM	DICOM	DICOM	DICOM	DICOM	
22	0	INP	INP/SA	SA	SA/-		-/INP	Pr. PD23
23	0	ZSP	ZSP	ZSP	ZSP	ZSP	ZSP	Pr. PD24
24	0	INP	INP/SA	SA	SA/-		-/INP	Pr. PD25
25	0	TLC	TLC	TLC	TLC/VLC	VLC	VLC/TLC	Pr. PD26
26								
27	1	TLA	(Note 3) TLA	(Note 3) TLA	(Note 3) TLA/TC	TC	TC/TLA	
28		LG	LG	LG	LG	LG	LG	
29								
30		LG	LG	LG	LG	LG	LG	
31								
32								
33	0	OP	OP	OP	OP	OP	OP	
34		LG	LG	LG	LG	LG	LG	
35	1	NP	NP/-	(Note 6)	(Note 6)	(Note 6)	-/NP	Pr. PD45/Pr. PD46 (Note 5)
36	1	NG	NG/-				-/NG	
(Note 8) 37	I	PP2	PP2/-	(Note 7)	(Note 7)	(Note 7)	-/PP2	Pr. PD43/Pr. PD44 (Note 5)
(Note 8) 38		NP2	NP2/-	(Note 7)	(Note 7)	(Note 7)	-/NP2	Pr. PD45/Pr. PD46 (Note 5)
39								
40								
41		CR	CR/SP1	SP1	SP1/SP1	SP1	SP1/CR	Pr. PD13/Pr. PD14
42	!	EM2	EM2	EM2	EM2	EM2	EM2	
43	<u>!</u>	LSP	LSP	LSP	LSP/-		-/LSP	Pr. PD17/Pr. PD18
44	1	LSN	LSN	LSN	LSN/-		-/LSN	Pr. PD19/Pr. PD20
45		LOP	LOP	LOP	LOP	LOP	LOP	Pr. PD21/Pr. PD22
46	$\overline{}$	DOCOM	DOCOM	DOCOM	DOCOM	DOCOM	DOCOM	
47		DOCOM	DOCOM	DOCOM	DOCOM	DOCOM	DOCOM	
48	0	ALM	ALM	ALM	ALM	ALM	ALM	0.5555
49		RD	RD	RD	RD	RD	RD	Pr. PD28
50								

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 change mode, S/T: Speed/torque control change mode, T/P: Torque/position control change mode
- 3. TLA will be available when TL (External torque limit selection) is enabled with [Pr. PD03] to [Pr. PD22].
- 4. Output devices are not assigned by default. Assign the output devices with [Pr. PD47] as necessary.
- 5. This is used with MR-J4-_A_-RJ servo amplifiers with software version B3 or later.
- 6. This is available as an input device of sink interface. Input devices are not assigned by default. Assign the input devices with [Pr. PD43] to [Pr. PD46] as necessary. Supply + of 24 V DC to CN1-12 pin. Also, this is available with servo amplifiers with software version B3 or later.
- 7. This is available as an input device of source interface. Input devices are not assigned by default. Assign the input devices with [Pr. PD43] to [Pr. PD46] as necessary.
- 8. These pins are available for MR-J4-_A_(-RJ) servo amplifiers manufactured in January 2015 or later with software version B7 or later.

3.5 Signal (device) explanations

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

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

P: Position control mode

S: Speed control mode

T: Torque control mode

"O" and " Δ " of the table shows the followings.

O: Usable device by default.

Δ: Usable device by setting the following parameters.

[Pr. PA04], [Pr. PD03] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]

(1) I/O device

(a) Input device

Device	Symbol	Connector	Funct	tion and applicatior	1	I/O		ontr node	-
Forced stop 2	EM2	CN1-42	Furn off EM2 (open between c	ommons) to decel	erate the servo motor to a	division DI-1	P 0	s O	T
			stop with commands. Furn EM2 on (short between hat state. The following shows the setting	,	forced stop state to reset				
			[Pr. PA04] EM2/EM1	Decelerati	on method				
				И2 or EM1 is off	Alarm occurred				
			0 EM1 brake	(Electromagnetic e interlock) turns ithout the forced deceleration.	MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.				
			2 EM2 brake off af	(Electromagnetic e interlock) turns fer the forced deceleration.	MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.				
			EM2 and EM1 are mutually exc EM2 has the same function as	EM1 in the torque					
Forced stop 1	EM1	(CN1-42)	When using EM1, set [Pr. PA0- Furn EM1 off (open between contate. The base circuit is shublecelerate the servo motor to a Furn EM1 on (short between contact that state.	ommons) to bring to ut off, the dynamical stop.	the motor to a forced stop c brake is operated and	DI-1	Δ	Δ	Δ
Servo-on	SON	CN1-15	Furn SON on to power on the beady to operate. (servo-on stanger it off to shut off the base of the bas	itus) circuit and coast the witch this signal on	e servo motor.	DI-1	0	0	0
Reset	RES	CN1-19	Furn on RES for more than 50 Some alarms cannot be deactive furning RES on in an alarm-frestreuit is not shut off when " Ship device is not designed to supperation.	vated by RES (Resee status shuts off t 1 _ " is set in [Pr.	set). Refer to chapter 8. the base circuit. The base PD30].	DI-1	0	0	0

Device	Symbol	Connector pin No.			Func	tion and appli	ication		I/O division	r	ontr	е
Forward rotation	LSP	CN1-43					urn it off to bri	ng the motor to a	DI-1	P 0	S	Τ Δ
stroke end					nake it servo to " 1"	-locked. will enable a	slow stop.					
Reverse rotation	LSN	CN1-44	Ī	(Note) Inp	out device	Oper	ration					
stroke end						CCW	CW					
				LSP	LSN	direction Positive direction	direction Negative direction					
			 	1	1	O	O					
				0	<u>·</u> 1	<u> </u>	0					
				1	0	0						
				0	0							
			N	lote. 0: Off 1: On								
			-	-		ow to switch servo ampli	Ū	s (keep terminals				
						Sta	atus					
				[Pr. P	D01]	LSP	LSN					
			 			Automatic						
				_4		on						
				_8			Automatic on					
				_c		Automatic on	Automatic on					
			WNG (PD23] availab In the t operati servo r magne	(Warning) tu to [Pr. PD26 ble with MR- torque contri ion. It can be motor contro etic pole dete	rns on. Whe fig. [Pr. PD28] J4-03A6(-R. ol mode, this e used durin ol mode and ection in the	n using WNG], and [Pr. Pt]) servo ampl s device cann g the magnet the DD motor	G, enable it by D47]. Howeve ifiers. not be used dutic pole detect	ion in the linear e. Also, when the				
External torque	TL	CN1-18	_	will be disab g off TL will		PA11 Forward	d torque limit]	and [Pr. PA12	DI-1	0	Δ	
limit selection					nit], and turni efer to section		enable TLA (A	nalog torque				
Internal torque limit selection	TL1			-		•		imit 2], enable ction 3.6.1 (5).	DI-1	Δ	Δ	Δ
Forward rotation start	ST1	CN1-17			rt the servo i				DI-1		0	
				(Note) Inp		Servo moto	or starting dire	ction				
			 	ST2	ST1	Cton	(comic look)			1		
			 	0	0 1	Stop	(servo-lock)			Ш		
			 	1	0		CW			М		
				1	1	Stop	(servo-lock)					
			N	lote. 0: Off 1: On								
Reverse rotation start	ST2	CN1-18	motor v servo-l When '	will be decel locked.	erated to a set in [Pr. PC	stop accordin		on, the servo PC02] setting and t servo-locked				

Device	Symbol	Connector pin No.				Functi	on and application	I/O division	r	ontr	е
Forward rotation selection	RS1	CN1-18					otor torque generation directions.	DI-1	P	S	0
				(Note)	Input de	vice	Tarania dan dinastian		$\ $		
				RS2	R	S1	Torque generation direction			П	
				0		0	Torque is not generated.			11	
Reverse rotation selection	RS2	CN1-17		0		1	Forward rotation in power running mode/reverse rotation in regenerative mode				
				1		0	Reverse rotation in power running mode/forward rotation in regenerative mode				
				1		1	Torque is not generated.		\perp		
				Note. 0: C)ff		<u> </u>			1	
				1: C							<u> </u>
Speed selection 1	SP1	CN1-41		speed co			and speed for operation.	DI-1		0	0
Speed selection 2	SP2	CN1-16		(Note	e) Input d	evice	Speed command	DI-1		0	0
_				SP3	SP2	SP1			$ \ $		
Speed selection 3	SP3			0	0	0	VC (Analog speed command)	DI-1		Δ	Δ
				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: C	off						
				1: C	n				Ш		
		\		the torqu			16				
			I nis i	s used to	select the	e limit s	peed for operation.				
		\		(Note	e) Input d	evice	0	1			
		\		SP3	SP2	SP1	Speed limit				
		\		0	0	0	VLA (Analog speed limit)				
		\		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			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	J			
	1	\		Note. 0: C							
				1: C	n						

Device	Symbol	Connector	Function and application	I/O	_	ontr nod	-
Device	Symbol	pin No.	i unction and application	division	P	S	T
Proportion control	PC	CN1-17	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. Doing so may cause the operation to be performed at a speed exceeding the speed limit value.	DI-1	0	Δ	
Clear	CR	CN1-41	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. PD32], the pulses are always cleared while CR is on.	DI-1	0		
Electronic gear selection 1	CM1		The combination of CM1 and CM2 enables you to select four different electronic gear numerators set in the parameters. CM1 and CM2 cannot be used in the absolute position detection system. (Note) Input device CM2	DI-1	Δ		
Electronic gear selection 2	CM2		0 1 Pr. PC32 1 0 Pr. PC33 1 1 Pr. PC34 Note. 0: Off 1: On	DI-1	Δ		
Gain switching	CDP		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.	DI-1	Δ	Δ	Δ

Device	Symbol	Connector pin No.	Function and application	I/O division		ontr mode S	
Control switching	LOP	CN1-45	«Position/speed control change mode» This is used to select the control mode in the position/speed control switching mode. (Note) LOP Control mode	DI-1	Fur and	fer to nctio d olicat	n
			0 Position 1 Speed Note. 0: Off 1: On				
			«Speed/torque control change mode» This is used to select the control mode in the speed/torque control switching mode.				
			(Note) LOP Control mode 0 Speed 1 Torque Note. 0: Off				
			1: On «Torque/position control change mode» This is used to select the control mode in the torque/position control switching mode.				
			(Note) LOP Control mode 0 Torque 1 Position Note. 0: Off 1: On				
Second acceleration/dece leration selection	STAB2		The device allows selection of the acceleration/deceleration time constant at servo motor rotation in the speed control mode or torque control mode. The s-pattern acceleration time constant and deceleration time constant is always uniform.	DI-1		Δ	Δ
			(Note) STAB2 Acceleration/deceleration time constant 0 Pr. PC01 Acceleration time constant				
			Note. 0: Off 1: On				
ABS transfer mode	ABSM	CN1-17	This is an ABS transfer mode request device. When " 1" is set in [Pr. PA03] and absolute position detection system by DIO is selected, CN1-17 pin will become ABSM. (Refer to chapter 12.)	DI-1	Δ		
ABS request	ABSR	CN1-18	This is an ABS request device. When "1" is set in [Pr. PA03] and absolute position detection system by DIO is selected, CN1-18 pin will become ABSR. (Refer to chapter 12.)	DI-1	Δ		
Fully closed loop selection	CLD		This is used when the semi closed loop control/fully closed loop control switching is enabled with [Pr. PE01]. Turn off CLD to select the semi closed loop control, and turn on CLD to select the fully closed loop control. This device is not available with MR-J4-03A6(-RJ) servo amplifiers.	DI-1	Δ	\setminus	
Motor-side/load- side position deviation counter clear	MECR		Turn on MECR to clear the motor-side/load-side position deviation counter to zero. - It operates during the fully closed loop control. - It does not affect the position control droop pulses. - Turning on this device during the semi closed loop control does not affect the operation. - Turning on this device while the fully closed loop control error detection	DI-1	Δ		
			function is disabled in [Pr. PE03] does not affect the operation. This device is not available with MR-J4-03A6(-RJ) servo amplifiers.			$ \ $	

(b) Output device

Device	Symbol Connector pin No. Function and application		Function and application	I/O	_	ontr	-
		pin No.		division	Р	S	Т
Malfunction	ALM	CN1-48	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. PD34] is " 1 _", an alarming or warning will turn off ALM.	DO-1	0	0	0
Dynamic brake interlock	DB		When using the signal, enable it by setting [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. DB turns off when the dynamic brake needs to operate. When using the external dynamic brake on the servo amplifier of 11 kW or more, this device is required. (Refer to section 11.17.) For the servo amplifier of 7 kW or less, it is not necessary to use this device. The external dynamic brake cannot be used with 11 kW or more servo amplifier for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs.	DO-1	0	0	0
Ready	RD	CN1-49	Enabling servo-on to make the servo amplifier ready to operate will turn on RD.	DO-1	0	0	0
In-position	INP	CN1-22 CN1-24	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	0		
Speed reached	SA		When the servo motor speed reaches the following range, SA will turn on. Set speed \pm ((Set speed \times 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		0	
Limiting speed	VLC	CN1-25	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] or VLA (Analog speed limit). This turns off when SON (Servo-on) turns off.	DO-1			0
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	0	0	

Device	Symbol	Connector	Function and application	I/O		onti	
Bevice	Cymbol	pin No.	r anotion and application	division	Р	S	Т
Zero speed detection	ZSP	CN1-23	ZSP turns on when the servo motor speed is zero speed (50 r/min) or less. Zero speed can be changed with [Pr. PC17]. Forward rotation direction OFF level 70 r/min ON level 50 r/min ON level 50 r/min OFF level -70	DO-1	P 0	S	О
Electromagnetic brake interlock	MBR		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. When using the device, set operation delay time of the electromagnetic brake in [Pr. PC16].	DO-1	Δ	Δ	Δ
Warning	WNG		When a servo-off status or alarm occurs, MBR will turn off. When warning has occurred, WNG turns on. When a warning is not	DO-1	Δ	Δ	Δ
Battery warning	BWNG		occurring, turning on the power will turn off WNG after 2.5 s to 3.5 s. BWNG turns on when [AL. 92 Battery cable disconnection warning] or [AL. 9F Battery warning] has occurred. When the battery warning is not occurring, turning on the power will turn off BWNG after 2.5 s to 3.5 s.	DO-1	Δ	Δ	Δ
Alarm code	ACD1 ACD2	(CN1-24) (CN1-23) (CN1-22)	To use these signals, set " 1" in [Pr. PD34]. 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 "Enabled (absolute position detection system by DIO) (1)" is selected in [Pr. PA03] and when MBR, DB, or ALM is assigned to CN1-22 pin, CN1-23 pin, or CN1-24 pin, selecting alarm code output will generate [AL. Parameter error].	DO-1	Δ	Δ	Δ
Variable gain selection	CDPS		CDPS turns on during gain switching.	DO-1	Δ	Δ	Δ
Absolute position undetermined	ABSV		ABSV turns on when the absolute position is undetermined.	DO-1	Δ		
ABS transmission data bit 0	ABSB0	(CN1-22)	This is used to output ABS transmission data bit 0. When "Enabled (absolute position detection system by DIO) (1)" is selected in [Pr. PA03], the CN1-22 pin will become ABSB0 only during ABS transfer mode. (Refer to chapter 12.)	DO-1	Δ		
ABS transmission data bit 1	ABSB1	(CN1-23)	This is used to output ABS transmission data bit 1. When "Enabled (absolute position detection system by DIO) (1)" is selected in [Pr. PA03], the CN1-23 pin will become ABSB1 only during ABS transfer mode. (Refer to chapter 12.)	DO-1	Δ		
ABS transmission data ready	ABST	(CN1-25)	This is used to output ABS transmission data ready. When "Enabled (absolute position detection system by DIO) (1)" is selected in [Pr. PA03], CN1-25 pin will become ABST only during ABS transfer mode. (Refer to chapter 12.)	DO-1	Δ		

Device Sym		Symbol Connector pin No. Function and application		I/O division	_	ol e	
		pin No.		division	Р	S	Т
During tough drive	MTTR		MTTR turns on when the instantaneous power failure tough drive operates while the tough drive function selection is enabled with [Pr. PA20]. This device is not available with MR-J4-03A6(-RJ) servo amplifiers.	DO-1	Δ	Δ	Δ
During fully closed loop control	CLDS		CLDS turns on during fully closed loop control. This device is not available with MR-J4-03A6(-RJ) servo amplifiers.	DO-1	Δ		

(2) Input signal

Device	Symbol	Connector	Function and application	I/O		ontr nod	
201.00	Cy	pin No.	and approach.	division	Р	S	
Analog torque limit	TLA	CN1-27	To use the signal in the speed control mode, enable TL (External torque limit selection) with [Pr. PD03] to [Pr. PD22]. 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	0	Δ	
Analog torque command	TC		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			С
Analog speed command	VC	CN1-2	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 For MR-J4ARJ 100 W or more servo amplifiers, setting [Pr. PC60] to " 1 _" increases the analog input resolution to 16 bits. This function is available with servo amplifiers manufactured in November 2014 or later.	Analog input		0	
Analog speed limit	VLA		Apply 0 V to ±10 V DC between VLA and LG. Speed set in [Pr. PC12] is provided at ±10 V. (Refer to section 3.6.3 (3).) If a value equal to or larger than the permissible speed is inputted to VLA, the value is clamped at the permissible speed.	Analog input			C
Forward rotation pulse train Reverse rotation pulse train	PP NP PP2 NP2 PG NG	CN1-10 CN1-35 CN1-37 CN1-38 CN1-11 CN1-36	This is used to enter a command pulse train. 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. a) Sink input interface Input the forward rotation pulse train between PP and DOCOM. Input the reverse rotation pulse train between NP and DOCOM. b) Source input interface Input the forward rotation pulse train between PP2 and PG. Input the reverse rotation pulse train between NP2 and NG. 2) For differential receiver type (max. input frequency: 4 Mpulses/s) 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. The command input pulse train form, pulse train logic, and command input pulse train filter are changed in [Pr. PA13]. When the command pulse train is over 1 Mpulse/s and lower than 4 Mpulse/s, set [Pr. PA13] to "_ 0".	DI-2	0		

3. SIGNALS AND WIRING

(3) Output signal

Device	Symbol	Connector pin No.	Function and application	I/O division	r	ontr	е
Encoder A- phase pulse	LA LAR	CN1-4 CN1-5	The encoder output pulses set in [Pr. PA15] are outputted in the differential line driver type.	DO-2	P 0	S	О
(differential line driver)	1	G. 1. C	In CCW rotation of the servo motor, the encoder B-phase pulse lags the encoder A-phase pulse by a phase angle of $\pi/2$.				
Encoder B- phase pulse (differential line driver)	LB LBR	CN1-6 CN1-7	The relation between rotation direction and phase difference of the A-phase and B-phase pulses can be changed with [Pr. PC19].				
Encoder Z- phase pulse (differential line driver)	LZ LZR	CN1-8 CN1-9	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 μ s. For home position return using this pulse, set the creep speed to 100 r/min or less.	DO-2	0	0	0
Encoder Z- phase pulse (open-collector)	OP	CN1-33	The encoder zero-point signal is outputted in the open-collector type.	DO-2	0	0	0
Analog monitor 1	MO1	CN6-3	This is used to output the data set in [Pr. PC14] to between MO1 and LG in terms of voltage. Output voltage: ±10 V Resolution: 10 bits or equivalent	Analog output	0	0	0
Analog monitor 2	MO2	CN6-2	This signal outputs the data set in [Pr. PC15] to between MO2 and LG in terms of voltage. Output voltage: ±10 V Resolution: 10 bits or equivalent	Analog output	0	0	0

(4) Communication

Device Sy	Symbol Connector pin No.	Function and application			Function and application		_	ontr node	-
		pin ivo.		division	Р	S	Т		
RS-422/RS-485	SDP	CN3-5	These are terminals for RS-422/RS-485 communication.	\setminus	0	0	0		
I/F	SDN	CN3-4							
	RDP	CN3-3							
	RDN	CN3-6		\					

3. SIGNALS AND WIRING

(5) Power supply

Device	Symbol	Connector	Function and application	I/O	_	ontr	
201.00	Gy20.	pin No.			Р	S	Т
Digital I/F power supply input	DICOM	CN1-20 CN1-21	Input 24 V DC (24 V DC ± 10% 500 mA) to 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.		0	0	0
Power input for open-collector	OPC	CN1-12	When inputting a pulse train in the open-collector type with sink interface, supply this terminal with the positive (+) power of 24 V DC.		0		
sink interface			Supply + of 24 V DC to this terminal when using CN1-10 pin and CN1-35 pin by DI. CN1-10 pin and CN1-35 pin are available for MR-J4ARJ servo amplifiers manufactured in November 2014 or later.			0	0
Digital I/F common	DOCOM	CN1-46 CN1-47	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.		0	0	0
15 V DC power supply	P15R	CN1-1	This outputs 15 V DC to between P15R and LG. This is available as power for TC, TLA, VC, or VLA. Permissible current: 30 mA		0	0	0
Control common	LG	CN1-3 CN1-28 CN1-30 CN1-34 CN3-1 CN3-7 CN6-1	This is a common terminal for TLA, TC, VC, VLA, FPA, FPB, OP, MO1, MO2, and P15R. Pins are connected internally.		0	0	0
Shield	SD	Plate	Connect the external conductive portion of the shielded cable.		0	0	0

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

	Command pulse logic setting			
Signal type	Positioning module Pr. 23 setting	MR-J4A_(-RJ) servo amplifier [Pr. PA13] setting		
		_ · · · · ·		
Open-collector type	Positive logic	Positive logic (0 _)		
Open-collector type	Negative logic	Negative logic (1 _)		
Differential line driver type	Positive logic (Note)	Negative logic (1 _)		
Differential life driver type	Negative logic (Note)	Positive logic (0 _)		

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

MELSEC-F series positioning module

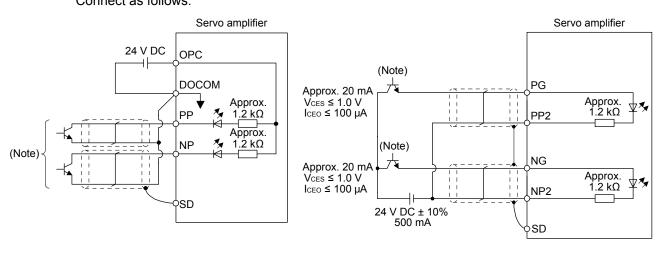
	Command pulse logic setting		
Signal type	Positioning module (fixed)	MR-J4A_(-RJ) servo amplifier [Pr. PA13] setting	
Open-collector Differential line driver	Negative logic	Negative logic (1 _)	

(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
 - Open-collector type Connect as follows.



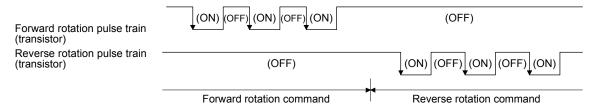
For sink input interface

For source input interface

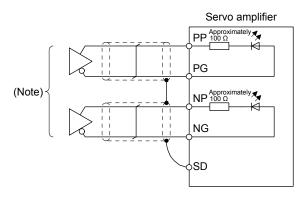
Note. Pulse train input interface is comprised of a photocoupler.

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

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].



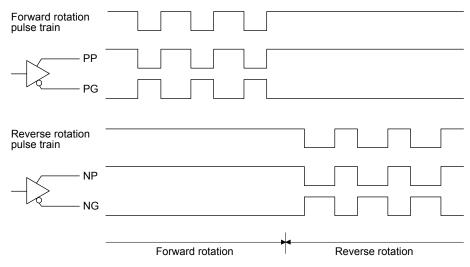
2) Differential line driver type Connect as follows.



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

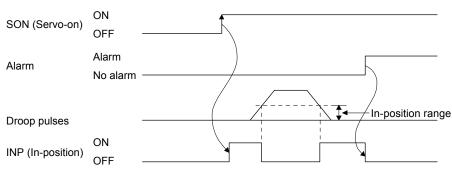
If a resistor is connected to the pulse train signal line, it may malfunction due to reduction in current.

The following section explains about the case where the negative logic and the forward/reverse rotation pulse trains are set to "_ _ 1 0" in [Pr. PA13]. The waveforms of PP, PG, NP, and NG are based on LG.

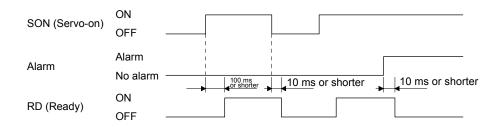


(2) INP (In-position)

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 goar numerator	
CM2	CM1	Electronic gear numerator	
0	0	Pr. PA06	
0	1	Pr. PC32	
1	0	Pr. PC33	
1	1	Pr. PC34	

Note. 0: Off 1: On

(5) Torque limit

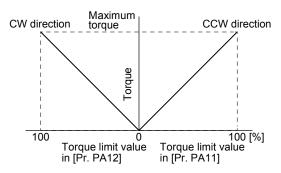


● If the torque limit is canceled during servo-lock, the servo motor may suddenly rotate according to position deviation in respect to the command position.

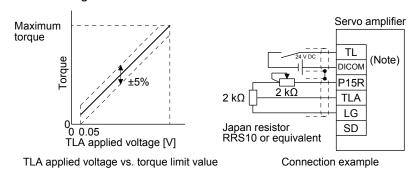
↑ CAUTION ●When using the torque limit, check that [Pr. PB06 Load to motor inertia ratio/load to motor mass ratio] is set properly. Improper settings may cause an unexpected operation such as an overshoot.

(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.



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. PD03] to [Pr. PD22], you can select [Pr. PC35 Internal torque limit 2/internal thrust 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.

3. SIGNALS AND WIRING

(Note) In	out device				Enabled torq	ue limit value
TL1	TL	Limit value status			CCW power running/CW regeneration	CW power running/CCW regeneration
0	0				Pr. PA11	Pr .PA12
0	4	TLA	>	Pr. PA11 Pr. PA12	Pr. PA11	Pr. PA12
	'	TLA	<	Pr. PA11 Pr. PA12	TLA	TLA
1	0	Pr. PC35	>	Pr. PA11 Pr. PA12	Pr. PA11	Pr. PA12
'	0	Pr. PC35	<	Pr. PA11 Pr. PA12	Pr. PC35	Pr. PC35
1	1	TLA	>	Pr. PC35	Pr. PC35	Pr. PC35
	I	TLA	<	Pr. PC35	TLA	TLA

Note. 0: Off 1: On

(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.

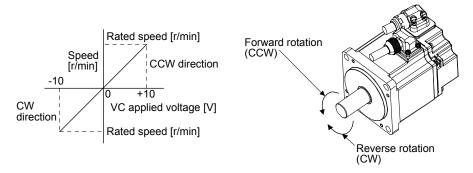
3.6.2 Speed control mode

(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.

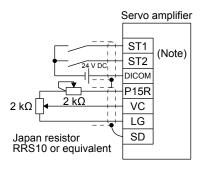
(Note 1) Ir	nput device	(Note 2) Rotation direction					
ST2	ST1	,	VC (Analog speed command)				
312	Polarity: +		0 V	Polarity: -	Internal speed command		
0	0	Stop	Stop	Stop	Stop		
U	0	(servo-lock)	(servo-lock)	(servo-lock)	(servo-lock)		
0	1	CCW	Stop	CW	CCW		
1	0	CW	(no servo-lock)	CCW	CW		
1	1	Stop	Stop	Stop	Stop		
'	l	(servo-lock)	(servo-lock)	(servo-lock)	(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.

Normally, connect as follows.



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

(b) SP1 (Speed selection 1), SP2 (Speed selection 2), and speed command value Select any of the speed settings by the internal speed commands 1 to 3 and by VC (Analog speed command) using SP1 (Speed selection 1) and SP2 (Speed selection 2) as follows.

(Note) Input device		Speed command value	
SP2	SP1	Speed confinand value	
0	0	VC (Analog speed command)	
0	1	Pr. PC05 Internal speed command 1	
1	0	Pr. PC06 Internal speed command 2	
1	1	Pr. PC07 Internal speed command 3	

Note. 0: Off 1: On

To select VC (Analog speed command) and a speed command value of internal speed commands 1 to 7, enable SP3 (Speed selection 3) with [Pr. PD03] to [Pr. PD22].

(No	ote) Input de	vice	Speed command value
SP3	SP2	SP1	Speed confinand value
0	0	0	VC (Analog speed command)
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

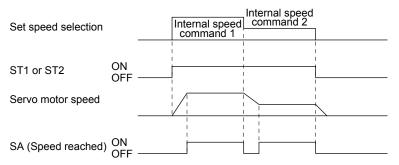
Note. 0: Off 1: On

You can change the speed during rotation. 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 As in section 3.6.1 (5)

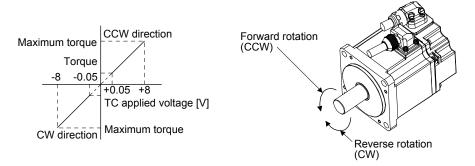
3.6.3 Torque control mode

(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].



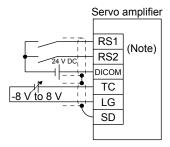
Generated torque command values will vary about 5% relative to the voltage depending on products. The torque may vary if the voltage is low (-0.05 V to 0.05 V) and the actual speed is close to the limit value. In such a case, increase the speed limit value.

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.

(Note) Inp	out device	Rotation direction					
RS2	RS1	7	TC (Analog torque command)				
NOZ	KOT	Polarity: +	0 V	Polarity: -			
0	0	Torque is not generated.		Torque is not generated.			
0	1	CCW (Forward rotation in power running mode/reverse rotation in regenerative mode)	Torque is not generated	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)	Torque is not generated.	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

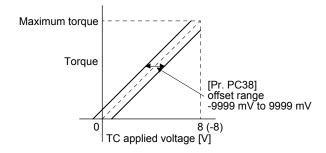
Normally, connect as follows.



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).

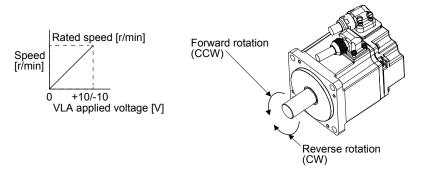
Note that TLA (Analog torque limit) is unavailable.

(3) Speed limit

(a) Speed limit value and speed

The speed is limited to the values set with [Pr. PC05 Internal speed limit 0] to [Pr. PC11 Internal speed limit 7] or the value set in the applied voltage of VLA (Analog speed limit). A relation between VLA (Analog speed limit) applied voltage and the servo motor speed is as follows. The speed limit direction and torque command direction are the same direction.

When the servo motor speed reaches the speed limit value, torque control may become unstable. Make the set value more than 100 r/min greater than the desired speed limit value.



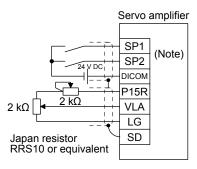
The following table indicates the limit direction according to RS1 (Forward rotation selection) and RS2 (Reverse rotation selection) combination.

(Note) Inp	out device	TC				
		(Analog torqu	ue command)	d) VLA (Analog speed limit)		
RS1	RS2	Voltage polarity	Torque command direction	Polarity: +	Polarity: -	Internal speed limit
1	0	Polarity: +	CCW	CCW	CCW	CCW
'	U	Polarity: -	CW	CW	CW	CW
0	1	Polarity: +	CW	CW	CW	CW
U	ı	Polarity: -	CCW	CCW	CCW	CCW

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) Speed limit value selection

Select any of the speed settings by the internal speed limits 1 to 7 and by VLA (Analog speed limit) using SP1 (Speed selection 1), SP2 (Speed selection 2), and SP3 (Speed selection 3) as follows.

(No	ote) Input dev	vice	Spand limit
SP3	SP2	SP1	Speed limit
0	0	0	VLA (Analog speed limit)
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 or analog speed limit.

3.6.4 Position/speed control switching mode

Set "___ 1" in [Pr. PA01] to switch to the position/speed control switching mode. This function is not available in the absolute position detection system.

(1) LOP (control switching)

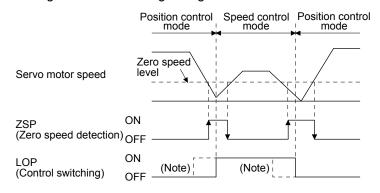
Use LOP (Control switching) to switch between the position control mode and the speed control mode with an external contact. The following shows a relation between LOP and control modes.

(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.

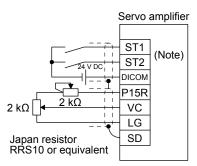
(2) Torque limit in position control mode As in section 3.6.1 (5)

(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

Select any of the speed settings by the internal speed commands 1 to 3 and by VC (Analog speed command) using SP1 (Speed selection 1) and SP2 (Speed selection 2) as follows.

(Note) Input device		Speed command value	
SP2	SP1	Speed command value	
0	0	VC (Analog speed command)	
0	1	Pr. PC05 Internal speed command 1	
1	0	Pr. PC06 Internal speed command 2	
1	1	Pr. PC07 Internal speed command 3	

Note. 0: Off 1: On

To select VC (Analog speed command) and a speed command value of internal speed commands 1 to 7, enable SP3 (Speed selection 3) with [Pr. PD03] to [Pr. PD22].

(Note) Input device			Speed command value
SP3	SP2	SP1	Speed confinant value
0	0	0	VC (Analog speed command)
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

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

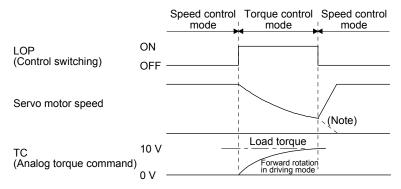
(1) LOP (control switching)

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.



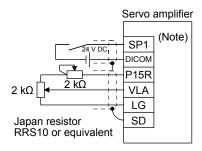
Note. When ST1 (Forward rotation start) and ST2 (Reverse rotation start) are switched off as soon as a mode is switched to the speed control, the servo motor comes to a stop according to the deceleration time constant. A shock may occur at switching control modes.

- (2) Speed setting in speed control mode As in section 3.6.2 (1)
- (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 of the parameter or the value set in the applied voltage of VLA (Analog speed limit).

A relation between the VLA (Analog speed limit) applied voltage and the limit value is as in section 3.6.3 (3) (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 limit value selection

Select any of the speed settings by the internal speed limit 1 and by VLA (Analog speed limit) using SP1 (Speed selection 1) as follows.

(Note) Input device	Speed command value
SP1	
0	VLA (Analog speed limit)
1	Pr. PC05 Internal speed limit 1

Note. 0: Off 1: On

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 limit 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

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

(1) LOP (control switching)

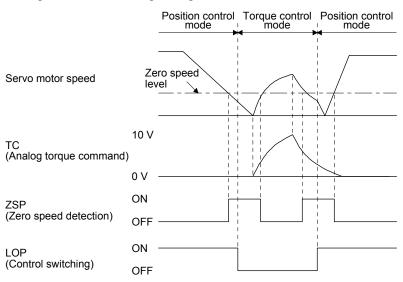
Use LOP (Control switching) to switch between the torque control mode and the position control mode with an external contact. The following shows a relation between LOP and control modes.

(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

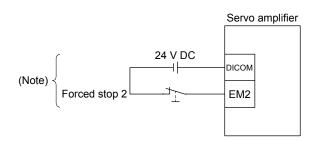
- ●When alarms not related to the forced stop function occur, control of motor deceleration cannot be guaranteed. (Refer to chapter 8.)
- ●In the torque control mode, the forced stop deceleration function is not available.
- •When using in a system configuration where synchronous operation is performed with multiple axes, disable the forced stop deceleration function. In this case, when an alarm occurs, the servo motor will stop with the dynamic brake.

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.

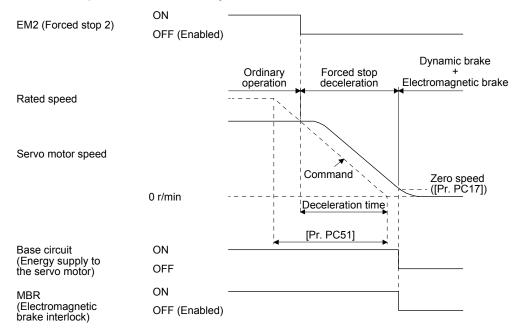
(2) Timing chart

POINT

■When LSP/LSN is turned on during a forced stop deceleration, the motor will stop depending on the setting of [Pr. PD30] as follows.

[Pr. PD30]	Stop system
0	Switching to sudden stop
1	Continuing forced stop deceleration

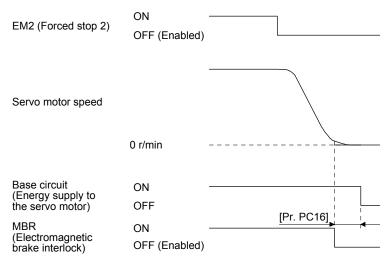
When EM2 (Forced stop 2) is turned off, the motor will decelerate according to [Pr. PC51 Forced stop deceleration time constant]. Once the motor speed is below [Pr. PC17 Zero speed] after completion of the deceleration command, base power is cut and the dynamic brake activates.



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.

(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

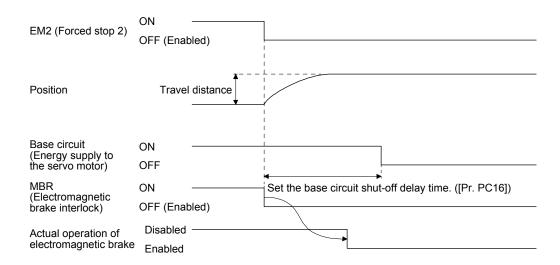
The vertical axis freefall prevention function avoids machine damage by pulling up the shaft slightly like the following case.

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, those 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



(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) If STO is turned off during forced stop deceleration, [AL.63 STO timing error] will occur.

3.8 Alarm occurrence timing chart



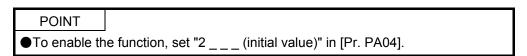
•When an alarm has occurred, remove its cause, make sure that the operation signal is not being input, ensure safety, and reset the alarm before restarting operation.

POINT

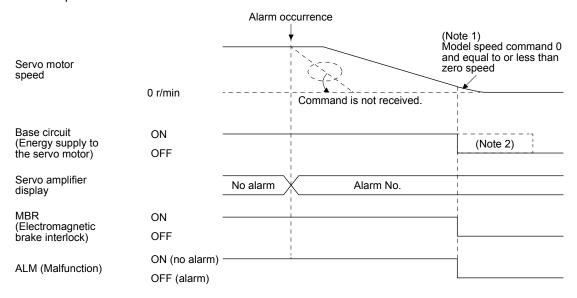
●In the torque control mode, the forced stop deceleration function is not available.

To deactivate an alarm, cycle the control circuit 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



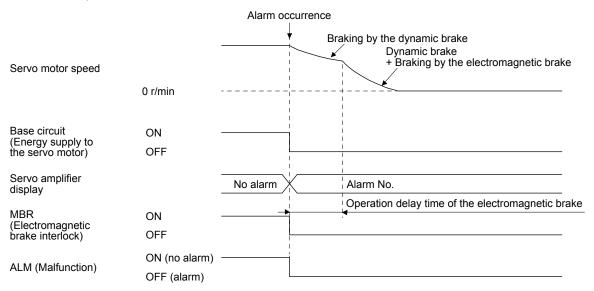
(1) When the forced stop deceleration function is enabled



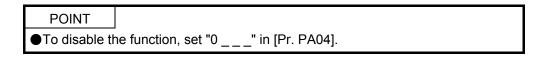
Note 1. The model speed command is a speed command generated in the servo amplifier for forced stop deceleration of the servo motor.

This is for when the electronic dynamic brake is enabled with [Pr. PF09] while a certain servo motor is
used. If the servo motor speed is 5 r/min or higher, the electronic dynamic brake will operate continuously
for the time period set in [Pr. PF15].

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



3.8.2 When you do not use the forced stop deceleration function



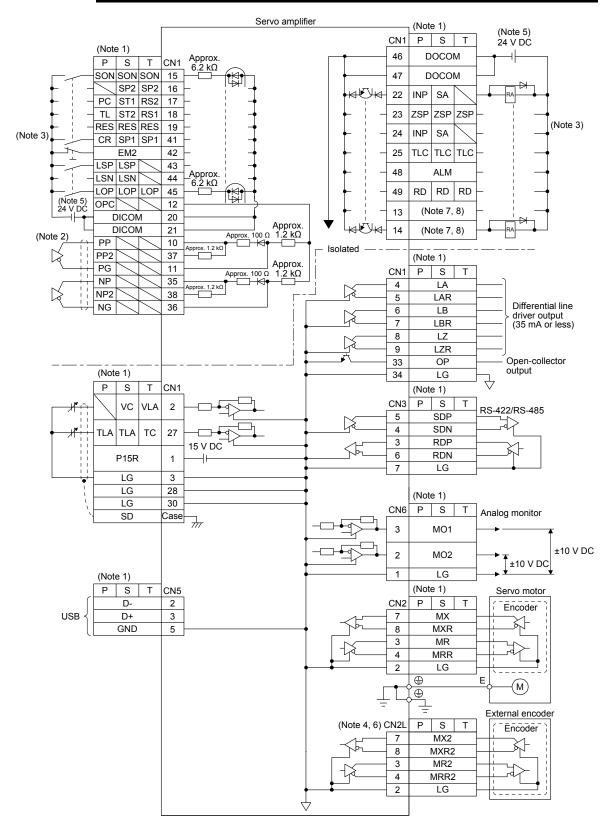
The operation status during an alarm is the same as section 3.8.1 (2).

3.9 Interfaces

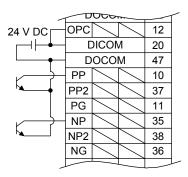
3.9.1 Internal connection diagram

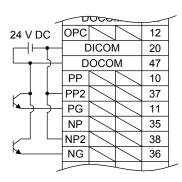
POINT

●Refer to section 13.3.1 for the CN8 connector.



- 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.





For sink input interface

For source input interface

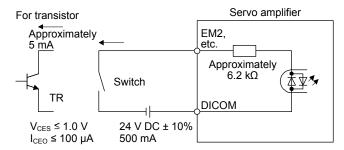
- 3. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 4. This is for MR-J4-_A_RJ servo amplifier. The MR-J4-_A_ servo amplifier does not have the CN2L connector.
- 5. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.
- 6. Refer to table 1.1 for connections of external encoders.
- 7. Output devices are not assigned by default. Assign the output devices with [Pr. PD47] as necessary.
- 8. This is used with MR-J4-_A_-RJ servo amplifiers with software version B3 or later.

3.9.2 Detailed explanation of interfaces

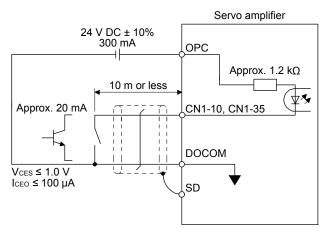
This section provides the details of the I/O signal interfaces (refer to the I/O division in the table) given in section 3.5. Refer to this section and make connection with the external device.

(1) Digital input interface DI-1

This is an input circuit whose photocoupler cathode side is the 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 is for when CN1-10 pin and CN1-35 pin are used as digital input interfaces.



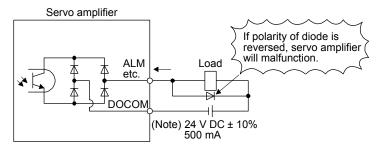
(2) Digital output interface DO-1

This is a circuit in which the collector side of the output transistor is the output terminal. When the output transistor is turned on, the current flows from 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.



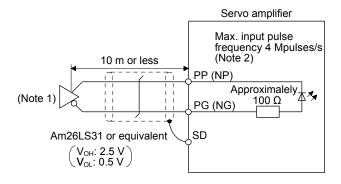
Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

(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

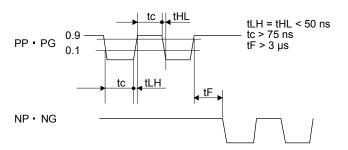


Note 1. Pulse train input interface is comprised of a photocoupler.

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

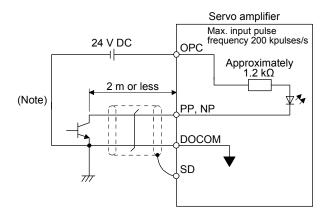
2. When the input pulse frequency is 4 Mpulses/s, set [Pr. PA13] to "_ 0 _ _".

2) Input pulse condition



(b) Open-collector type

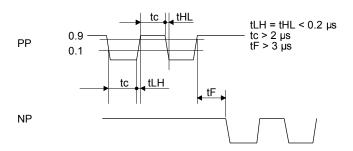
1) Interface



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

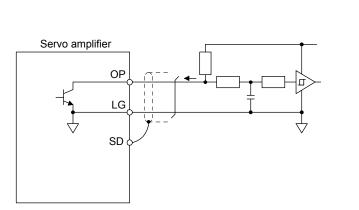


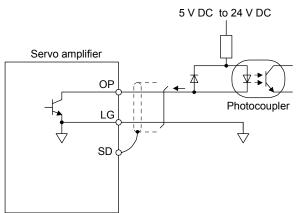
(4) Encoder output pulse DO-2

(a) Open-collector type

Interface

Maximum sink current: 35 mA

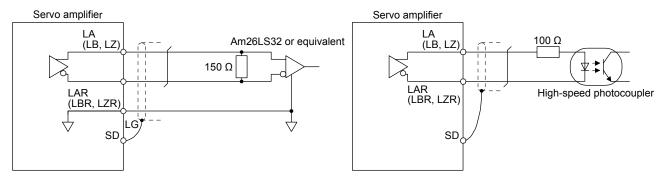




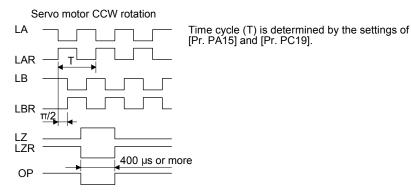
(b) Differential line driver type

1) Interface

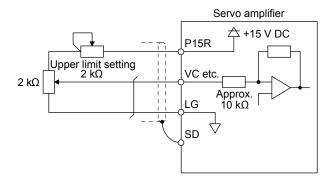
Maximum output current: 35 mA



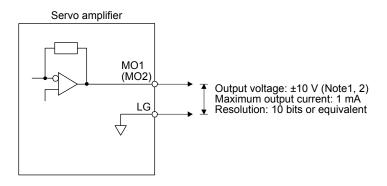
2) Output pulse



(5) Analog input Input impedance 10 k Ω to 12 k Ω



(6) Analog output



Note 1. Output voltage range varies depending on the monitored signal.

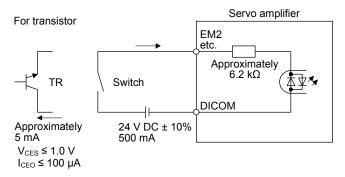
2. For MR-J4-03A6(-RJ) servo amplifiers, the output voltage becomes 5 V \pm 4 V.

3.9.3 Source I/O interfaces

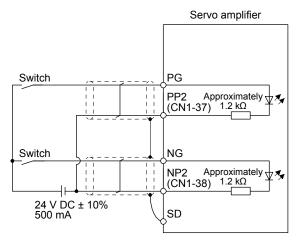
In this servo amplifier, source type I/O interfaces can be used.

(1) Digital input interface DI-1

This is an input circuit whose photocoupler anode side is the input terminal. Transmit signals using source (open-collector) type transistor output, relay switch, etc. Additionally, the CN1-10 and CN1-35 pins cannot be used for source inputs.



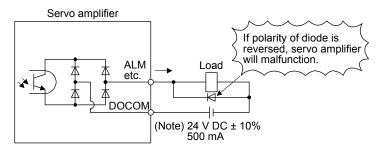
The following shows when the CN1-37 pin and the CN1-38 pin are used as digital input interface:



(2) Digital output interface DO-1

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

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

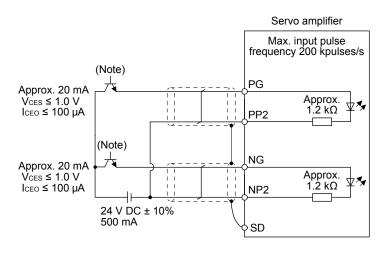


Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

(3) Pulse train input interface DI-2

Give a pulse train signal in the open-collector type.

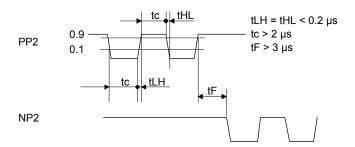
1) Interface



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



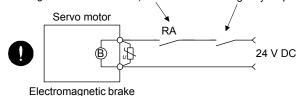
3.10 Servo motor with an electromagnetic brake

3.10.1 Safety precautions

■Configure an electromagnetic brake circuit so that it is activated also by an external emergency stop switch.

Contacts must be opened when ALM (Malfunction) or MBR (Electromagnetic brake interlock) turns off.

Contacts must be opened with the emergency stop switch.





- 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 torque of the electromagnetic brake. This can result in delay of the deceleration to a stop from a set value.

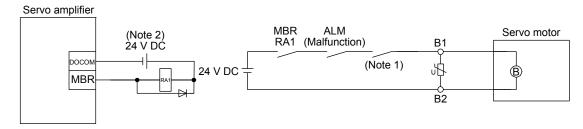
POINT

- Refer to "Servo Motor Instruction Manual (Vol. 3)" for specifications such as the power supply capacity and operation delay time of the electromagnetic brake.
- ■Refer to "Servo Motor Instruction Manual (Vol. 3)" 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 off SON (Servo-on) after the servo motor stopped.

(1) Connection diagram



Note 1. Create the circuit in order to shut off by interlocking with the emergency stop switch.

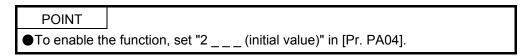
2. Do not use the 24 V DC interface power supply for the electromagnetic brake.

(2) Setting

- (a) Enable MBR (Electromagnetic brake interlock) with [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47].
- (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).

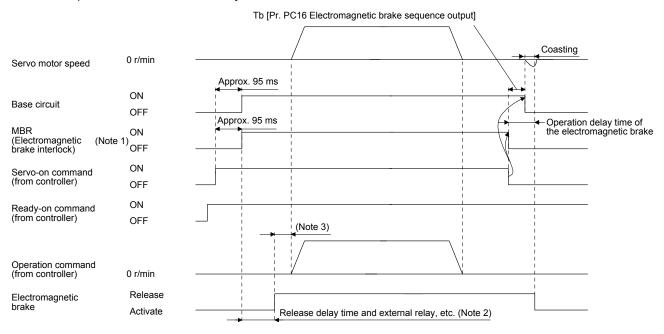
3.10.2 Timing chart

(1) When you use the forced stop deceleration function



(a) SON (Servo-on) on/off

When SON (Servo-on) is turned off, the servo lock will be released after Tb [ms], and the servo motor will coast. 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.

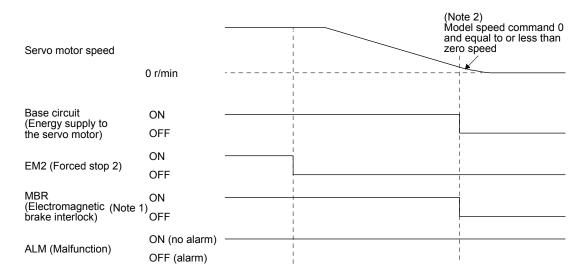
OFF: Electromagnetic brake has been activated.

- 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 "Servo Motor Instruction Manual (Vol. 3)".
- 3. Give a position command after the electromagnetic brake is released.
- 4. This is in position control mode.

(b) Forced stop 2 on/off

POINT

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



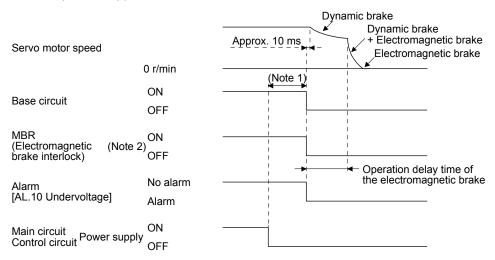
Note 1. ON: Electromagnetic brake is not activated.

OFF: Electromagnetic brake has been activated.

- The model speed command is a speed command generated in the servo amplifier for forced stop deceleration of the servo motor.
- (c) Alarm occurrence

The operation status during an alarm is the same as section 3.8.

(d) Both main and control circuit power supplies off



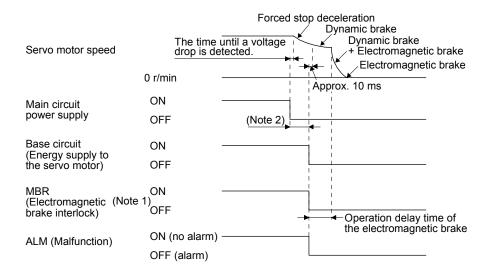
Note 1. Variable according to the operation status.

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

(e) Main circuit power supply off during control circuit power supply on

POINT

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



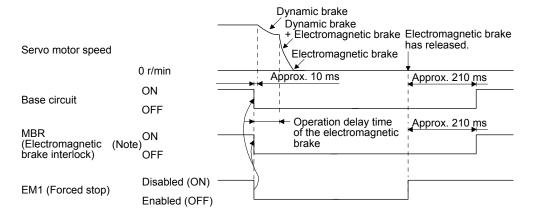
- Note 1. ON: Electromagnetic brake is not activated.

 OFF: Electromagnetic brake has been activated.
 - 2. Variable according to the operation status.
- (2) When you do not use the forced stop deceleration function

POINT

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

- (a) SON (Servo-on) on/offIt is the same as (1) (a) in this section.
- (b) EM1 (Forced stop 1) on/off



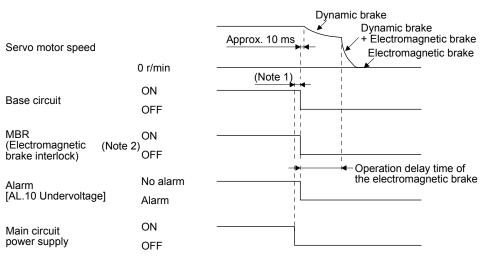
Note. ON: Electromagnetic brake is not activated.

OFF: Electromagnetic brake has been activated.

3. SIGNALS AND WIRING

- (c) Alarm occurrence

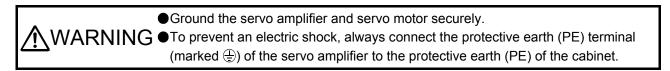
 The operation status during an alarm is the same as section 3.8.
- (d) Both main and control circuit power supplies off It is the same as (1) (d) of this section.
- (e) Main circuit power supply off during control circuit power supply on



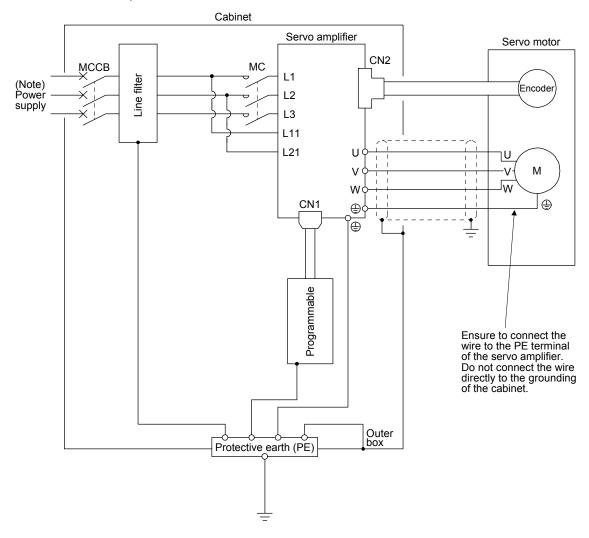
Note 1. Variable according to the operation status.

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

3.11 Grounding



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.

3. SIGNALS AND WIRING

MEMO		

4. STARTUP

WARNING 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.

POINT

■When you use a linear servo motor, replace the following left words to the right words.

Load to motor inertia ratio → Load to motor mass ratio

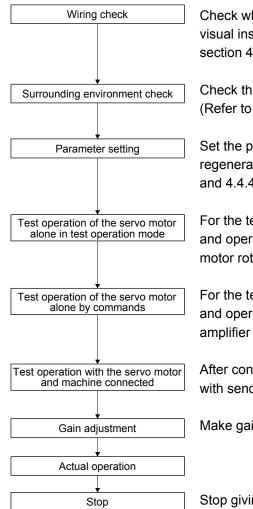
Torque \rightarrow Thrust

(Servo motor) speed → (Linear servo motor) speed

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 4.5.8), 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.

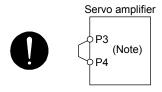
After connecting the servo motor with the machine, check machine motions with sending operation commands from the controller.

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

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

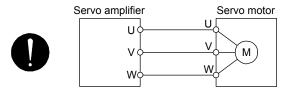
4.1.2 Wiring check

- Power supply system wiring
 Before switching on the main circuit and control circuit power supplies, check the following items.
 - (a) Power supply system wiring
 - 1) The power supplied to the power input terminals (L1, L2, L3, L11, and L21) of the servo amplifier should satisfy the defined specifications. (Refer to section 1.3.)
 - 2) Between P3 and P4 should be connected.

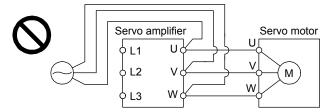


Note. The 100 V class servo amplifiers do not have P3 and P4.

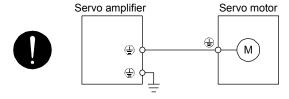
- (b) Connection of servo amplifier and servo motor
 - 1) The servo amplifier power output (U, V, and W) should match in phase with the servo motor power input terminals (U, V, and W).



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

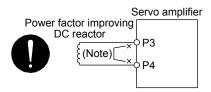


3) The grounding terminal of the servo motor is connected to the PE terminal of the servo amplifier.



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 option and auxiliary equipment are used
 - 1) 200 V class
 - a) When you use a regenerative option for 5 kW or less 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.)
 - b) When you use a regenerative option for 7 kW or more servo amplifiers
 - For 7 kW servo amplifiers, the lead wire of the 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.)
 - c) When you use a brake unit and power regeneration converter for 5 kW or more servo amplifiers
 - For 5 kW or less servo amplifiers, the lead wire between P+ terminal and D terminal should not be connected.
 - For 7 kW servo amplifiers, the lead wire of the built-in regenerative resistor connected to P+ terminal and C terminal should not be connected.
 - Brake unit or power regeneration converter should be connected to P+ terminal and Nterminal. (Refer to section 11.3 and 11.4.)
 - Twisted wires should be used when wiring is over 5 m and equal to or less than 10 m using a brake unit. (Refer to section 11.3)
 - d) When you use a power regeneration common converter
 - For 5 kW or less servo amplifiers, the lead wire between P+ terminal and D terminal should not be connected.
 - For 7 kW servo amplifiers, the lead wires of the built-in regenerative resistor connected to P+ terminal and C terminal should not be connected.
 - The wire of power regeneration common converter should be connected to P4 terminal and N- terminal. (Refer to section 11.5.)
 - e) The power factor improving DC reactor should be connected between P3 and P4. (Refer to section 11.11.)

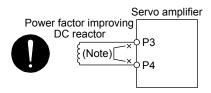


Note. Always disconnect between P3 and P4 terminals.

2) 400 V class

- a) When you use a regenerative option for 3.5 kW or less 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.)

- b) When you use a regenerative option for 5 kW or more servo amplifiers
 - For 5 kW or 7 kW servo amplifiers, the lead wire of the 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.)
- c) When you use a brake unit and power regeneration converter for 5 kW or more servo amplifiers
 - For 5 kW or 7 kW servo amplifiers, the lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should not be connected.
 - Brake unit, power regeneration converter should be connected to P+ terminal and Nterminal. (Refer to section 11.3 and 11.4.)
 - Twisted wires should be used when wiring is over 5 m and equal to or less than 10 m using a brake unit. (Refer to section 11.3)
- d) When you use a power regeneration common converter for 11 kW or more servo amplifiers
 - Power regeneration common converter should be connected to P4 terminal and N- terminal.
 (Refer to section 11.5.)
- e) The power factor improving DC reactor should be connected between P3 and P4. (Refer to section 11.11.)



Note. Always disconnect between P3 and P4.

- 3) 100 V class
 - 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 CN1 connector. You can use the function to check the wiring. In this case, switch on the control circuit power supply only.
 - Refer to section 3.2 for details of I/O signal connection.
 - (b) 24 V DC or higher voltage is not applied to the pins of the CN1 connector.
 - (c) Plate and DOCOM of the CN1 connector is not 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 the methods 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) Switch on the main circuit power supply and control circuit power supply. When main circuit power/control circuit power is switched on, the display shows "C (Cumulative feedback pulses)", and in 2 s later, shows data.



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) Switch off the main circuit power supply and control circuit power supply.

4. STARTUP

4.2.2 Stop

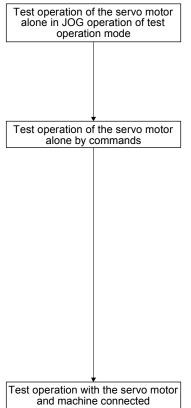
If any of the following situations occurs, the servo amplifier suspends the running of the servo motor and brings it to a stop. Refer to section 3.10 for the servo motor with an electromagnetic brake.

Operation/command	Stopping condition
Switch of 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. (Note))
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.
STO (STO1, STO2) off	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop.
LSP (Forward rotation stroke end) of 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.

Note. Only a list of alarms and warnings is listed in chapter 8. Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" for details of alarms and warnings.

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 the power on and off methods of 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 4.5.9 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



Never adjust or change the parameter values extremely as it will make 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

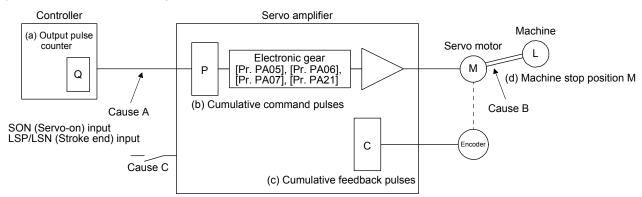
No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
1	1 Power on - The 5-digit, 7-segment LED is not lit The 5-digit, 7-segment LED flickers.	7-segment LED is not lit. The 5-digit,	Not improved even if CN1, CN2 and CN3 connectors are disconnected.	Power supply voltage fault The servo amplifier is malfunctioning.	
			Improved when CN1 connector is disconnected.	Power supply of CN1 cabling is shorted.	
		Improved when CN2 connector is disconnected.	 Power supply of encoder cabling is shorted. Encoder is malfunctioning. 		
		Improved when CN3 connector is disconnected.	Power supply of CN3 cabling is shorted.		
		Alarm occurs.	Refer to chapter 8 and remove caus	se.	Chapter 8 (Note)

4. STARTUP

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
2	Switch on SON (Servo-on).	Alarm occurs.	Refer to chapter 8 and remove caus	e.	Chapter 8 (Note)
		Servo motor shaft is not servo-locked. (Servo motor shaft is free.)	Check the display to see if the servo amplifier is ready to operate. Check the external I/O signal indication (section 4.5.7) to see if SON (Servo-on) is on.	SON (Servo-on) is not input. (wiring mistake) 2. 24 V DC power is not supplied to DICOM.	Section 4.5.7
3	Input command pulse. (Test operation)	Servo motor does not rotate.	Check the cumulative command pulse on the status display (section 4.5.3).	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. Pulse is not input from the controller.	Section 4.5.3
		Servo motor run in reverse direction.		Mistake in setting of [Pr. PA13]. 1. Mistake in wiring to controller. 2. Mistake in setting of [Pr. PA14].	Chapter 5
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 or more 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 run with safety, repeat acceleration and deceleration three times or more 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

Note. Only a list of alarms and warnings is listed in chapter 8. Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" for details of alarms and warnings.

(2) How to find the cause of position shift



When a position shift occurs, check (a) output pulse counter display 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 _ _ _ "

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

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

$$P \cdot \frac{4194304}{FBP [Pr. PA05]} = C$$

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

$$P \cdot \frac{CMX [Pr. PA06]}{CDV [Pr. PA07]} \times 16 = C$$

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

Check for a position mismatch in the following sequence.

1) When Q ≠ 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 11.14 (2) (a).)
- Change the [Pr. PA13 Command pulse input form] setting.

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

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)

When C • Δℓ ≠ 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) Switch on the main circuit power supply and control circuit power supply. When main circuit power/control circuit power is switched on, the display shows "r (Servo motor speed)", and in 2 s later, shows data.



(2) Power-off

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

4. STARTUP

4.3.2 Stop

If any of the following situations occurs, the servo amplifier suspends the running of the servo motor and brings it to a stop.

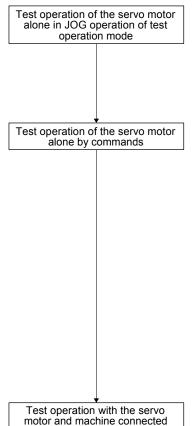
Refer to section 3.10 for the servo motor with an electromagnetic brake.

Operation/command	Stopping condition
Switch of 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. (Note))
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.
STO (STO1, STO2) off	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop.
LSP (Forward rotation stroke end) of 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.

Note. Only a list of alarms and warnings is listed in chapter 8. Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" for details of alarms and warnings.

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 the power on and off methods of 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 4.5.9 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.
- 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



Never adjust or change the parameter values extremely as it will make 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 • The 5-digit, 7-segment LEI not lit.	7-segment LED is	Not improved even if CN1, CN2, and CN3 connectors are disconnected.	Power supply voltage fault The servo amplifier is malfunctioning.	
		The 5-digit, 7-segment LED	Improved when CN1 connector is disconnected.	Power supply of CN1 cabling is shorted.	
		flickers.	Improved when CN2 connector is disconnected.	 Power supply of encoder cabling is shorted. Encoder is malfunctioning. 	
			Improved when CN3 connector is disconnected.	Power supply of CN3 cabling is shorted.	\rceil
		Alarm occurs.	Refer to chapter 8 and remove cau	use.	Chapter 8 (Note)

4. STARTUP

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
2	Switch on SON (Servo-on).			use.	Chapter 8 (Note)
		Servo motor shaft is not servo-locked. (Servo motor shaft is free.)	 Check the display to see if the servo amplifier is ready to operate. Check the external I/O signal indication (section 4.5.7) to see if SON (Servo-on) is on. 	SON (Servo-on) is not input. (wiring mistake) 224 V DC power is not supplied to DICOM.	Section 4.5.7
3	Switch on ST1 (Forward rotation start) or ST2 (Reverse rotation	Servo motor does not rotate.	Call the status display (section 4.5.3) and check the input voltage of VC (Analog speed command).	Analog speed command is 0 V.	Section 4.5.3
	start).		Call the external I/O signal display (section 4.5.7) and check the on/off status of the input signal.	LSP, LSN, ST1, and ST2 are off.	Section 4.5.7
			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 status display.	Torque limit level is too low as compared to the load torque.	Section 4.5.3
4	Gain adjustment	Rotation ripples (speed fluctuations) are large at low speed.	Make gain adjustment in the following procedure. Increase the auto tuning response level. Repeat acceleration and deceleration three times or more 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 run with safety, repeat acceleration and deceleration three times or more to complete auto tuning.	Gain adjustment fault	Chapter 6

Note. Only a list of alarms and warnings is listed in chapter 8. Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" for details of alarms and warnings.

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) Switch on the main circuit power supply and control circuit power supply. Data is displayed in 2 s after "U" (Analog torque command) is displayed.



(2) Power-off

- 1) Switch off RS1 (Forward rotation selection) or RS2 (Reverse rotation selection).
- 2) Switch off SON (Servo-on).
- 3) Switch off the main circuit power supply and control circuit power supply.

4.4.2 Stop

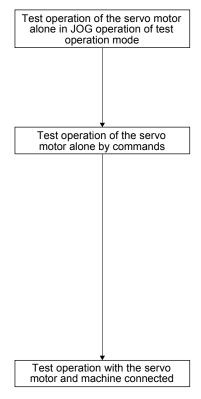
If any of the following situations occurs, the servo amplifier suspends the running of the servo motor and brings it to a stop. Refer to section 3.10 for the servo motor with an electromagnetic brake.

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. (Note))
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.
STO (STO1, STO2) off	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop.
Simultaneous on or off of RS1 (Forward rotation selection) and RS2 (Reverse rotation selection)	The servo motor coasts.

Note. Only a list of alarms and warnings is listed in chapter 8. Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" for details of alarms and warnings.

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 the power on and off methods of 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 4.5.9 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

ACAUTION

Never adjust or change the parameter values extremely as it will make unstable movement.

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.

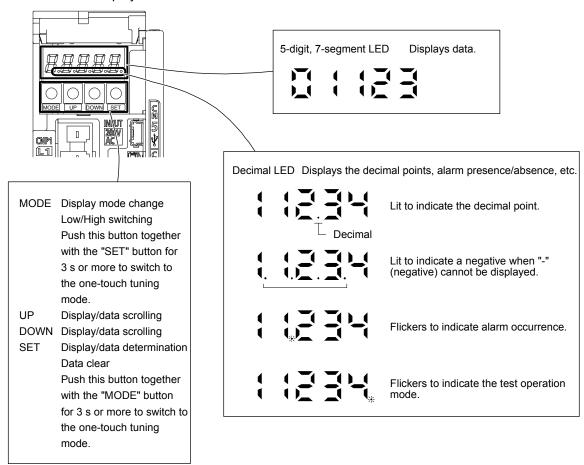
No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
1	Power on	The 5-digit, 7-segment LED is not lit. The 5-digit,	Not improved even if CN1, CN2, and CN3 connectors are disconnected.	Power supply voltage fault The servo amplifier is malfunctioning.	
		7-segment LED	Improved when CN1 connector is disconnected.	Power supply of CN1 cabling is shorted.	
		flickers.	Improved when CN2 connector is disconnected.	 Power supply of encoder cabling is shorted. Encoder is malfunctioning. 	
			Improved when CN3 connector is disconnected.	Power supply of CN3 cabling is shorted.	
		Alarm occurs.	Refer to chapter 8 and remove cau	use.	Chapter 8 (Note)
2	Switch on SON (Servo-on).	Alarm occurs.	Refer to chapter 8 and remove cau	use.	Chapter 8 (Note)
		(Servo motor shaft is free.)	Call the external I/O signal display (section 4.5.7) and check the on/off status of the input signal.	SON (Servo-on) is not input. (wiring mistake) 24 V DC power is not supplied to DICOM.	Section 4.5.7
3	Switch on RS1 (Forward rotation start) or RS2 (Reverse rotation	Servo motor does not rotate.	Call the status display (section 4.5.3) and check the input voltage of TC (Analog torque command).	Analog torque command is 0 V.	Section 4.5.3
	start).		Call the external I/O signal display (section 4.5.7) and check the on/off status of the input signal.	RS1 and RS2 are off.	Section 4.5.7
			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

Note. Only a list of alarms and warnings is listed in chapter 8. Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" for details of alarms and warnings.

4.5 Display and operation sections

4.5.1 Summary

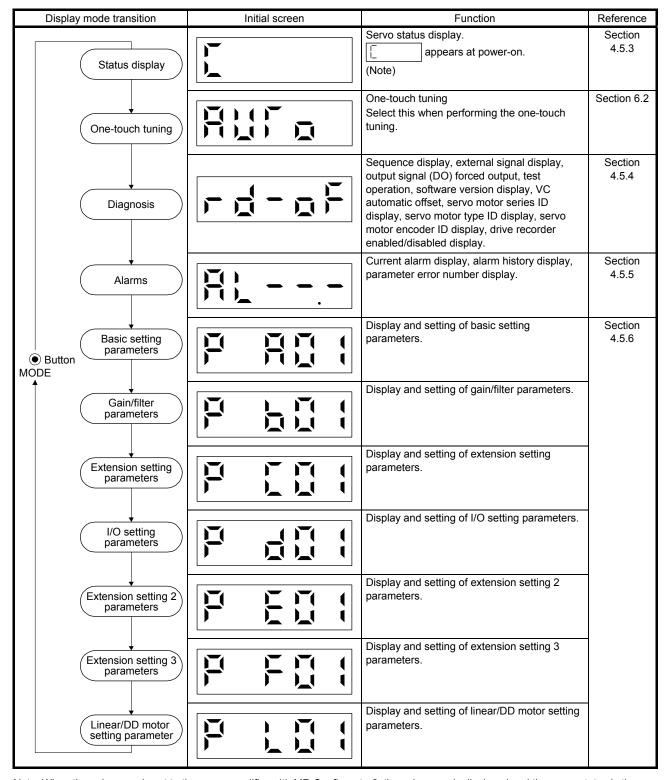
The MR-J4-_A_(-RJ) servo amplifier has the display section (5-digit, 7-segment LED) and operation section (4 pushbuttons) for servo amplifier status display, alarm display, parameter setting, etc. Also, press the "MODE" and "SET" buttons at the same time for 3 s or more to switch to the one-touch tuning mode. The operation section and display data are described below.



4.5.2 Display flowchart

Press the "MODE" button once to shift to the next display mode. Refer to section 4.5.3 and later for the description of the corresponding display mode.

To refer to and set the gain/filter parameters, extension setting parameters and I/O setting parameters, enable them with [Pr. PA19 Parameter writing inhibit].



Note. When the axis name is set to the servo amplifier with MR Configurator2, the axis name is displayed and the servo status is then displayed.

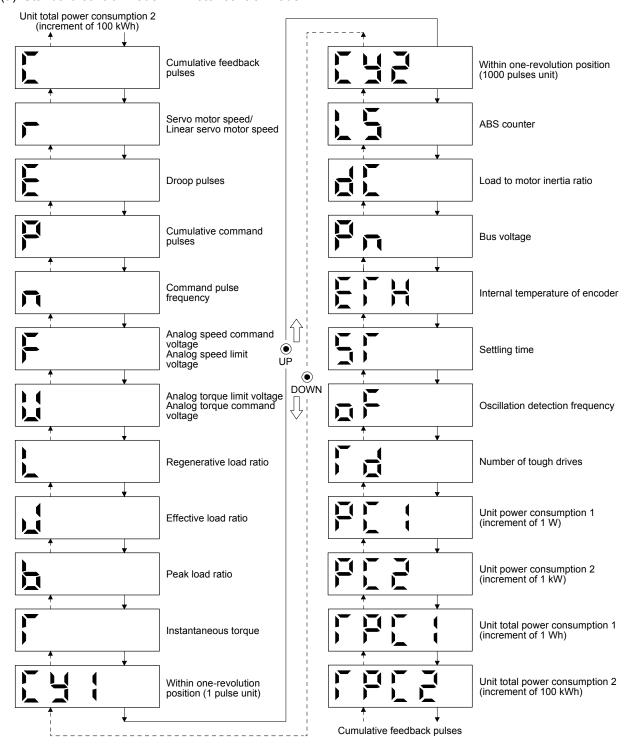
4.5.3 Status display mode

The servo status during operation is shown on the 5-digit, 7-segment LED display. Press the "UP" or "DOWN" button to change display data as desired. When the required data is selected, the corresponding symbol is displayed. Press the "SET" button to display that data. At only power-on, however, data appears after the symbol of the status display selected in [Pr. PC36] has been shown for 2 s.

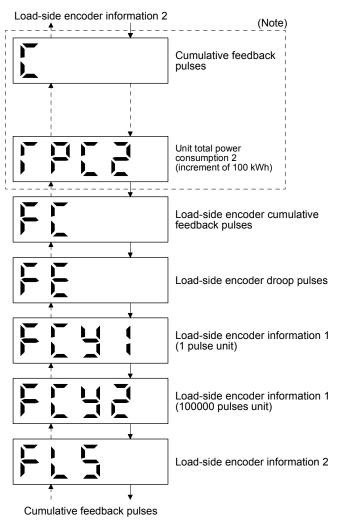
(1) Display transition

After selecting the status display mode with the "MODE" button, pressing the "UP" or "DOWN" button changes the display as shown below.

(a) Standard control mode/DD motor control mode

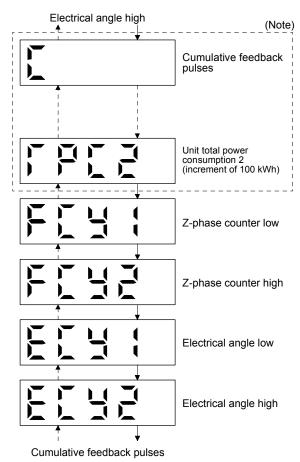


(b) Fully closed loop control mode



Note. The displays in the frames are the standard control modes in one cycle with some displays omitted.

(c) Linear servo motor control mode



Note. The displays in the frames are the standard control modes in one cycle with some displays omitted.

(2) Display examples

The following table shows the display examples.

Item	State	Displayed data
nem	State	Servo amplifier display
	Forward rotation at 2500 r/min	
Servo motor speed	Reverse rotation at 3000 r/min	Reverse rotation is indicated by "- ".
Load to motor inertia ratio	7.00 times	
	11252 rev	
ABS counter	-12566 rev	Negative value is indicated by the lit decimal points in the upper four digits.

(3) Status display list

The following table lists the servo statuses that may be shown. Refer to app. 7.3 for the measurement point.

Status display	Symbol	Unit	Description	
Cumulative feedback pulses	С	pulse	Feedback pulses from the servo motor encoder are counted and displayed. The values in excess of ±99999 can be counted. However, the counter shows only the lower five digits of the actual value since the servo amplifier display is five digits. Press the "SET" button to reset the display value to zero. The value of minus is indicated by the lit decimal points in the upper four digits.	
Servo motor speed/ Linear servo motor speed	r	r/min	The servo motor speed or Linear servo motor speed is displayed. It is displayed rounding off 0.1 r/min (0.1 mm/s) unit.	
Droop pulses	E	pulse	The number of droop pulses in the deviation counter is displayed. The decimal points in the upper four digits are lit for reverse rotation pulses. The values in excess of ±99999 can be counted. However, the counter shows only the lower five digits of the actual value since the servo amplifier display is five digits.	
Cumulative command pulses	Р	pulse	The number of pulses displayed is in the encoder pulse unit. Position command input pulses are counted and displayed. As the value displayed is not yet multiplied by the electronic gear (CMX/CDV), it may not match the indication of the cumulative feedback pulses. The values in excess of ±99999 can be counted. However, the counter shows only the lower five digits of the actual value since the servo amplifier display is five digits. Press the "SET" button to reset the display value to zero. When the servo motor is rotating in the reverse direction, the decimal points in the upper four digits are lit.	
Command pulse frequency	n	kpulse/s	The frequency of position command input pulses is counted and displayed. The value displayed is not multiplied by the electronic gear (CMX/CDV).	
Analog speed command voltage Analog speed limit voltage	F	V	Torque control mode Input voltage of VLA (Analog speed limit) voltage is displayed. Speed control mode Input voltage of VC (Analog speed command) voltage is displayed	
Analog torque command voltage Analog torque limit voltage	U	V	Position control mode and speed control mode Voltage of TLA (Analog torque limit) voltage is displayed. Torque control mode Voltage of TC (Analog torque command) voltage is displayed.	
Regenerative load ratio	L	%	The ratio of regenerative power to permissible regenerative power is displayed in %.	
Effective load ratio	J	%	The continuous effective load current is displayed. The effective value in the past 15 s is displayed relative to the rated current of 100%.	
Peak load ratio	b	%	The maximum occurrence torque is displayed. The highest value in the past 15 s is displayed relative to the rated current of 100%.	
Instantaneous torque	Т	%	The instantaneous occurrence torque is displayed. The value of torque being occurred is displayed in real time considering a rated torque as 100%.	
Within one-revolution position (1 pulse unit)	Cy1	pulse	Position within one revolution is displayed in encoder pulses. The values in excess of ±99999 can be counted. However, the counter shows only the lower five digits of the actual value since the servo amplifier display is five digits. When the servo motor rotates in the CCW direction, the value is added.	
Within one-revolution position (1000 pulses unit)	Cy2	1000 pulses	The within one-revolution position is displayed in 1000 pulse increments of the encoder. When the servo motor rotates in the CCW direction, the value is added.	
ABS counter	LS	rev	The travel distance from the home position is displayed as multi-revolution counter value of the absolution position encoder in the absolution position detection system.	

Status display	Symbol	Unit	Description
Load to motor inertia ratio	dC	Multiplier	The estimated ratio of the load inertia moment to the servo motor shaft inertia moment is displayed.
Bus voltage	Pn	V	The voltage of main circuit converter (between P+ and N-) is displayed.
Internal temperature of encoder	ETh	°C	Inside temperature of encoder etected by the encoder is displayed.
Settling time	ST	ms	Settling time is displayed. When it exceeds 1000 ms, "1000" will be displayed.
Oscillation detection frequency	oF	Hz	Frequency at the time of oscillation detection is displayed.
Number of tough operations	Td	times	The number of tough drive functions activated is displayed.
Unit power consumption 1 (increment of 1 W)	PC1	W	Unit power consumption is displayed by increment of 1 W. Positive value indicate power running, and negative value indicate regeneration. The values in excess of ±99999 can be counted. However, the counter shows only the lower five digits of the actual value since the servo amplifier display is five digits.
Unit power consumption 2 (increment of 1 kW)	PC2	kW	Unit power consumption is displayed by increment of 1 kW. Positive value indicate power running, and negative value indicate regeneration.
Unit total power consumption 1 (increment of 1 Wh)	TPC1	Wh	Unit total power consumption is displayed by increment of 1 Wh. Positive value is cumulated during power running and negative value during regeneration. The values in excess of ±99999 can be counted. However, the counter shows only the lower five digits of the actual value since the servo amplifier display is five digits.
Unit total power consumption 2 (increment of 100 kWh)	TPC2	100 Wh	Unit total power consumption is displayed by increment of 100 kWh. Positive value is cumulated during power running and negative value during regeneration.
Load-side encoder Cumulative feedback pulses	FC	pulse	Feedback pulses from the load-side encoder are counted and displayed. The values in excess of ±99999 can be counted. However, the counter shows only the lower five digits of the actual value since the servo amplifier display is five digits. Press the "SET" button to reset the display value to zero. The value of minus is indicated by the lit decimal points in the upper four digits.
Load-side encoder Droop pulses	FE	pulse	Droop pulses of the deviation counter between a load-side encoder and a command are displayed. When the count exceeds ±99999, it starts from 0. Negative value is indicated by the lit decimal points in the upper four digits. The display shows the average droop pulses of 128 samplings at the rate of 444 [µs].
Load-side encoder information 1 (1 pulse unit)	FCY1	pulse	The Z-phase counter of a load-side encoder is displayed in the encoder pulse unit. For an incremental linear encoder, the Z-phase counter is displayed. The value is counted up from 0 based on the home position (reference mark). For an absolute position linear encoder, the encoder absolute position is displayed. When the count exceeds 99999, it starts from 0.
Load-side encoder information 1 (100000 pulses unit)	FCY2	100000 pulses	The Z-phase counter of a load-side encoder is displayed by increments of 100 pulses. For an incremental linear encoder, the Z-phase counter is displayed. The value is counted up from 0 based on the home position (reference mark). For an absolute position linear encoder, the encoder absolute position is displayed. When the count exceeds 99999, it starts from 0.
Load-side encoder information 2	FL5	rev	When an incremental linear encoder is used as the load-side encoder, the display shows 0. When an absolute position linear encoder is used as the load-side encoder, the display shows 0. When a rotary encoder is used as the load-side encoder, the display shows the value of the multi-revolution counter.
Z-phase counter low	FCY1	pulse	The Z-phase counter is displayed in the encoder pulse unit. For an incremental linear encoder, the Z-phase counter is displayed. The value is counted up from 0 based on the home position (reference mark). For an absolute position linear encoder, the encoder absolute position is displayed. When the count exceeds 99999, it starts from 0.
Z-phase counter high	FCY2	100000 pulses	The Z-phase counter is displayed by increments of 100000 pulses. For an incremental linear encoder, the Z-phase counter is displayed. The value is counted up from 0 based on the home position (reference mark). For an absolute position linear encoder, the encoder absolute position is displayed. When the count exceeds 99999, it starts from 0.

4. STARTUP

Status display	Symbol	Unit	Description
Electrical angle low	ECY1	pulse	The servo motor electrical angle is displayed.
Electrical angle high	ECY2	100000 pulses	The servo motor electrical angle is displayed by increments of 100000 pulses.

(4) Changing the status display screen

The status display item of the servo amplifier display shown at power-on can be changed by changing [Pr. PC36] settings. The item displayed in the initial status changes with the control mode as follows.

Control mode	Status display	
Position	Cumulative feedback pulses	
Position/speed	Cumulative feedback pulses/servo motor speed	
Speed	Servo motor speed	
Speed/torque	Servo motor speed/analog torque command voltage	
Torque	Analog torque command voltage	
Torque/position	Analog torque command voltage/cumulative feedback pulses	

4.5.4 Diagnostic mode

Name		Display	Description
Soguence			Not ready Indicates that the servo amplifier is being initialized or an alarm has occurred.
Sequence			Ready Indicates that the servo was switched on after completion of initialization and the servo amplifier is ready to operate.
			Drive recorder enabled When an alarm occurs in the status, the drive recorder will operate and write the status of occurrence.
Drive recorder ena	abled/disabled display		Drive recorder enabled The drive recorder will not operate on the following conditions. 1. You are using the graph function of MR Configurator2. 2. You are using the machine analyzer function. 3. [Pr. PF21] is set to "-1".
External I/O signa	l display	Refer to section 4.5.7.	This Indicates the on/off status of external I/O signal. The upper segments correspond to the input signals and the lower segments to the output signals.
Output signal (DO) forced output		This allows digital output signal to be switched on/off forcibly. For details, refer to section 4.5.8.
	JOG operation		JOG operation can be performed when there is no command from an external controller. For details, refer to section 4.5.9 (2).
	Positioning operation		Positioning operation can be performed when there is no command from an external controller. MR Configurator2 is required to perform positioning operation. For details, refer to section 4.5.9 (3).
Test operation mode	Motor-less operation		Without connecting the servo motor, output signals or status display monitoring can be provided in response to the input device as if the servo motor is actually running. For details, refer to section 4.5.9 (4).
mode	Machine analyzer operation		Merely connecting the servo amplifier allows the resonance point of the mechanical system to be measured. MR Configurator2 is required to perform machine analyzer operation. Refer to section 11.7 for details.
	For manufacturer		This is for manufacturer.
	For manufacturer		This is for manufacturer.

Name	Display	Description
Software version – Lower		Indicates the version of the software.
Software version - Upper		Indicates the system number of the software.
Automatic VC offset		If offset voltages in the analog circuits inside and outside the servo amplifier cause the servo motor to rotate slowly at VC (Analog speed command) or VLA (Analog speed limit) of 0 V, this function automatically makes zero-adjustment of offset voltages. When using this function, enable the function in the following procedure. When it is enabled, [Pr. PC37] value changes to the automatically adjusted offset voltage. 1) Push "SET" once. 2) Set the number in the first digit to 1 with "UP". 3) Push "SET". This function cannot be used if the input voltage of VC or VLA is - +0.4 V or less, or + 0.4 V or more. (Note)
Servo motor series ID		Push the "SET" button to show the series ID of the servo motor currently connected. For indication details, refer to the Servo Motor Instruction Manual (Vol. 3).
Servo motor type ID		Push the "SET" button to show the type ID of the servo motor currently connected. For indication details, refer to the Servo Motor Instruction Manual (Vol. 3).
Servo motor encoder ID		Push the "SET" button to show the encoder ID of the servo motor currently connected. For indication details, refer to the Servo Motor Instruction Manual (Vol. 3).
For manufacturer		This is for manufacturer.
For manufacturer		This is for manufacturer.

Note. Even if Automatic VC offset is performed and 0 V is input, the servo motor may not completely stop due to an internal error. To completely stop the servo motor, switch off ST1 or ST2.

4.5.5 Alarm mode

The current alarm, past alarm history and parameter error are displayed. The lower 3 digits on the display indicate the alarm number that has occurred or the parameter number in error.

Name	Display	Description
Current alarm		Indicates no occurrence of an alarm.
Current alann		Indicates the occurrence of [AL. 33.1 Main circuit voltage error]. Flickers at alarm occurrence.
		Indicates that the last alarm is [AL. 50.1 Thermal overload error 1 during operation].
		Indicates the second last alarm is [AL. 33.1 Main circuit voltage error].
		Indicates the third last alarm is [AL. 10.1 Voltage drop in the control circuit power].
Alarm history		Indicates that there is no tenth alarm in the past.
		Indicates that there is no eleventh alarm in the past.
		Indicates that there is no twelfth alarm in the past.
		Indicates that there is no sixteenth alarm in the past.
Parameter error No.		This indicates no occurrence of [AL. 37 Parameter error].
		The data content error of [Pr. PA12 Reverse rotation torque limit].

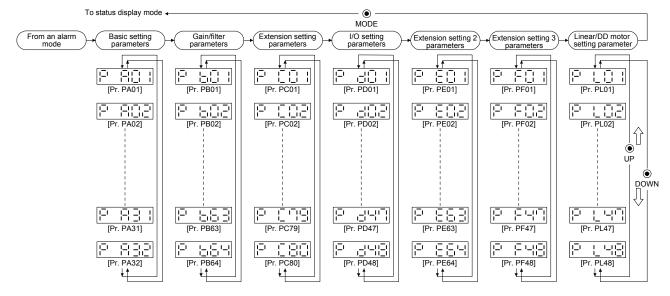
Functions at occurrence of an alarm

- (1) Any mode screen displays the current alarm.
- (2) Even during alarm occurrence, the other screen can be viewed by pressing the button in the operation area. At this time, the decimal point in the fourth digit remains flickering.
- (3) For any alarm, remove its cause and clear it in any of the following methods. (Refer to chapter 8 for the alarms that can be cleared.)
 - (a) Switch power off, then on.
 - (b) Push the "SET" button on the current alarm screen.
 - (c) Turn on RES (Reset).
- (4) Use [Pr. PC18] to clear the alarm history.
- (5) Push "UP" or "DOWN" to move to the next history.

4.5.6 Parameter mode

(1) Parameter mode transition

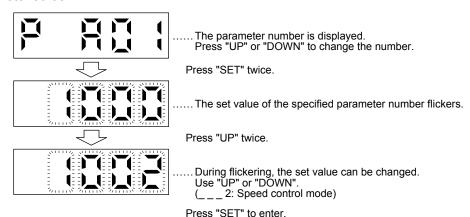
After selecting the corresponding parameter mode with the "MODE" button, pushing the "UP" or "DOWN" button changes the display as shown below.



(2) Operation example

(a) Parameters of 5 or less digits

The following example shows the operation procedure performed after power-on to change the control mode to the speed control mode with [Pr. PA01 Operation mode]. Press "MODE" to switch to the basic setting parameter screen.

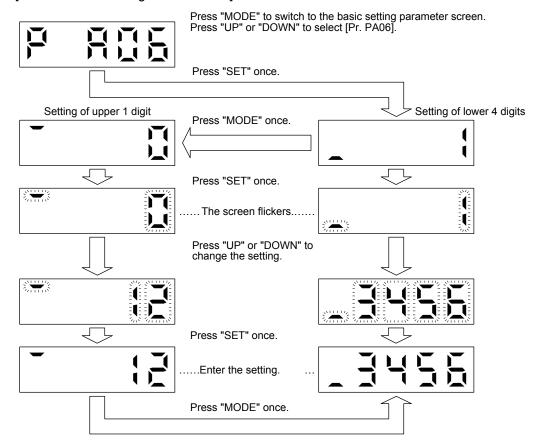


To shift to the next parameter, press the "UP" or "DOWN" button.

When changing the [Pr. PA01] setting, change its set value, then switch power off once and switch it on again to enable the new value.

(b) Parameters of 6 or more digits

The following example gives the operation procedure to change the electronic gear numerator to "123456" with [Pr. PA06 Electronic gear numerator].



4.5.7 External I/O signal display

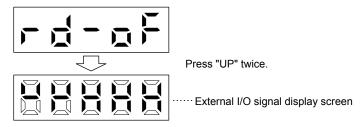
POINT

● The I/O signal settings can be changed using the I/O setting parameters [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47].

The on/off states of the digital I/O signals connected to the servo amplifier can be confirmed.

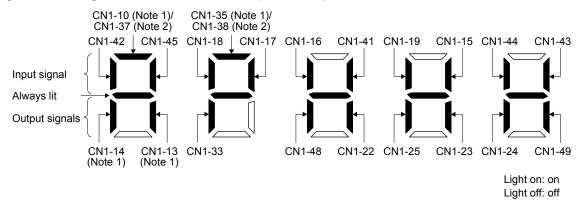
(1) Operation

Call the display screen shown after power-on. Using the "MODE" button, show the diagnostic screen.



(2) Display definition

The 7-segment LED segments and CN1 connector pins correspond as shown below.



- Note 1. This is used with MR-J4-_A_-RJ servo amplifiers with software version B3 or later.
 - 2. This is available for MR-J4-_A_(-RJ) servo amplifiers manufactured in January 2015 or later with software version B7 or later.

The LED segment corresponding to the pin is lit to indicate on, and is extinguished to indicate off. The signals corresponding to the pins in the respective control modes are indicated below.

(a) Control modes and I/O signals

Connector	Din No	Signal		(Note 2) Sy	mbols of I/O	signals in co	ntrol modes		Deleted parameter
Connector P	Pin No.	input/output (Note 1) I/O	Р	P/S	S	S/T	Т	T/P	Related parameter
	10	1	PP	PP/-	(Note 5)	(Note 5)	(Note 5)	-/PP	Pr. PD43/Pr. PD44 (Note 4)
	13	0	(Note 3)	(Note 3)	(Note 3)	(Note 3)	(Note 3)	(Note 3)	Pr. PD47 (Note 4)
	14	0	(Note 3)	(Note 3)	(Note 3)	(Note 3)	(Note 3)	(Note 3)	Pr. PD47 (Note 4)
	15	1	SON	SON	SON	SON	SON	SON	Pr. PD03/Pr. PD04
	16	1		-/SP2	SP2	SP2/SP2	SP2	SP2/-	Pr. PD05/Pr. PD06
	17	1	PC	PC/ST1	ST1	ST1/RS2	RS2	RS2/PC	Pr. PD07/Pr. PD08
	18	Ţ	TL	TL/ST2	ST2	ST2/RS1	RS1	RS1/TL	Pr. PD09/Pr. PD10
	19	I	RES	RES	RES	RES	RES	RES	Pr. PD11/Pr. PD12
	22	0	INP	INP/SA	SA	SA/-		-/INP	Pr.PD23
	23	0	ZSP	ZSP	ZSP	ZSP	ZSP	ZSP	Pr. PD24
CN1	24	0	INP	INP/SA	SA	SA/-		-/INP	Pr. PD25
	25	0	TLC	TLC	TLC	TLC/VLC	VLC	VLC/TLC	Pr. PD26
	33	0	OP	OP	OP	OP	OP	OP	
	35	1	NP	NP/-	(Note 5)	(Note 5)	(Note 5)	-/NP	Pr. PD45/Pr. PD46 (Note 4)
	37 (Note 7)	I	PP2	PP2/-	(Note 6)	(Note 6)	(Note 6)	-/PP2	Pr. PD43/Pr. PD44 (Note 4)
	38 (Note 7)	I	NP2	NP2/-	(Note 6)	(Note 6)	(Note 6)	-/NP2	Pr. PD45/Pr. PD46 (Note 4)
	41	Ţ	CR	CR/SP1	SP1	SP1/SP1	SP1	SP1/CR	Pr. PD13/Pr. PD14
	42	Ţ	EM2	EM2	EM2	EM2	EM2	EM2	
	43	Ţ	LSP	LSP	LSP	LSP/-		-/LSP	Pr. PD17/Pr. PD18
	44	I	LSN	LSN	LSN	LSN/-		-/LSN	Pr. PD19/Pr. PD20
	45	I	LOP	LOP	LOP	LOP	LOP	LOP	Pr. PD21/Pr. PD22
	48	0	ALM	ALM	ALM	ALM	ALM	ALM	
	49	0	RD	RD	RD	RD	RD	RD	Pr. PD28

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

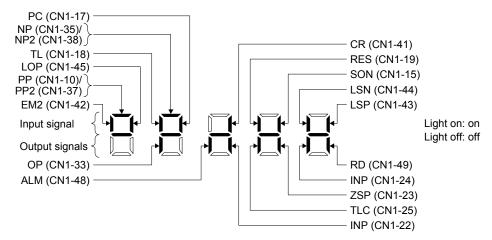
- 2. P: position control mode, S: speed control mode, T: torque control mode
 P/S: position/speed control switching mode, S/T: speed/torque control switching mode, T/P: torque/position switching mode
- 3. Output devices are not assigned by default. Assign the output devices with [Pr. PD47] as necessary.
- 4. This is used with MR-J4-_A_-RJ servo amplifiers with software version B3 or later.
- 5. This is available as an input device of sink interface. Input devices are not assigned by default. Assign the input devices with [Pr. PD43] to [Pr. PD46] as necessary. Supply + of 24 V DC to CN1-12 pin. Also, this is available with servo amplifiers with software version B3 or later.
- 6. This is available as an input device of source interface. Input devices are not assigned by default. Assign the input devices with [Pr. PD43] to [Pr. PD46] as necessary.
- 7. These pins are available for MR-J4-_A_(-RJ) servo amplifiers manufactured in January 2015 or later with software version B7 or later.

(b) Symbol and signal names

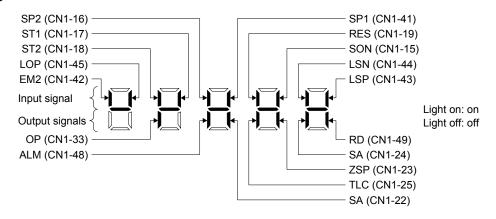
Symbol	Application	Symbol	Application
SON	Servo-on	RES	Reset
LSP	Forward rotation stroke end	EM2	Forced stop 2
LSN	Reverse rotation stroke end	LOP	Control switching
CR	Clear	TLC	Limiting torque
SP1	Speed selection 1	VLC	Limiting speed
SP2	Speed selection 2	RD	Ready
PC	Proportion control	ZSP	Zero speed detection
ST1	Forward rotation start	INP	In-position
ST2	Reverse rotation start	SA	Speed reached
RS1	Forward rotation selection	ALM	Malfunction
RS2	Reverse rotation selection	OP	Encoder Z-phase pulse (open collector)
TL	External torque limit selection		

(3) Display data at initial values

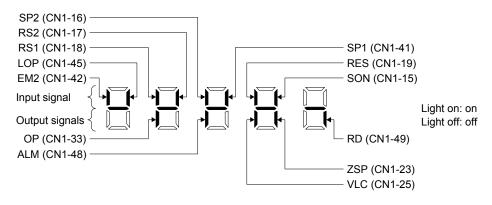
(a) Position control mode



(b) Speed control mode



(c) Torque control mode



4.5.8 Output signal (DO) forced output

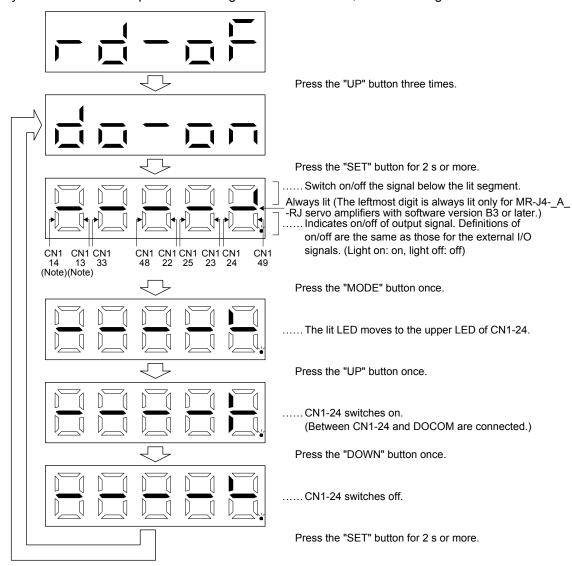
POINT

•When the servo system is used in a vertical lift application, turning on MBR (Electromagnetic brake interlock) by the DO forced output after assigning it to connector CN1 will release the electromagnetic brake, causing a drop. Take drop preventive measures on the machine side.

Output signals can be switched on/off forcibly independently of the servo status. This function is used for output signal wiring check, etc. This operation must be performed in the servo off state by turning off the SON (Servo-on).

Operation

Call the display screen shown after power-on. Using the "MODE" button, show the diagnostic screen.



Note. This is used with MR-J4-_A_-RJ servo amplifiers with software version B3 or later.

4.5.9 Test operation mode



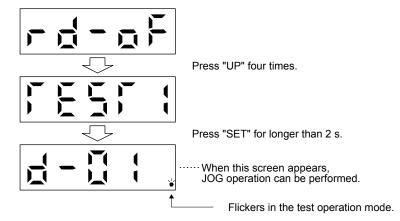
- ■The test operation mode is designed for checking servo operation. Do not use it for actual operation.
- ●If the servo motor operates unexpectedly, use EM2 (Forced stop 2) to stop it.

POINT

- ●The test operation mode cannot be used in the absolute position detection system by DIO ([Pr. PA03: _ _ 1]).
- ●MR Configurator2 is required to perform positioning operation.
- Test operation cannot be performed if SON (Servo-on) is not turned off.

(1) Mode switching

Call the display screen shown after power-on. Select JOG operation or motor-less operation in the following procedure. Using the "MODE" button, show the diagnostic screen.



(2) JOG operation

POINT

■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__ ".

JOG operation can be performed when there is no command from the controller.

(a) Operation

The servo motor rotates while holding down the "UP" or the "DOWN" button. The servo motor stops rotating by releasing the button. The operation condition can be changed using MR Configurator2. The initial operation condition and setting range for operation are listed below.

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

The following table shows how to use the buttons.

Button	Description
"UP"	Press to start CCW rotation. Release to stop.
"DOWN"	Press to start CW rotation. Release to stop.

If the USB cable is disconnected during JOG operation using the MR Configurator2, the servo motor decelerates to a stop.

(b) Status display

Press the "MODE" button in the JOG operation-ready status to call the status display screen. When the JOG operation is performed using the "UP" or "DOWN" button, the servo status is displayed during the JOG operation. Every time the "MODE" button is pushed, the next status display screen appears. When one cycle of the screen display is complete, it returns to the jog operation-ready status screen. Refer to section 4.5.3 for details of status display. Note that the status display screen cannot be changed by the "UP" or "DOWN" button during the JOG operation.

(c) Termination of JOG operation

To end the JOG operation, shut the power off once, or press the "MODE" button to switch to the next screen, and then hold down the "SET" button for 2 s or longer.



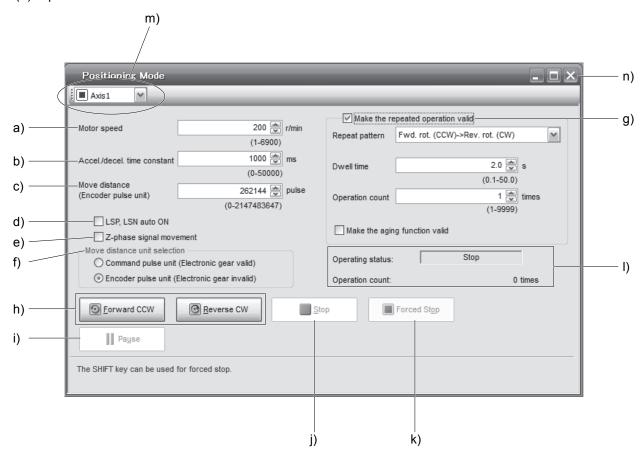
(3) Positioning operation

POINT

- ●MR Configurator2 is required to perform positioning operation.
- ●Turn on EM2 (forced stop 2) when performing positioning operation.

Positioning operation can be performed when there is no command from a controller.

(a) Operation



- a) Motor speed [r/min]
 - Enter the servo motor speed into the "Motor speed" input field.
- b) Acceleration/deceleration time constant [ms]

 Enter the acceleration/deceleration time constant into the "Accel/decel time" input field.
- c) Travel distance [pulse]

 Enter the travel distance into the "Travel distance" input field.
- d) LSP/LSN are automatically turned on When setting the external stroke signal to automatic on, click the check box to enable it. When it is not selected, turn on LSP and LSN externally.
- e) Move till Z-phase signal

 Travel is made until the travel distance is reached and the first Z-phase signal in the travelling direction turns on.

f) Travel distance unit selection

Select with the option buttons whether the travel distance set in c) is in the command pulse unit or in the encoder pulse unit.

When the command input pulse unit is selected, the value, which is the set travel distance multiplied by the electronic gear, will be the command value. When the encoder pulse unit is selected, the travel distance is not multiplied by the electronic gear.

g) Enable repeat operation

To perform repeat operation, click the check. The initial setting and setting range for the repeat operation are listed below.

Item	Initial setting	Setting range
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 operations [times]	1	1 to 9999

To perform continuous operation with the repeat pattern and dwell time settings, which are set by referring to the above table, click the check box of "Make the aging function enabled".

h) Forward/reverse the servo motor

Click "Forward" to rotate the servo motor in the forward rotation direction.

Click "Reverse" to rotate the servo motor in the reverse rotation direction.

i) Pause the servo motor

Click "Pause" during servo motor rotation to temporarily stop the servo motor.

"Pause" is enabled during servo motor rotation.

j) Stop the servo motor

Click "Stop" during servo motor rotation to stop the servo motor.

k) Forced stop

Click "Forced stop" during servo motor rotation to make a sudden stop.

"Forced stop" is enabled during servo motor rotation.

I) Operation status

The operation status during the repeat operation, and the number of operations are displayed

m) Axis No.

Axis No. in operation is displayed.

n) Termination of positioning operation window

Click "X" to cancel the positioning operation mode and close the window.

(b) Status display

The status display can be monitored during positioning operation.

4. STARTUP

(4) Motor-less operation

Without connecting the servo motor, output signals or status display can be provided in response to the input device as if the servo motor is actually running. This operation can be used to check the sequence of a controller or the like.

- (a) Start of motor-less operation
 After setting "_ _ 1" in [Pr. PC60], cycle the power. After that, perform external operation as in ordinary operation.
- (b) Termination of motor-less operation

 To terminate the motor-less operation, set [Pr. PC60] to "___ 0" and then turn the power off.

(5) Program operation

Positioning operation can be performed in two or more operation patterns combined, without using a controller. Use this operation with the forced stop reset. This operation may be used independently of whether servo-on or servo-off and whether a controller is connected or not.

Exercise control on the program operation screen of MR Configurator2. For full information, refer to the MR Configurator2 Installation Guide.

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

(6) Output signal (DO) forced output

Output signals can be switched on/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.

MEMO	

5. PARAMETERS

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

- CAUTION •If fixed values are written in the digits of a parameter, do not change these values.
 - Do not change parameters for manufacturer setting.
 - Do not set a value other than the described values to each parameter.

POINT

- The following parameters are not available with MR-J4-03A6(-RJ) servo amplifiers.
 - [Pr. PA02 Regenerative option]
 - [Pr. PA17 Servo motor series setting]
 - [Pr. PA18 Servo motor type setting]
 - [Pr. PA26 Function selection A-5]
 - [Pr. PC44 Function selection C-9]
 - [Pr. PC45 Function selection C-A]
 - [Pr. PD47 Output device selection 7]
 - [Pr. PE03 Fully closed loop function selection 2]
 - [Pr. PE04 Fully closed loop control Feedback pulse electronic gear 1 -Numerator]
 - [Pr. PE05 Fully closed loop control Feedback pulse electronic gear 1 -Denominator]
 - [Pr. PE06 Fully closed loop control Speed deviation error detection level]
 - [Pr. PE07 Fully closed loop control Position deviation error detection level]
 - [Pr. PE08 Fully closed loop dual feedback filter]
 - [Pr. PE10 Fully closed loop function selection 3]
 - [Pr. PE34 Fully closed loop control Feedback pulse electronic gear 2 -Numerator]
 - [Pr. PE35 Fully closed loop control Feedback pulse electronic gear 2 -Denominator]
 - [Pr. PF25 SEMI-F47 function Instantaneous power failure detection time]
 - [Pr. PF34 RS-422 communication function selection 3]
- ●Linear servo motor/DD motor setting parameters ([Pr. PL_ _]) cannot be used with MR-J4-03A6(-RJ) servo amplifiers.

5.1 Parameter list

POINT

- ■To enable a parameter whose symbol is preceded by *, cycle the power after setting it.
- Abbreviations of operation modes indicate the followings.

Standard: Standard (semi closed loop system) use of the rotary servo motor

Full.: Fully closed loop system use of the rotary servo motor

Lin.: Linear servo motor use

DD: Direct drive (DD) motor use

For MR-J4-03A6(-RJ) servo amplifiers, the operation mode is available only in standard (semi closed loop system).

- ●The symbols in the control mode column mean as follows.
 - P: Position control mode
 - S: Speed control mode
 - T: Torque control mode
- For servo amplifier with software version B3 or later, the parameter initial values for the manufacturer setting are partially changed.
- Setting an out of range value to each parameter will trigger [AL. 37 Parameter error].

5.1.1 Basic setting parameters ([Pr. PA__])

					(Oper mo		n		ontro node	
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	D.D.	Ь	S	Τ
PA01	*STY	Operation mode	1000h		0	0	0	0	0	0	0
PA02	*REG	Regenerative option	0000h		0	0	0	0	0	0	0
PA03	*ABS	Absolute position detection system	0000h		0	0	0	0	0		
PA04	*AOP1	Function selection A-1	2000h		0	0	0	0	0	0	
PA05	*FBP	Number of command input pulses per revolution	10000		0	0	0	0	0		
PA06	CMX	Electronic gear numerator (command pulse multiplication numerator)	1		0	0	0	0	0		
PA07	CDV	Electronic gear denominator (command pulse multiplication denominator)	1		0	0	0	0	0		
PA08	ATU	Auto tuning mode	0001h		0	0	0	0	0	0	$\overline{\ }$
PA09	RSP	Auto tuning response	16		0	0	0	0	0	0	$\overline{\ }$
PA10	INP	In-position range	100	[pulse]	0	0	0	0	0		$\overline{\ }$
PA11	TLP	Forward rotation torque limit/positive direction thrust limit	100.0	[%]	0	0	0	0	0	0	0
PA12	TLN	Reverse rotation torque limit/negative direction thrust limit	100.0	[%]	0	0	0	0	0	0	0
PA13	*PLSS	Command pulse input form	0100h		0	0	0	0	0		
PA14	*POL	Rotation direction selection/travel direction selection	0		0	0	0	0	0		
PA15	*ENR	Encoder output pulses	4000	[pulse/rev]	0	0	0	0	0	0	0
PA16	*ENR2	Encoder output pulses 2	1		0	0	0	0	0	0	0
PA17	*MSR	Servo motor series setting	0000h				0	/	0	0	0
PA18	*MTY	Servo motor type setting	0000h				0		0	0	0
PA19	*BLK	Parameter writing inhibit	00AAh		0	0	0	0	0	0	0
PA20	*TDS	Tough drive setting	0000h		0	0	0	0	0	0	0
PA21	*AOP3	Function selection A-3	0001h		0	0	0	0	0	0	$\sqrt{}$
PA22	*PCS	Position control composition selection	0000h		0	0	0	0	0		$\overline{\ \ }$
PA23	DRAT	Drive recorder arbitrary alarm trigger setting	0000h		0	0	0	0	0	0	0

5. PARAMETERS

					(ation de	n		ontro node	
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	D.D.	А	S	⊥
PA24	AOP4	Function selection A-4	0000h		0	0	0	0	0	0	
PA25	OTHOV	One-touch tuning - Overshoot permissible level	0	[%]	0	0	0	0	0	0	
PA26	*AOP5	Function selection A-5	0000h		0	0	0	0	0	0	
PA27		For manufacturer setting	0000h		\	\		\	\		\setminus
PA28			0000h		\	\			\setminus	\	\setminus
PA29			0000h			l \			$ \cdot $	\	$\setminus \setminus$
PA30			0000h		l \	l \	\	\	$ \ $	\	$ \ $
PA31			0000h		\	I \	\	\	$ \ $	\	· \
PA32	\		0000h		$ \ $		$ \ $	ackslash	. ∖	\	. \

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

					(Opei mo	ratio ode	n	_	ontr mode	-
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	D.D.	۵	S	Т
PB01	FILT	Adaptive tuning mode (adaptive filter II)	0000h		0	0	0	0	0	0	0
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control II)	0000h		0	0	0	0	0		
PB03	PST	Position command acceleration/deceleration time constant (position smoothing)	0	[ms]	0	0	0	0	0		
PB04	FFC	Feed forward gain	0	[%]	0	0	0	0	0		
PB05		For manufacturer setting	500								
PB06	GD2	Load to motor inertia ratio/load to motor mass ratio	7.00	[Multiplier]	0	0	0	0	0	0	
PB07	PG1	Model loop gain	15.0	[rad/s]	0	0	0	0	0	0	
PB08	PG2	Position loop gain	37.0	[rad/s]	0	0	0	0	0		
PB09	VG2	Speed loop gain	823	[rad/s]	0	0	0	0	0	0	
PB10	VIC	Speed integral compensation	33.7	[ms]	0	0	0	0	0	0	
PB11	VDC	Speed differential compensation	980		0	0	0	0	0	0	
PB12	OVA	Overshoot amount compensation	0	[%]	0	0	0	0	0		
PB13	NH1	Machine resonance suppression filter 1	4500	[Hz]	0	0	0	0	0	0	0
PB14	NHQ1	Notch shape selection 1	0000h		0	0	0	0	0	0	0
PB15	NH2	Machine resonance suppression filter 2	4500	[Hz]	0	0	0	0	0	0	0
PB16	NHQ2	Notch shape selection 2	0000h		0	0	0	0	0	0	0
PB17	NHF	Shaft resonance suppression filter	0000h		0	0	0	0	0	0	0
PB18	LPF	Low-pass filter setting	3141	[rad/s]	0	0	0	0	0	0	
PB19	VRF11	Vibration suppression control 1 - Vibration frequency	100.0	[Hz]	0	0	0	0	0		
PB20	VRF12	Vibration suppression control 1 - Resonance frequency	100.0	[Hz]	0	0	0	0	0	abla	
PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping	0.00		0	0	0	0	0		
PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping	0.00		0	0	0	0	0		
PB23	VFBF	Low-pass filter selection	0000h		0	0	0	0	0	0	0
PB24	*MVS	Slight vibration suppression control	0000h		0	0	0	0	0	$\overline{\ }$	
PB25	*BOP1	Function selection B-1	0000h		Ō	0	0	0	Ō	0	abla
PB26	*CDP	Gain switching function	0000h		0	0	0	0	0	0	
PB27	CDL	Gain switching condition	10	[kpulse/s]/ [pulse]/ [r/min]	0	0	0	0	0	0	
PB28	CDT	Gain switching time constant	1	[ms]	0	0	0	0	0	0	
PB29	GD2B	Load to motor inertia ratio/load to motor mass ratio after gain switching	7.00	[Multiplier]	0	0	0	0	0	0	

					(Opei mo	atio	n		Control mode	
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	D.D.	Д	S	Т
PB30	PG2B	Position loop gain after gain switching	0.0	[rad/s]	0	0	0	0	0		
PB31	VG2B	Speed loop gain after gain switching	0	[rad/s]	0	0	0	0	0	0	
PB32	VICB	Speed integral compensation after gain switching	0.0	[ms]	0	0	0	0	0	0	
PB33	VRF1B	Vibration suppression control 1 - Vibration frequency after gain switching	0.0	[Hz]	0	0	0	0	0		
PB34	VRF2B	Vibration suppression control 1 - Resonance frequency after gain switching	0.0	[Hz]	0	0	0	0	0		
PB35	VRF3B	Vibration suppression control 1 - Vibration frequency damping after gain switching	0.00		0	0	0	0	0		
PB36	VRF4B	Vibration suppression control 1 - Resonance frequency damping after gain switching	0.00		0	0	0	0	0		
PB37	\	For manufacturer setting	1600	\land	1	\	\	\	\	\	\
PB38			0.00		1	\	\	1	\	1	\
PB39			0.00		1	\	1	$ \rangle$	\	$ \rangle$	\
PB40	\		0.00		١\	١\	١\	1	١\		\setminus
PB41	\		0000h		1	1	1		1		\
PB42	\		0000h		$ \ $			1			\
PB43	\		0000h		l \	\	\	\	۱ ۱		\
PB44	\		0.00		1			\			\
PB45	CNHF	Command notch filter	0000h		0	0	0	0	0		
PB46	NH3	Machine resonance suppression filter 3	4500	[Hz]	0	0	0	0	0	0	0
PB47	NHQ3	Notch shape selection 3	0000h		0	0	0	0	0	0	0
PB48	NH4	Machine resonance suppression filter 4	4500	[Hz]	0	0	0	0	0	0	0
PB49	NHQ4	Notch shape selection 4	0000h		0	0	0	0	0	0	0
PB50	NH5	Machine resonance suppression filter 5	4500	[Hz]	0	0	0	0	0	0	0
PB51	NHQ5	Notch shape selection 5	0000h		0	0	0	0	0	0	0
PB52	VRF21	Vibration suppression control 2 - Vibration frequency	100.0	[Hz]	0	0	0	0	0		
PB53	VRF22	Vibration suppression control 2 - Resonance frequency	100.0	[Hz]	0	0	0	0	0		
PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping	0.00		0	0	0	0	0		
PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping	0.00		0	0	0	0	0		
PB56	VRF21B	Vibration suppression control 2 - Vibration frequency after gain switching	0.0	[Hz]	0	0	0	0	0		
PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching	0.0	[Hz]	0	0	0	0	0		
PB58	VRF23B	Vibration suppression control 2 - Vibration frequency damping after gain switching	0.00		0	0	0	0	0		
PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching	0.00		0	0	0	0	0		
PB60	PG1B	Model loop gain after gain switching	0.0	[rad/s]	0	0	0	0	0	0	
PB61		For manufacturer setting	0.0		\	\	\	\	\	\	
PB62			0000h		\	\	\	\	\	\	$ \setminus $
PB63			0000h		\	\	\	\	\		\
PB64			0000h	\	\] \] \] \] \		\

5.1.3 Extension setting parameters ([Pr. PC $_$])

					(Oper	atio	n	_	ontro	
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	D.D.	۵	S	_
PC01	STA	Acceleration time constant	0	[ms]	0		0	0		0	0
PC02	STB	Deceleration time constant	0	[ms]	0		0	0		0	0
PC03	STC	S-pattern acceleration/deceleration time constant	0	[ms]	0		0	0		0	0
PC04	TQC	Torque command time constant/thrust command time constant	0	[ms]	0		0	0			0
PC05	SC1	Internal speed command 1	100	[r/min]/	0		0	0		0	
		Internal speed limit 1		[mm/s]	0		0	0			0
PC06	SC2	Internal speed command 2	500	[r/min]/	0		0	0		0	
		Internal speed limit 2		[mm/s]	0		0	0	\subseteq		0
PC07	SC3	Internal speed command 3	1000	[r/min]/	0	\angle	0	0	$\overline{}$	0	
		Internal speed limit 3		[mm/s]	0	\angle	0	0	\leq	abla	0
PC08	SC4	Internal speed command 4	200	[r/min]/	0	\angle	0	0	\angle	0	Š
		Internal speed limit 4		[mm/s]	0	\angle	0	0	\angle	Ĭ	0
PC09	SC5	Internal speed command 5	300	[r/min]/	0	\angle	0	0	\subset	0	$\overline{\ }$
		Internal speed limit 5		[mm/s]	0	$\overline{}$	0	0	$\overline{}$	Ĭ	0
PC10	SC6	Internal speed command 6	500	[r/min]/	0		0	0	$\overline{}$	0	$\check{\ }$
		Internal speed limit 6	-	[mm/s]	0	$\overline{}$	0	0	$\overline{}$	Ŭ	\circ
PC11	SC7	Internal speed command 7	800	[r/min]/	0		0	0	$\overline{}$	0	$\check{\ }$
		Internal speed limit 7	-	[mm/s]	0	$\overline{}$	0	0	$\overline{}$	Ŭ	0
PC12	VCM	Analog speed command - Maximum speed	0	[r/min]/	0		0	0		0	$\check{\ }$
. 0.2	V 0.111	Analog speed limit - Maximum speed	⊣	[mm/s]	0		0	0	$\overline{}$	\forall	0
PC13	TLC	Analog torque/thrust command maximum output	100.0	[%]	0		0	0			0
PC14	MOD1	Analog monitor 1 output	0000h	[70]	0	0	0	0	0	0	0
PC15	MOD2	Analog monitor 2 output	0001h		0	0	0	0	0	0	0
PC16	MBR	Electromagnetic brake sequence output	0	[ms]	0	0	0	0	0	0	0
PC17	ZSP	Zero speed	50	[r/min]/	0	0	0	0	0	0	0
	_	· ·		[mm/s]							
PC18	*BPS	Alarm history clear	0000h		0	0	0	0	0	0	0
PC19	*ENRS	Encoder output pulse selection	0000h		0	0	0	0	0	0	0
PC20	*SNO	Station No. setting	0	[station]	0	0	0	0	0	0	0
PC21	*SOP	RS-422 communication function selection	0000h		0	0	0	0	0	0	0
PC22	*COP1	Function selection C-1	0000h		0	0	0	0	0	0	0
PC23	*COP2	Function selection C-2	0000h		0		0	0		O	0
PC24	*COP3	Function selection C-3	0000h		0	0	0	0	0	\geq	\geq
PC25		For manufacturer setting	0000h							\triangle	\geq
PC26	*COP5	Function selection C-5	0000h		0	0	0	0	0	0	
PC27	*COP6	Function selection C-6	0000h		0	0	0	0	0	0	0
PC28	*COP7	Function selection C-7	0000h			\geq	0		0	0	0
PC29		For manufacturer setting	0000h			\geq			igtriangle	\triangle	
PC30	STA2	Acceleration time constant 2	0	[ms]	0	\geq	0	0		0	0
PC31	STB2	Deceleration time constant 2	0	[ms]	0		0	0		0	0
PC32	CMX2	Command input pulse multiplication numerator 2	1		0	0	0	0	0	igtriangleup	\triangle
PC33	CMX3	Command input pulse multiplication numerator 3	1		0	0	0	0	0		
PC34	CMX4	Command input pulse multiplication numerator 4	1		0	0	0	0	0		
PC35	TL2	Internal torque limit 2/internal thrust limit 2	100.0	[%]	0	0	0	0	0	0	0
PC36	*DMD	Status display selection	0000h		0	0	0	0	0	0	0
PC37	VCO	Analog speed command offset	0	[mV]	0		0	0		0	
		Analog speed limit offset			0		0	0			0

					(atio	n		ontro node	
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	D.D.	Д	S	Т
PC38	TPO	Analog torque command offset	0	[mV]	0		0	0			0
		Analog torque limit offset			0	0	0	0		0	
PC39	MO1	Analog monitor 1 offset	0	[mV]	0	0	0	0	0	0	0
PC40	MO2	Analog monitor 2 offset	0	[mV]	0	0	0	0	0	0	0
PC41		For manufacturer setting	0					\setminus	\setminus	abla	
PC42			0							\Box	
PC43	ERZ	Error excessive alarm detection level	0	[rev]/[mm]	0	0	0	0	0		
PC44	*COP9	Function selection C-9	0000h			0			0		
PC45	*COPA	Function selection C-A	0000h			0	0		0	0	0
PC46		For manufacturer setting	0		\	\	\	\	\	Λľ	\
PC47			0		\	\	\	١\	١\	$ \setminus $	\
PC48			0		\	\	\	\	\	$ \setminus $	\
PC49			0		\	\	\	$ \ $	$ \ $	$ \cdot $	\
PC50			0000h		\	\ \	\	\	\	oxed	
PC51	RSBR	Forced stop deceleration time constant	100	[ms]	0	0	0	0	0	0	\geq
PC52		For manufacturer setting	0							$ \cdot $	
PC53			0							\square	igstyle
PC54	RSUP1	Vertical axis freefall prevention compensation amount	0	[0.0001 rev]/ [0.01 mm]	0	0	0	0	0		
PC55		For manufacturer setting	0		\	\	\	\	\	\ \	\
PC56			100		\	\	\	\	\	$ \cdot $	\
PC57			0000h			\	\	\	\	$ \setminus $	\
PC58			0		$ \ $	\	\	$ \ $	$ \ $	$ \cdot $	\
PC59			0000h		\	()			\	$oxed{}$	_\
PC60	*COPD	Function selection C-D	0000h		0				0	0	0
PC61	\	For manufacturer setting	0000h	Λ	١					1	\
PC62	\		0000h] \	\	\	\	\setminus	\mathbb{I}	1	\
PC63	\		0000h	\	1	1	1	1	1	ı\ I	\
PC64	\		0000h	\	1	١	1			ı \	\
PC65	\		0000h	\		1	1			ı \	\
PC66	\		0	\		1	1	1	1	$ \cdot $	1
PC67	\		0	\	1		1			1	1
PC68	\		0	\	1	1	1	1	١ ١	ιVI	1
PC69	\		0	\			1	1	1	ı \	\
PC70	\		0	\				1	1	ı \	\
PC71	\		0040h	\		١ ١	1	1		ı \	\
PC72	\		0000h	\	- 1			1		\sqcup	
PC73	ERW	Error excessive warning level	0	[rev]/[mm]	0	0	0	0	0	\bowtie	\triangle
PC74		For manufacturer setting	0000h		\	\	\	\	\	ıΝ	\
PC75			0000h				\	[\	[\	\setminus	\
PC76	\		0000h		\	\	\	\	\	$ \setminus $	\
PC77			0000h	\	\	\	\	\	\	$ \ $	\
PC78	\		0000h	\	\	\		\		$ \cdot $	\
PC79	\		0000h	\	\	\			\	. \	\
PC80	\		0000h		\			\		\	_\

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

					(Oper mo	atio	n		ontro	
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	D.D.	Ь	S	Т
PD01	*DIA1	Input signal automatic on selection 1	0000h		0	0	0	0	0	0	0
PD02		For manufacturer setting	0000h								
PD03	*DI1L	Input device selection 1L	0202h		0	0	0	0	0	0	
PD04	*DI1H	Input device selection 1H	0202h		0		0	0			0
PD05	*DI2L	Input device selection 2L	2100h		0	0	0	0	0	0	
PD06	*DI2H	Input device selection 2H	2021h		0		0	0			0
PD07	*DI3L	Input device selection 3L	0704h		0	0	0	0	0	0	
PD08	*DI3H	Input device selection 3H	0707h		0		0	0			0
PD09	*DI4L	Input device selection 4L	0805h		0	0	0	0	0	0	
PD10	*DI4H	Input device selection 4H	0808h		0		0	0			0
PD11	*DI5L	Input device selection 5L	0303h		0	0	0	0	0	0	
PD12	*DI5H	Input device selection 5H	3803h		0		0	0			0
PD13	*DI6L	Input device selection 6L	2006h		0	0	0	0	0	0	
PD14	*DI6H	Input device selection 6H	3920h		0		0	0			0
PD15		For manufacturer setting	0000h		\setminus		\setminus			\setminus	
PD16			0000h							$ _ $	$oxed{\setminus}$
PD17	*DI8L	Input device selection 8L	0A0Ah		0	0	0	0	0	0	
PD18	*DI8H	Input device selection 8H	0A00h		0		0	0			0
PD19	*DI9L	Input device selection 9L	0B0Bh		0	0	0	0	0	0	
PD20	*DI9H	Input device selection 9H	0B00h		0		0	0			0
PD21	*DI10L	Input device selection 10L	2323h		0	0	0	0	0	0	
PD22	*DI10H	Input device selection 10H	2B23h		0		0	0			0
PD23	*DO1	Output device selection 1	0004h		0	0	0	0	0	0	0
PD24	*DO2	Output device selection 2	000Ch		0	0	0	0	0	0	0
PD25	*DO3	Output device selection 3	0004h		0	0	0	0	0	0	0
PD26	*DO4	Output device selection 4	0007h		0	0	0	0	0	0	0
PD27		For manufacturer setting	0003h								
PD28	*DO6	Output device selection 6	0002h		0	0	0	0	0	0	0
PD29	*DIF	Input filter setting	0004h		0	0	0	0	0	0	0
PD30	*DOP1	Function selection D-1	0000h		0	0	0	0	0	0	0
PD31	*DOP2	Function selection D-2	0000h		0	0	0	0	0		
PD32	*DOP3	Function selection D-3	0000h		0	0	0	0	0	\subseteq	
PD33	*DOP4	Function selection D-4	0000h		0	0	0	0	0	0	0
PD34	DOP5	Function selection D-5	0000h		0	0	0	0	0	0	0
PD35	\setminus	For manufacturer setting	0000h	$\sqrt{}$	\			\	\	$\setminus \Box$	\
PD36			0000h] \	[\	1	[\	\	\	\	\
PD37			0000h		١\	$ \rangle$	١\	\	\	\setminus	\
PD38	\		0] \				\	\	$\setminus \setminus$	\
PD39	\		0		\		\	\	\	\	\
PD40	\		0] \	\		\	\	\		\
PD41	\		0000h		\	\		\	\	\	\
PD42	\		0000h	\	L_\	L	╚	\	\	\	
PD43	*DI11L	Input device selection 11L	0000h		0	0	0	0	0	0	
PD44	*DI11H	Input device selection 11H	3A00h		0		0	0			0
PD45	*DI12L	Input device selection 12L	0000h		0	0	0	0	0	0	
PD46	*DI12H	Input device selection 12H	3B00h		0		0	0			0
PD47	*D07	Output device selection 7	0000h		0	0	0	0	0	0	0
PD48		For manufacturer setting	0000h								

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

					(Oper mo	atio	n		ontro	
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	D.D.	А	S	T
PE01	*FCT1	Fully closed loop function selection 1	0000h			0			0		
PE02		For manufacturer setting	0000h								
PE03	*FCT2	Fully closed loop function selection 2	0003h			0			0		
PE04	*FBN	Fully closed loop control - Feedback pulse electronic gear 1 - Numerator	1			0			0		
PE05	*FBD	Fully closed loop control - Feedback pulse electronic gear 1 - Denominator	1			0			0		
PE06	BC1	Fully closed loop control - Speed deviation error detection level	400	[r/min]		0			0		
PE07	BC2	Fully closed loop control - Position deviation error detection level	100	[kpulse]		0			0		
PE08	DUF	Fully closed loop dual feedback filter	10	[rad/s]		0		\geq	0		
PE09		For manufacturer setting	0000h					\geq			
PE10	FCT3	Fully closed loop function selection 3	0000h		\vdash	0	\vdash		0	\vdash	
PE11	\	For manufacturer setting	0000h	1							
PE12	\		0000h	\							1
PE13	\		0000h	\							
PE14			0111h	\							
PE15			20	\						$\ \cdot \ $	
PE16 PE17			0000h 0000h	\						$ \cdot $	
PE17	\		0000h	\						$ \cdot $	
PE10			0000h	\							
PE20			0000h	\							
PE21	\		0000h	\							
PE22	\		0000h	\						$ \cdot $	
PE23			0000h	\							
PE24	\		0000h	\							
PE25	\		0000h	\							
PE26	\		0000h	\							
PE27	\		0000h	\							
PE28	\		0000h	\							
PE29	\		0000h	\ \							
PE30	\		0000h	1 \	1						l II
PE31	\		0000h	\							
PE32	\		0000h] \							
PE33			0000h	<u> </u>				L١	L		
PE34	*FBN2	Fully closed loop control - Feedback pulse electronic gear 2 - Numerator	1			0			0		
PE35	*FBD2	Fully closed loop control - Feedback pulse electronic gear 2 - Denominator	1			0		\bigcup	0		
PE36		For manufacturer setting	0.0	\setminus	\	\	\setminus		\	\bigcap	
PE37			0.00		١\	\	١\	$ \cdot $	$ \setminus $	$ \setminus $	\setminus
PE38			0.00		\	\	\	\	\		\
PE39			20		\	\	\	\	\		$ \ $
PE40			0000h		\	╚	╚	_\	igsquare	igsquare	$oxed{}$
PE41	EOP3	Function selection E-3	0000h		0	0	0	0	0	0	0

5. PARAMETERS

					(Oper mo	atio	n	_	ontr node	
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	D.D.	Ь	S	⊥
PE42		For manufacturer setting	0					\setminus	abla		\bigcup
PE43			0.0								igstyle
PE44	LMCP	Lost motion compensation positive-side compensation value selection	0	[0.01%]	0	0	0	0	0		
PE45	LMCN	Lost motion compensation negative-side compensation value selection	0	[0.01%]	0	0	0	0	0		
PE46	LMFLT	Lost motion filter setting	0	[0.1 ms]	0	0	0	0	0	/	
PE47	TOF	Torque offset	0	[0.01%]	0	0			0	0	0
PE48	*LMOP	Lost motion compensation function selection	0000h		0	0	0	0	0	/	
PE49	LMCD	Lost motion compensation timing	0	[0.1 ms]	0	0	0	0	0	/	
PE50	LMCT	Lost motion compensation non-sensitive band	0	[pulse]/ [kpulse]	0	0	0	0	0	\setminus	
PE51	\	For manufacturer setting	0000h	\							
PE52]\		0000h	1\	\		\				\
PE53] \		0000h] \				1	\	\	
PE54	\		0000h] \	1		1	1	\	1	$ \rangle $
PE55			0000h] \	1		1		\	١	$ \cdot $
PE56	\		0000h] \					1		$ \cdot $
PE57	\		0000h] \	1				\		$ \cdot $
PE58	\		0000h] \					١.	1	$ \ $
PE59	\		0000h] \							
PE60	\		0000h] \	1 \						
PE61	\		0.00] \							
PE62	\		0.00] \							
PE63	\		0.00] \							
PE64	\		0.00	\							

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

					(Oper mo		n		ontro	
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	D.D.	Ь	S	Τ
PF01		For manufacturer setting	0000h	\		\				\	\
PF02			0000h		\	\	\	\	\setminus	\	\setminus
PF03			0000h		1	\	1	1	$ \setminus $	$ \setminus $	\
PF04			0			\			$ \setminus $	$ \setminus $	\
PF05			0		\			\	$ \ $	$ \ \ $	\
PF06			0000h		١ ١				$ \ $	$ \ $	\
PF07			1				\	\		\	\
PF08	\		1		١	\				\	\
PF09	*FOP5	Function selection F-5	0000h		0	0			0	0	0
PF10		For manufacturer setting	0000h		\	\	\	\	\setminus	\setminus	\
PF11			0000h			\	\	\	$ \setminus $	$ \setminus $	\
PF12			10000		\	\	\		$ \setminus $	$ \setminus $	\setminus
PF13			100		١ \	\	\	\	$ \ $	$ \ $	\
PF14			100		١	_\	igsqcup	igstyle igstyle	\square	_\	\
PF15	DBT	Electronic dynamic brake operating time	2000	[ms]	0	0			0	0	0
PF16		For manufacturer setting	0000h								
PF17	*0700	0.70 %	10		_\	\	\	\	-	_\	_\
PF18	*STOD	STO diagnosis error detection time	0	[s]	0	0	0	0	0	0	0
PF19		For manufacturer setting	0000h								
PF20	DDT	Drive as a sada a suitabia a tima a sattina	0000h			$\bar{\Box}$			-	$\overline{}$	$\overline{}$
PF21	DRT	Drive recorder switching time setting	0	[s]	\circ	0	0	0	0	0	\circ
PF22	00014	For manufacturer setting	200	10/1	$\stackrel{\circ}{}$	$\overset{\circ}{-}$	$\stackrel{\circ}{\nearrow}$	$\stackrel{\circ}{\nearrow}$	$\stackrel{\circ}{\rightarrow}$	$\overline{}$	$\overline{}$
PF23 PF24	OSCL1 *OSCL2	Vibration tough drive - Oscillation detection level Vibration tough drive function selection	50 0000h	[%]	0	0	0	0	0	0	$\overline{}$
PF25	CVAT	SEMI-F47 function - Instantaneous power failure detection	200	[ms]	0	0	0	0	0	0	$\stackrel{\sim}{\rightarrow}$
	CVAT	time	200	[IIIS]	0	0	0	0	0	0	0
PF26	\setminus	For manufacturer setting	0		\	\	\	\	\setminus	\setminus	\
PF27			0		\	\	\	\	$ \setminus $	$ \setminus $	\
PF28			0		\	\	\		$ \setminus $	$ \setminus $	\
PF29			0000h		١ \	\	\	\	$ \ $	$ \ $	\
PF30			0		١	_\	_\	_\	\sqcup	_\	\
PF31	FRIC	Machine diagnosis function - Friction judgement speed	0	[r/min]/ [mm/s]	0	0	0	0	0	0	0
PF32		For manufacturer setting	50	[11111111111111111111111111111111111111							$\overline{}$
PF33			0000h								
PF34	*SOP3	RS-422 communication function selection 3	0000h		0		0	0	0	0	\circ
PF35		For manufacturer setting	0000h		Ĭ	Ĭ	Ĭ	Ĭ	Ť	Ĭ	Ĭ
PF36	\	_	0000h	\	1	1			1	\	\
PF37	\		0000h		1	1	1	1	$ \cdot $		
PF38	\		0000h] \	1		1				\
PF39] \		0000h] \	$ \rangle$	П		1		$ \setminus $	\
PF40] \		0] \					$ \setminus $		
PF41] \		0	\					$ \ $	$ \ $	\
PF42	\		0	\		$ \ $					\
PF43	\		0	\							
PF44	\		0	\						$ \ $	
PF45	\		0000h	\							\
PF46	\		0000h	\							
PF47	\		0000h	\							
PF48	\		0000h	\					Ш		

5.1.7 Linear servo motor/DD motor setting parameters ([Pr. PL_ $_$])

					(Oper mo	atioi de	n		ontro node	
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	D.D.	Ь	S	Τ
PL01	*LIT1	Linear servo motor/DD motor function selection 1	0301h				0	0	0	0	0
PL02	*LIM	Linear encoder resolution - Numerator	1000	[µm]			0		0	0	0
PL03	*LID	Linear encoder resolution - Denominator	1000	[µm]			0		0	0	0
PL04	*LIT2	Linear servo motor/DD motor function selection 2	0003h				0	0	0	0	0
PL05	LB1	Position deviation error detection level	0	[mm]/ [0.01 rev]			0	0	0		
PL06	LB2	Speed deviation error detection level	0	[r/min]/ [mm/s]			0	0	0	0	
PL07	LB3	Torque/thrust deviation error detection level	100	[%]			0	0	0	0	0
PL08	*LIT3	Linear servo motor/DD motor function selection 3	0010h	F0/1			0	0	0	0	0
PL09	LPWM	Magnetic pole detection voltage level	30	[%]			0	0	0	0	0
PL10 PL11		For manufacturer setting	5 100		\	\	\	\	\	\	\
PL11			500		١\	\	\	\	\	\	\
PL13			0000h			\	\	\	\setminus	\setminus	\
PL14			0000h		\	\	\	\			\setminus
PL15			20		1	\	\	\	$ \cdot $	$ \cdot $	\
PL16			0		 	\	\	\	\	\	\
PL17	LTSTS	Magnetic pole detection - Minute position detection method -	0000h		\vdash		0	0	0	0	0
PL18	IDLV	Function selection Magnetic pole detection - Minute position detection method -	0	[%]			0	0	0	0	0
	IDLV	Identification signal amplitude		[70]))			
PL19		For manufacturer setting	0	1							
PL20	\		0	\							
PL21			0	\							
PL22	\		0	\							
PL23	1		0000h	\							
PL24			0	\							
PL25			0000h								
PL26			0000h								
PL27	1		0000h	\							
PL28	\		0000h	\							
PL29			0000h	\							
PL30			0000h	\							
PL31	\		0000h	\							
PL32	\		0000h	\							
PL33	\		0000h								
PL34	\		0000h	\							
PL35			0000h	\							
PL36			0000h	\							
PL37	\		0000h								
PL38	\		0000h	\							
PL39			0000h	\							
PL40	\		0000h	\							
PL41	\		0000h	\							
PL42			0000h	\ \							
PL43	\		0000h	\							
PL44	\		0000h	\							
PL45			0000h	\					III.		
PL46	\		0000h	\							
PL47	\		0000h	\							
PL48			0000h	\							

5. PARAMETERS

5.1.8 Option setting parameters ([Pr. Po_])

									C	-			
No.	Symbol	Name	Initial value	Unit	Standard	Full.	Lin.	DD	Ь	S	Т		
Po01		For manufacturer setting	0000h										
Po02	*ODI1	MR-D01 input device selection 1	0302h		0	0	0	0	0	0	0		
Po03	*ODI2	MR-D01 input device selection 2	0905h		0	0	0	0	0	0	0		
Po04	*ODI3	MR-D01 input device selection 3	2524h		0	0	0	0	0	0	0		
Po05	*ODI4	MR-D01 input device selection 4	2026h		0	0	0	0	0	0	0		
Po06	*ODI5	MR-D01 input device selection 5	0427h		0	0	0	0	0	0	0		
Po07	*ODI6	MR-D01 input device selection 6	0807h		0	0	0	0	0	0	0		
Po08	*ODO1	MR-D01 output device selection 1	2726h		0	0	0	0	0	0	0		
Po09	*ODO2	MR-D01 output device selection 2	0423h		0	0	0	0	0	0	0		
Po10	*00P1	Function selection O-1	2001h		0	0	0	0					
Po11	*00P2	Function selection O-2	0000h		0	0	0	0	0	0	0		
Po12	*00P3	Function selection O-3	0000h		0	0	0	0					
Po13	*OMOD1	MR-D01 analog monitor 1 output selection	0000h		0	0	0	0	0	0	0		
Po14	*OMOD2	MR-D01 analog monitor 2 output selection	0000h		0	0	0	0	0	0	0		
Po15	OMO1	MR-D01 analog monitor 1 offset	0	[mV]	0	0	0	0	0	0	0		
Po16	OMO2	MR-D01 analog monitor 2 offset	0	[mV]	0	0	0	0	0	0	0		
Po17		For manufacturer setting	0000h		Ť	Ĭ	Ť	Ĭ	Ĭ	\	Ť		
Po18		-	0000h	1 \	\	\	\	\	\	\	\setminus		
Po19					0000h	1 \	\	\	$ \ $	\	\	\	$ \ $
Po20		0000h			\	\	$ \ $	$ \ $	\	$ \ $			
Po21	OVCO	MR-D01 override offset	0	[mV]	0	0	0	0	0	0	0		
Po22	OTLO	MR-D01 override offset	0	[mV]	0	0	0	0	0	0	0		
Po23		For manufacturer setting	0000h		\	\	\	\	\	\	\		
Po24			0000h		\	\	\	\	\	\	\setminus		
Po25			0000h		\	\	$ \ $	\	\	\	$ \ $		
Po26			0000h		\	\	I \	$ \ $	\	$ \ $			
Po27	*ODI7	MR-D01 input device selection 7	2D2Ch				\angle	\angle		egthanking	abla		
Po28	*ODI8	MR-D01 input device selection 8	002Eh		\angle	\subset	乀	\setminus			abla		
Po29		For manufacturer setting	0000h		abla	lacksquare	lacksquare	$\overline{}$	\setminus	\setminus	\bigcap		
Po30		Ŭ	0000h		\	\	Ι\	$ \setminus $	\	\	\		
Po31			0000h		\	\	\	\	\	\	\		
Po32			0000h		\	\	\	\	\	\	\setminus		

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	Function	Initial value	1	ol O	
name	digit		[unit]	Р	S	Т
PA01 *STY Operation mode	x	Control mode selection Select a control mode. 0: Position control mode 1: Position control mode and speed control mode 2: Speed control mode 3: Speed control mode and torque control mode 4: Torque control mode 5: Torque control mode and position control mode	Oh	0	0	0
	x_	Operation mode selection 0: Standard control mode 1: Fully closed loop control mode 4: Linear servo motor control mode 6: DD motor control mode Setting other than above will trigger [AL. 37 Parameter error]. The linear servo system, direct drive servo system and fully closed loop system are available for the MR-J4A_(-RJ) servo amplifiers of which software version is A5 or later. For MR-J4-03A6(-RJ) servo amplifiers, this digit cannot be used when a setting value other than the initial value is set.	Oh	0	0	0
	_ x	For manufacturer setting	0h 1h			

5. PARAMETERS

No./symbol/				ı	ol e	
Harrio	aigit		[unit]	Р	S	T
PA02 *REG Regenerative option	digit	Regenerative option Select the 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 the servo amplifier of 100 W, a regenerative resistor is not used. • For the servo amplifier of 0.2 kW to 7 kW, the built-in regenerative resistor is used. • The supplied regenerative resistor or a regenerative option is used with the servo amplifier of 11 kW to 22 kW. 01: FR-RC-(H)/FR-CV-(H)/FR-BU2-(H) When you use FR-RC-(H) or FR-CV-(H), select "Mode 2 (1)" of "Undervoltage alarm detection mode selection" in [Pr. PC27]. 02: MR-RB032 03: MR-RB12 04: MR-RB30 06: MR-RB50 (Cooling fan is required.) 08: MR-RB51 (Cooling fan is required.)	value [unit] 00h	P	S O	_
		OB: MR-RB3N OC: MR-RB5N (Cooling fan is required.) 80: MR-RB1H-4 81: MR-RB3M-4 (Cooling fan is required.) 82: MR-RB3G-4 (Cooling fan is required.) 83: MR-RB5G-4 (Cooling fan is required.) 84: MR-RB34-4 (Cooling fan is required.) 85: MR-RB54-4 (Cooling fan is required.) 91: MR-RB3U-4 (Cooling fan is required.) 92: MR-RB5U-4 (Cooling fan is required.) FA: When the supplied regenerative resistor or a regenerative option used with the servo amplifier of 11 kW to 22 kW is cooled by a cooling fan to increase regenerative ability. For MR-J4-03A6(-RJ) servo amplifiers, this digit cannot be used when a setting value other than the initial value is set.				
	_x	For manufacturer setting	0h			\vdash
	x		0h			

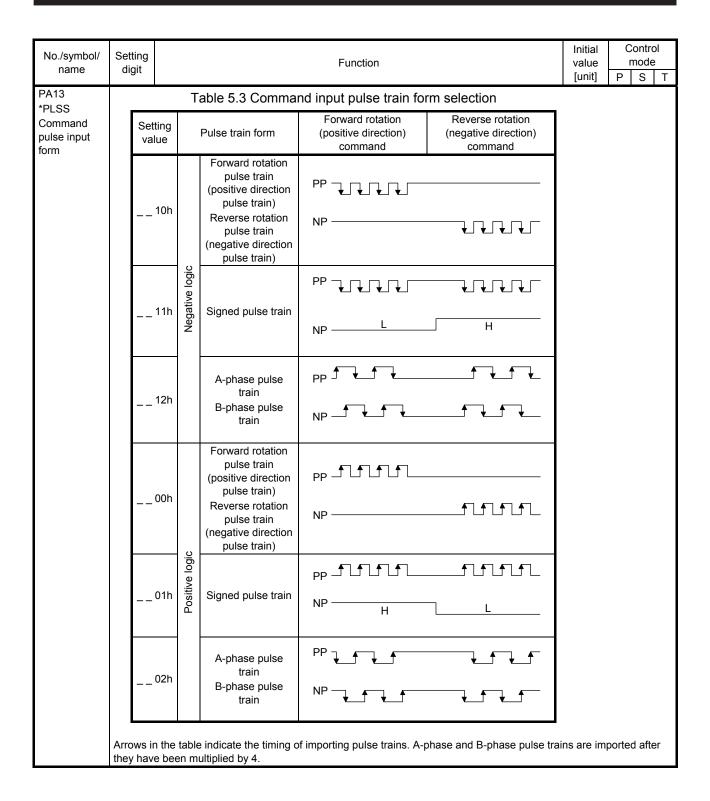
No./symbol/	Setting		Function					Contro mode		
name	digit					[unit]	Р	S	Т	
PA03 *ABS Absolute position detection system	x	Set the control or Dis 1: End 2: End soft The a linear	nis digit when u ol mode. sabled (increme abled (absolute abled (absolute tware version A absolute position encoder is use	ental system) e position detection system b e position detection system b A3 or later) on detection system cannot b	y communication) (available for the e used when an incremental type lly closed loop switching is enabled.	Oh	0			
	x_	For m	0h							
	_x					0h				
	x					0h			\geq	
PA04		For m	nanufacturer se	etting		0h			\geq	
*AOP1	x_					0h			$\overline{}$	
Function selection A-1	_x	Force	nd stop dosolor	ation function soloction		0h 2h	0	0	\leftarrow	
	x Forced stop deceleration function selection 0: Forced stop deceleration function disabled (with EM1) 2: Forced stop deceleration function enabled (with EM2) Refer to table 5.1 for details.							0		
			Т	able 5.1 Deceleration r	method					
	Se	etting		Deceleration method						
		lue	EM2/EM1	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		To en comm set in	nable the paran	he Linear servo motor contro	ear selection" to "Number of fin [Pr. PA21]. "1 " cannot be	10000	0			

No./symbol/ name	Setting digit	Function	Initial value [unit]		ontro node	
PA06 CMX Electronic gear numerator (command pulse multiplication numerator)		Set the numerator of the electronic gear. To enable the parameter, set "Electronic gear selection" to "Electronic gear (0)", "J3 electronic gear setting value compatibility mode (2)", or "J2S electronic gear setting value compatibility mode (3)" in [Pr. PA21]. For MR-J4-03A6(-RJ) servo amplifiers, "J3 electronic gear setting value compatibility mode (2)" and "J2S electronic gear setting value compatibility mode (3)" cannot be selected. The following shows a standard of the setting range of the electronic gear. 1	1	0		
PA07 CDV Electronic gear denominator (command pulse multiplication		Set the denominator of the electronic gear. To enable the parameter, set "Electronic gear selection" to "Electronic gear (0)", "J3 electronic gear setting value compatibility mode (2)", or "J2S electronic gear setting value compatibility mode (3)" in [Pr. PA21]. For MR-J4-03A6(-RJ) servo amplifiers, "J3 electronic gear setting value compatibility mode (2)" and "J2S electronic gear setting value compatibility mode (3)" cannot be selected.	1			
denominator)		Setting range: 1 to 16777215			\setminus	\

No./symbol/	Set	ting			Forester	Initial		Contr	
name	dig	git			Function	value		mode	
						[unit]	Р	S	Т
PA08		_		n adjustment mode sele		1h	0	0	\
ATU				ect the gain adjustment					1
Auto tuning				gain adjustment mode	1 (interpolation mode)				١\
mode				uto tuning mode 1					1 \
				uto tuning mode 2					\
				lanual mode	_				\
				gain adjustment mode					١ ١
		Refer to table 5.2 for details. x For manufacturer setting			i.				Ļ_
		x _	For	manufacturer setting		0h			
	_ x					0h			
	x_					0h			
		Table 5.2 Gain adjustment mode selection							
	Settin		na	Gain adjustment					
			-	mode	Automatically adjusted parameter				
			0	2 gain adjustment	[Pr. PB06 Load to motor inertia ratio]				
				mode 1	[Pr. PB08 Position loop gain]				
				(interpolation mode)	[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	[Pr. PB08 Position loop gain]				
			-	mode 2					
	-		4	2 gain adjustment mode 2	[Pr. PB08 Position loop gain] [Pr. PB09 Speed loop gain] [Pr. PB10 Speed integral compensation]				

No./symbol/ name		ting git		Function						Initial value [unit]		Contro mode S	
PA09	Set	a respo	nse of the aut	to tuning.						16	0	0	
RSP			Machin	e characteristic			Machin	e characteristic	Ì				
Auto tuning response		Setting value	9	Guideline for machine resonance	Set val	_	Response	Guideline for machine resonance					
				frequency [Hz]	l			frequency [Hz]					
		1	Low	2.7	2		Middle	67.1					
		2	response	3.6	2		response	75.6					
		3 4	_	4.9 6.6	2			85.2 95.9					
		5	-	10.0	2			108.0					
		6	-	11.3	2			121.7					
		7	-	12.7	2			137.1					
		8	-	14.3	2			154.4					
		9		16.1	2			173.9					
		10		18.1	3	0		195.9					
		11		20.4	3	1		220.6					
		12		23.0	3	2		248.5					
		13		25.9	3	3		279.9					
		14		29.2	3	4		315.3					
		15		32.9	3	5		355.1					
		16		37.0	3	6		400.0					
		17		41.7	3	7		446.6					
		18	_	47.0	3		↓	501.2					
		19	Middle	52.9	3		High	571.5					
		20	response	59.6	4	.0	response	642.7					
	Sot	tina ran	no: 1 to 40										
PA10	Set		ge: 1 to 40	on range per comm	and nuls	20				100	0		
INP				the servo motor en			unit. set [Pr.	PC241.		[pulse]		\	\
In-position			.				. ,						\
range		S	etting range: () to 65535								\	
PA11	\			, ,	generated	d by t	the servo m	otor. Set the param	eter	100.0	0	0	0
TLP	\		ferring to sec	` '	aa anala	a ma	nitar autaut	the larger value of	:ID»	[%]			
Forward rotation			, ,		,	_		, the larger value of limit value] or [Pr. F					
torque	\			n torque limit/nega					=				
limit/positive	\	١ ١		ut voltage (8 V).									
direction thrust limit		١	•					rque or thrust is 100					
unustiiniit								in the CCW power in the position					
		١ ١	-	-				Set this parameter					
		\ "0	.0" to generat	e no torque or thru	st.								
DA40			etting range: (نيجالم		stan Cattha name		100.0			
PA12 TLN	\		ou can limit the ferring to sec		generated	a by i	tne servo m	otor. Set the param	ieter	100.0 [%]	0	0	0
Reverse			_		with anal	log m	onitor outpu	ut, the larger value	of [Pr.	[/0]			
rotation	\							limit value] or [Pr. F					
torque	\			n torque limit/nega	tive direc	ction	thrust limit v	value] will be the					
limit/negative direction	١ ١		•	ut voltage (8 V).	ion that t	tha m	anyimum ta	rque or thrust is 100	0 0 10/1				
thrust limit		1	•					in the CW power ru					
		١ ١	•	•	•			vo motor in the pos	_				
						on re	generation.	Set this parameter	to				
		\ "0	.u" to generat	e no torque or thru	st.								
		\\ e	Setting range: 0.0 to 100.0										
	L	Setting range: 0.0 to 100.0									1	<u> </u>	1

No./symbol/	Setting digit	Function	Initial value	1	Contr mode	
Hame	uigit		[unit]	Р	S	Т
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.	Oh	0		
	x_	Pulse train logic selection 0: Positive logic 1: Negative logic Choose the right parameter to match the logic of the command pulse train received from a connected controller. 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	0		
	_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 (available for the software version A5 or later) 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". Incorrect setting 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	0		
	x	For manufacturer setting	0h			



No./symbol/ name	Setting digit	Function	Initial value		Contr	
	uigit		[unit]	Р	S	Т
PA14 *POL Rotation		Select the servo motor rotation direction or linear servo motor travel direction for the input pulse train.	0	0		
direction selection/		Servo motor rotation direction/ Setting linear servo motor travel direction				
travel direction selection		value When forward rotation When reverse rotation pulse is input pulse is input				
		0 CCW or positive direction CW or negative direction				
		1 CW or negative direction CCW or positive direction				
		Forward rotation (CCW) Reverse rotation (CW) The positive/negative directions of the linear servo motor are as follows. Negative direction Positive direction Positive direction Positive direction Negative direction Positive direction Negative direction Positive direction Negative direction Positive direction Negative direction Negative direction Negative direction Positive direction Negative direction				
PA15 *ENR Encoder output pulses		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) To set a numerator of the electronic gear, select "A-phase/B-phase pulse electronic gear setting (3_)" of "Encoder output pulse setting selection" in [Pr. PC19]. The maximum output frequency is 4.6 Mpulses/s. Set the parameter within this range.	4000 [pulse/ rev]	0	0	0
PA16 *ENR2 Encoder output pulses		Setting range: 1 to 4194304 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].	1	0	0	0
2		Setting range: 1 to 4194304				

No./symbol/ name	Setting digit			Initial value	ı	ontro mode	е		
	gir					[unit]	Р	S	Т
PA17 *MSR Servo motor series setting		Set this and [Pr. PA18] a Refer to the following taken				0000h	0	0	0
				Para	meter				
		Linear servo motor series	Linear servo motor (primary side)	[Pr. PA17]	[Pr. PA18]				
		Selles	(primary side)	setting	setting				
			LM-H3P2A-07P-BSS0		2101h				
			LM-H3P3A-12P-CSS0		3101h				
			LM-H3P3B-24P-CSS0		3201h				
			LM-H3P3C-36P-CSS0		3301h				
		LM-H3	LM-H3P3D-48P-CSS0	00BBh	3401h				
			LM-H3P7A-24P-ASS0		7101h				
			LM-H3P7B-48P-ASS0		7201h				
			LM-H3P7C-72P-ASS0		7301h				
			LM-H3P7D-96P-ASS0		7401h				
			LM-U2PAB-05M-0SS0		A201h				
			LM-U2PAD-10M-0SS0		A401h				
			LM-U2PAF-15M-0SS0		A601h				
		1.14.110	LM-U2PBB-07M-1SS0	000 41-	B201h				
		LM-U2	LM-U2PBD-15M-1SS0	00B4h	B401h				
			LM-U2PBF-22M-1SS0		2601h 2201h				
			LM-U2P2B-40M-2SS0 LM-U2P2C-60M-2SS0		2301h				
			LM-U2P2D-80M-2SS0		2401h				
			LM-FP2B-06M-1SS0						
			(natural cooling)		2201h				
			LM-FP2D-12M-1SS0		2401h				
			(natural cooling) LM-FP2F-18M-1SS0 (natural cooling)		2601h				
			LM-FP4B-12M-1SS0 (natural cooling)		4201h				
			LM-FP4D-24M-1SS0 (natural cooling)		4401h				
			LM-FP4F-36M-1SS0 (natural cooling) LM-FP4H-48M-1SS0		4601h				
			(natural cooling) LM-FP5H-60M-1SS0		4801h 5801h				
		LM-F	(natural cooling) LM-FP2B-06M-1SS0 (liquid cooling)	00B2h	2202h				
			LM-FP2D-12M-1SS0 (liquid cooling)		2402h				
			LM-FP2F-18M-1SS0 (liquid cooling)		2602h				
			LM-FP4B-12M-1SS0 (liquid cooling) LM-FP4D-24M-1SS0		4202h				
			(liquid cooling) LM-FP4F-36M-1SS0		4402h 4602h				
			(liquid cooling) LM-FP4H-48M-1SS0 (liquid cooling)		4802h				
			LM-FP5H-60M-1SS0 (liquid cooling)		5802h				
			LM-K2P1A-01M-2SS1		1101h				
			LM-K2P1C-03M-2SS1		1301h				
			LM-K2P2A-02M-1SS1		2101h				
		LM-K2	LM-K2P2C-07M-1SS1	00B8h	2301h				
			LM-K2P2E-12M-1SS1		2501h				
			LM-K2P3C-14M-1SS1		3301h				
			LM-K2P3E-24M-1SS1		3501h				

No./symbol/	Setting					unction					Initial value		ontro	
name	digit				г	inction					[unit]	P	S	T
PA18		When you u	ico a linoar	corvo m	otor colo	ot ite mo	dal fram	[Dr DA1	71 and ID	r DA101	0000h	-		
*MTY		Set this and				ct its ino	uei iioiii	ĮFI. FAT	i j aliu įr	i. FATOJ.	000011	0	0	0
Servo motor		Refer to the	-	-		as.								
type setting		This param	_	-		-	(-RJ) ser	vo amplif	iers.					
PA19		Select a ref					. ,				00AAh	0	0	0
*BLK			er to table 5.4 for settings.											
Parameter		Linear serve	o motor/DD	motor se	etting par	ameters	([Pr. PL_]) can	not be us	ed with				
writing inhibit		MR-J4-03A	6(-RJ) serv	o amplifi	ers.									
		Table	5.4 [Pr.	PA19]	setting	value a	and rea	ding/wr	iting ra	nge				
		PA19	Setting operation	PA	РВ	PC	PD	PE	PF	PL				
		Other than	Reading	0										
		below	Writing	0										
		000Ah	Reading	Only 19										
		OOOAII	Writing	Only 19										
		000Bh	Reading	0	0	0								
		OOODII	Writing	0	0	0								
		000Ch	Reading	0	0	0	0							
			Writing	0	0	0	0							
		00AAh (initial	Reading	0	0	0	0	0	0					
		value)	Writing	0	0	0	0	0	0					
		00ABh	Reading	0	0	0	0	0	0	0				
		UUADII	Writing	0	0	0	0	0	0	0				
		100Bh	Reading	0										
		ТООВП	Writing	Only 19										
		100Ch	Reading	0	0	0	0							
		100011	Writing	Only 19										
		10AAh	Reading	0	0	0	0	0	0					
		10,011	Writing	Only 19										
	10AR	10ABh	Reading	0	0	0	0	0	0	0				
		10/10/1	Writing	Only 19										

No./symbol/	Setting	Franklin	Initial		Contro	
name	digit	Function	value [unit]	P	mode S	T
DAGO	A I =					l I
PA20 *TDS	fluctuation	nay not be avoided with the tough drive function depending on the situations of the pov on	ver suppry	anu	ioau	
Tough drive setting	You can PD23] to	assign MTTR (During tough drive) to the pins CN1-22 to CN1-25, CN1-49, CN1-13, ar [Pr. PD26], [Pr. PD28], and [Pr. PD47]. For MR-J4-03A6(-RJ) servo amplifiers, MTTR e assigned.)
	x	For manufacturer setting	0h			
	x_	Vibration tough drive selection 0: Disabled 1: Enabled	Oh	0	0	
		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.				
	-x	SEMI-F47 function selection 0: Disabled 1: Enabled	0h	0	0	0
		Selecting "1" enables to avoid occurring [AL. 10 Undervoltage] using the electrical energy charged in the capacitor in case that an instantaneous power failure occurs during operation. In [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time], set the time period until the occurrence of [AL. 10.1 Voltage drop in the control circuit power]. For MR-J4-03A6(-RJ) servo amplifiers, this digit cannot be used when a setting value other than the initial value is set.				
	x	For manufacturer setting	0h			
PA21 *AOP3 Function selection A-3	x	One-touch tuning function selection 0: Disabled 1: Enabled	1h	0	0	
		When the digit is "0", the one-touch tuning is not available.				
	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]) 2: J3 electronic gear setting value compatibility mode (Electronic gear ([Pr. PA06] and [Pr. PA07] × 16)) The electronic gear setting value can be used set with MR-J3. 3: J2S electronic gear setting value compatibility mode (Electronic gear ([Pr. PA06] and [Pr. PA07] × 32)) The electronic gear setting value can be used set with MR-J2S. (available for the software version B3 or later) For MR-J4-03A6(-RJ) servo amplifiers, "2" and "3" cannot be selected for this digit.	Oh	0		
PA22	x	For manufacturer setting	0h			
*PCS Position control composition	x_	Super trace control selection 0: Disabled 2: Enabled	0h	0		
selection		This parameter setting is used with servo amplifier with software version B4 or later.			\	$ldsymbol{ld}}}}}}}}} $
	_x	For manufacturer setting	0h			
	X		0h	$\overline{}$	<u> </u>	\setminus

No./symbol/	Setting	Function	Initial value		ontro mode	
name	digit		[unit]	Р	S	Т
PA23 DRAT Drive recorder	xx	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	0	0	0
arbitrary alarm trigger setting	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	0	0	0
		example: ate the drive recorder when [AL. 50 Overload 1] occurs, set "5 0 0 0". ate the drive recorder when [AL. 50.3 Thermal overload error 4 during operation] occurs	s, 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.	Oh	0	0	
PA25	x _x	For manufacturer setting Set a permissible value of overshoot amount for one-touch tuning as a percentage of	0h 0h 0h		//// 0	
OTHOV One-touch tuning - Overshoot permissible level		the in-position range. Setting "0" will be 50%. Setting range: 0 to 100	[%]			
PA26 *AOP5 Function selection A-5	x	Torque limit function selection at instantaneous power failure (instantaneous power failure tough drive selection) 0: Disabled 1: Enabled When an instantaneous power failure occurs during operation, the torque at acceleration is limited to save electric energy charged in the capacitor in the servo amplifier and the time until [AL. 10.2 Voltage drop in the main circuit power] occurs is extended with the instantaneous power failure tough drive function. Consequently, you can set a longer time in [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time]. The torque limit function at instantaneous power failure is enabled when "SEMI-F47 function selection" in [Pr. PA20] is "Enabled (_ 1)". This parameter setting is used with servo amplifier with software version A6 or later. For MR-J4-03A6(-RJ) servo amplifiers, this digit cannot be used when a setting value other than the initial value is set.	Oh	0	0	
	x	For manufacturer setting	Oh Oh Oh			

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

No./symbol/	Setting	Function	Initial value	_	contro mode	-
name	digit	Function	[unit]	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	0	0	0
	x_	For manufacturer setting	0h			
	_x		0h			
	×	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. This digit is available with servo amplifier with software version C5 or later.	0h	0	0	0
PB02 VRFT Vibration suppression control tuning mode	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	0	\setminus	
(advanced vibration suppression control II)	x_	Vibration suppression control 2 tuning mode selection Select the tuning mode of the vibration suppression control 2. To enable the setting of this digit, set "Vibration suppression mode selection" to "3 inertia mode (1)" in [Pr. PA24]. Refer to section 7.1.5 for details. 0: Disabled 1: Automatic setting 2: Manual setting	0h	0		
	_x	For manufacturer setting	0h			
	x		0h			

No./symbol/	Setting	Function	Initial value		Contro mode	
name	digit		[unit]	Р	S	Τ
PB03 PST Position command acceleration/ deceleration time constant (position smoothing)		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 Function selection B-1]. When the linear acceleration/deceleration is selected, the setting range 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 or linear servo motor to make a sudden stop at the time of position control mode switching or restart. (Example) When a command is given from a synchronizing encoder, synchronous operation will start smoothly even if it start during line operation. Synchronizing encoder Without time constant setting Servo motor Servo motor Servo motor Servo motor with time constant setting ON OFF Start Setting range: 0 to 65535	0 [ms]	0		
PB04 FFC Feed forward gain		Set the feed forward gain. When the setting is 100%, the droop pulses during operation at constant speed are nearly zero. When the super trace control is enabled, constant speed and uniform acceleration/deceleration droop pulses will be almost 0. 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	0 [%]	0		

No./symbol/	Setting	F	unction		Initial value		ontro	
name	digit		uu.		[unit]	Р	S	Т
PB06 GD2 Load to motor inertia ratio/ load to motor mass ratio		Setting a value considerably different from mass may cause an unexpected operat. The setting of the parameter will be the depending on the [Pr. PA08] setting. Re						
		Pr. PA08	This parameter					
		0 (2 gain adjustment mode 1 (interpolation mode)) 1: (Auto tuning mode 1)	Automatic setting					
		2: (Auto tuning mode 2) 3 (Manual mode) 4: (2 gain adjustment mode 2)	Manual setting					
PB07 PG1 Model loop gain		Set the response gain up to the target p Increasing the setting value will also incommand but will be liable to generate the The setting of the parameter will be the depending on the [Pr. PA08] setting. Res Setting range: 1.0 to 2000.0	rease the response level to the vibration and noise. automatic setting or manual set	ting	15.0 [rad/s]	0	0	
		Pr. PA08	This parameter					
		0 (2 gain adjustment mode 1 (interpolation mode))	Manual setting					
		1: (Auto tuning mode 1)2: (Auto tuning mode 2)	Automatic setting					
		3 (Manual mode)4: (2 gain adjustment mode 2)	Manual setting					

No./symbol/ name	Setting digit	Function	Initial value		Contro)
PB08 PG2 Position loop gain		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	[unit] 37.0 [rad/s]	P 0	S	T
		Pr. PA08 This parameter 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) Automatic setting Automatic setting				
PB09 VG2 Speed loop gain		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	823 [rad/s]	0	0	
PB10 VIC Speed integral compensation		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	33.7 [ms]	0	0	
PB11 VDC Speed differential compensation		Set the differential compensation. To enable the setting value, turn on PC (proportional control). Setting range: 0 to 1000	980	0	0	
PB12 OVA Overshoot amount compensation		Set a percentage of viscous friction torque against the servo motor rated value or thrust against the linear servo motor rated value. When the response level is low or when the torque/thrust is limited, the efficiency of the parameter may be lower. Setting range: 0 to 100	0 [%]	0		
PB13 NH1 Machine resonance suppression filter 1		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]	0	0	0

No./symbol/	Setting	Function	Initial value		ontro			
name	digit				S	Т		
PB14	Set the s	of the machine resonance suppression filter 1.						
NHQ1 Notch shape	When "Filter tuning mode selection" is set to "Automatic setting (1)" in [Pr. PB01], this parameter will be							
selection 1		ilter tuning mode selection" is set to "Manual setting ($_$ $_2$)" in [Pr. PB01], the setting	value wil	l be e	nabl	ed.		
		For manufacturer setting	0h					
	x_	Notch depth selection	0h	0	0	0		
		0: -40 dB						
		1: -14 dB						
		2: -8 dB						
		3: -4 dB						
	_x	Notch width selection	0h	0	0	0		
		0: α = 2						
		1: α = 3						
		2: α = 4						
		3: α = 5						
	x	For manufacturer setting	0h					
PB15		Set the notch frequency of the machine resonance suppression filter 2.	4500	0	0	0		
NH2		To enable the setting value, set "Machine resonance suppression filter 2 selection"	[Hz]					
Machine		to "Enabled (1)" in [Pr. PB16].						
resonance								
suppression filter 2		Setting range: 10 to 4500						
PB16	Set the s	hape of the machine resonance suppression filter 2.	<u> </u>	<u> </u>		l .		
NHQ2	x	Machine resonance suppression filter 2 selection	0h	0	0	0		
Notch shape		0: Disabled						
selection 2		1: Enabled						
	x_	Notch depth selection	0h	0	0	0		
		0: -40 dB						
		1: -14 dB						
		2: -8 dB						
		3: -4 dB						
	_x	Notch width selection	0h	0	0	0		
		0: α = 2						
		1: α = 3						
		2: α = 4						
		3: α = 5						
	x	For manufacturer setting	0h					

PB17 NHF Set the shaft resonance suppression filter. This is used to suppress a low-frequency machine vibration. When "Shaft resonance suppression filter Shaft resonance suppression filt	No./symbol/ name	Setting digit			Func	tion		Initial value [unit]		Contro mode S	
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. _x Notch depth selection	NHF Shaft resonance suppression	This is upon When "S calculate calculate is used a When "S paramete When "Men "Note that when "Men "Men "Men "Men "Men "Men "Men "M	sed to sup thaft reson ad automated for the li as it is. thaft reson er is disab flachine re	o suppress a low-frequency machine vibration. resonance suppression filter selection" is "Automatic setting (0)" in [Pr. PB23], the value will be tomatically from the servo motor you use and load to motor inertia ratio. It will not be automatically the linear servo motor. When "Manual setting (1)" is selected, the setting written to the parameter s. resonance suppression filter selection" is "Disabled (2)" in [Pr. PB23], the setting value of this disabled. ne resonance suppression filter 4 selection" is "Enabled (1)" in [Pr. PB49], the shaft resonance							
0: -40 dB		xx	Refer to t	able 5.5 for settings.				00h	0	0	0
Table 5.5 Shaft resonance suppression filter setting frequency selection Setting Frequency [Hz]		_x	0: -40 dB 1: -14 dB 2: -8 dB	•				Oh	0	0	0
setting frequency selection Setting value Frequency [Hz] Setting value Frequency [Hz]								0h			
value Frequency [HZ] 00 Disabled 01 Disabled 02 4500 03 3000 04 2250 05 1800 06 1500 07 1285 08 1125 09 1000 0A 900 0B 818 0C 750 0D 692 Frequency [HZ] 10 10 562 11 529 11 529 11 529 11 529 11 529 11 473 11 450 11 450 12 428 15 428 16 409 17 391 18 375 19 360 10 346 18 333 10 321 10 310					ency selec		1				
01			_	Frequency [Hz]	_	Frequency [Hz]					
02			00	Disabled	10	562					
03			01	Disabled	11	529					
04			02	4500	12	500					
05			03	3000	13	473					
06			04	2250	14	450					
07											
08											
09			07	1285	17	391					
0A											
0B											
0C											
0D 6921D 310											
			0E	642	1E	300	l				J
0F 600 1F 290			0F	600	1F	290	j				

No./symbol/ name	Setting digit	Function	Initial value		Contr mode	
Hame	digit		[unit]	Р	S	Т
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]	0	0	
	i	ID DDGG ID DDGG				
		[Pr. PB23] [Pr. PB18]				
		0 _ (Initial value) Automatic setting				
		1_ Setting value enabled				
		2 _ Setting value disabled				
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 "Automaticsetting (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: 0.1 to 300.0	100.0 [Hz]	0		
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 "Automaticsetting (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: 0.1 to 300.0	100.0 [Hz]	0		
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 "Automaticsetting (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	0		
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 "Automaticsetting (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	0		
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.	Oh	0	0	0
	x_	Low-pass filter selection Select the low-pass filter. 0: Automatic setting 1: Manual setting 2: Disabled	0h	0	0	
	_x	For manufacturer setting	0h			
	x	-	0h	$\overline{}$	\setminus	$\overline{}$

No./symbol/	Setting	Formation	Initial		Contro	
name	digit	Function	value [unit]	P	mode S	T
DD04		Olishta thankan ayan ayan ayan ayan ayan ayan ayan			\ \	<u> </u>
PB24	×	Slight vibration suppression control selection	0h	0	\	\
*MVS		Select the slight vibration suppression control.			\	1
Slight vibration		0: Disabled			\	
suppression		1: Enabled			\	$ \ $
control		To enable the slight vibration suppression control, set "Gain adjustment mode selection" to "Manual mode (3)" in [Pr. PA08]. Slight vibration suppression			\	1 \
Control		control cannot be used in the speed control mode.			\	1 \
	x_	For manufacturer setting	0h		$\sqrt{}$	Κ'
		To manuacturer setting	0h			
	_X		0h	$\overline{}$		
DD25	x	Model adaptive control selection		$\overset{\sim}{-}$	$\overline{}$	\leftarrow
PB25 *BOP1	×		0h	0	0	\
		0: Enabled (model adaptive control)				\
Function selection B-1		2: Disabled (PID control)				\
Selection b-1		This parameter is supported with software version B4 or later.	01			
	×-	Position acceleration/deceleration filter type selection	0h	0	\	\
		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.			\ \	1 \
		Doing so will cause the servo motor to make a sudden stop at the time of control mode switching.			\	1 \
		For manufacturer setting	0h			\ '
	_x	1 of Manuacturer Setting	0h	$\overline{}$		
PB26	X	o gain awitahing condition	OII			
*CDP		e gain switching condition. litions to enable the gain switching values set in [Pr. PB29] to [Pr. PB36] and [Pr. PB56	l to [Dr Di	2601		
Gain		Gain switching selection	0h			١
switching	×	0: Disabled	OH	0	0	\
function		1: Input device (gain switching (CDP))				١\
		2: Command frequency				\
		3: Droop pulses				\
		4: Servo motor speed/linear servo motor speed				\
		Gain switching condition selection	0h			\ \ \
	×-	Cain after switching is enabled with gain switching condition or more	OH	0	0	
		Gain after switching is enabled with gain switching condition or less				$ \ $
		Gain switching time constant disabling condition selection	0h			\vdash
	-x	Switching time constant disabiling condition selection Switching time constant enabled	OII	0	0	\
		Switching time constant enabled Switching time constant disabled				١\
		2: Return time constant disabled				١\
		Refer to section 7.2.4 for details.				\
		This parameter is used by servo amplifier with software version B4 or later.				\
	_	For manufacturer setting	0h			\
PB27	×	This is used to set the value of gain switching (command frequency, droop pulses,	10	$\stackrel{\sim}{-}$	$\stackrel{\sim}{\vdash}$	\vdash
CDL	\	and servo motor speed/linear servo motor speed) selected in [Pr. PB26].	[kpulse/s]	0	0	1
Gain	\	The set value unit differs depending on the switching condition item. (Refer to	/[pulse/s]			$ \rangle$
switching	\	section 7.2.3.)	/[r/min]			
condition	\	The unit "r/min" will be "mm/s" for linear servo motors.				\
	\					
	\	Setting range: 0 to 9999				\
PB28	/	This is used to set the time constant at which the gains will change in response to	1	0	0	
CDT	\	the conditions set in [Pr. PB26] and [Pr. PB27].	[ms]			\
Gain	\					\
switching						\
owitoring						

No./symbol/	Setting	Function	Initial value		Contro mode	
name	digit		[unit]	Р	S	Т
PB29 GD2B Load to motor inertia ratio/ load to motor mass ratio		This is used to set the load to motor inertia ratio/load to motor mass ratio when gain switching is enabled. This parameter is enabled only when "Gain adjustment mode selection" is "Manual mode (3)" in [Pr. PA08].	7.00 [Multiplier]	0	0	
after gain switching		Setting range: 0.00 to 300.00				
PB30 PG2B Position loop gain after gain		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 "Gain adjustment mode selection" is "Manual mode (3)" in [Pr. PA08].	0.0 [rad/s]	0		
switching		Setting range: 0.0 to 2000.0			_ \	\ \ \
PB31 VG2B Speed loop gain after gain		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 "Gain adjustment mode selection" is "Manual mode (3)" in [Pr. PA08].	0 [rad/s]	0	0	
switching PB32	<u> </u>	Setting range: 0 to 65535 Set the speed integral compensation when the gain changing is enabled.	0.0	0	0	\vdash
VICB Speed integral compensation after gain		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 "Gain adjustment mode selection" is "Manual mode (3)" in [Pr. PA08].	[ms])		
switching PB33	\	Setting range: 0.0 to 5000.0 Set the vibration frequency for vibration suppression control 1 when the gain	0.0	0		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
VRF1B Vibration suppression control 1 - Vibration frequency after gain switching		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" in [Pr. PB26] is "Input device (gain switching (CDP)) (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops. Setting range: 0.0 to 300.0	[Hz]			
PB34 VRF2B 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" in [Pr. PB26] is "Input device (gain switching (CDP)) (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops.	0.0 [Hz]	0		
PB35 VRF3B 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" in [Pr. PB26] is "Input device (gain switching (CDP)) (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops. Setting range: 0.00 to 0.30	0.00	0		

No./symbol/ name	Setting digit	Function	Initial value [unit]	_	ontr node S	-
PB36 VRF4B 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" in [Pr. PB26] is "Input device (gain switching (CDP)) (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops.	0.00	0		

No./symbol/	Setting	Function		Control mode		
name	digit		[unit]	Р	S 1	Γ
PB45	Set the	command notch filter.				7
CNHF	x x	Command notch filter setting frequency selection	00h	0	$\overline{\ \ }$	
Command		Refer to table 5.6 for the relation of setting values to frequency.				
notch filter	_x	Notch depth selection	0h	0	\	
		Refer to table 5.7 for details.				
	x	For manufacturer setting	0h			

Table 5.6 Command notch filter setting frequency selection

	Table 5.6 Com
Setting value	Frequency [Hz]
00	Disabled
01	2250
02	1125
03	750
04	562
05	450
06	375
07	321
08	281
09	250
0A	225
0B	204
0C	187
0D	173
0E	160
0F	150
10	140
11	132
12	125
13	118
14	112
15	107
16	102
17	97
18	93
19	90
1A	86
1B	83
1C	80
1D	77
1E	75
1F	72

Setting	Frequency [Hz]
value	r requerioy [ri2]
20	70
21	66
22	62
23	59
24	56
25	53
26	51
27	48
28	46
29	45
2A	43
2B	41
2C	40
2D	38
2E	37
2F	36
30	35.2
31	33.1
32	31.3
33	29.6
34	28.1
35	26.8
36	25.6
37	24.5
38	23.4
39	22.5
3A	21.6
3B	20.8
3C	20.1
3D	19.4
3E	18.8
3F	18.2

lency selection					
Setting value	Frequency [Hz]				
40	17.6				
41	16.5				
42	15.6				
43	14.8				
44	14.1				
45	13.4				
46	12.8				
47	12.2				
48	11.7				
49	11.3				
4A	10.8				
4B	10.4				
4C	10				
4D	9.7				
4E	9.4				
4F	9.1				
50	8.8				
51	8.3				
52	7.8				
53	7.4				
54	7.0				
55	6.7				
56	6.4				
57	6.1				
58	5.9				
59	5.6				
5A	5.4				
5B	5.2				
5C	5.0				
5D	4.9				
5E	4.7				
5F	4.5				

Table 5.7 Notch depth selection

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

Setting value	Depth [dB]
_8	-6.0
_9	-5.0
_A	-4.1
_B	-3.3
_C	-2.5
_D	-1.8
_E	-1.2
_F	-0.6

No./symbol/ name	Setting digit	Function	Initial value	ı	Contro	
Hamo	aigit		[unit]	Р	S	Т
PB46 NH3 Machine resonance		Set the notch frequency of the machine resonance suppression filter 3. To enable the setting value, set "Machine resonance suppression filter 3 selection" to "Enabled (1)" in [Pr. PB47].	4500 [Hz]	0	0	0
suppression filter 3		Setting range: 10 to 4500				
PB47	Set the s	hape of the machine resonance suppression filter 3.				
NHQ3 Notch shape selection 3	x	Machine resonance suppression filter 3 selection 0: Disabled 1: Enabled	0h	0	0	0
	x_	Notch depth selection	0h	0	0	0
	^_	0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0			
	-×	Notch width selection 0: $\alpha = 2$ 1: $\alpha = 3$ 2: $\alpha = 4$	0h	0	0	0
		3: α = 5				
	x	For manufacturer setting	0h			
PB48 NH4 Machine resonance		Set the notch frequency of the machine resonance suppression filter 4. To enable the setting value, set "Machine resonance suppression filter 4 selection" to "Enabled (1)" in [Pr. PB49].	4500 [Hz]	0	0	0
suppression filter 4		Setting range: 10 to 4500				
PB49	Set the s	shape of the machine resonance suppression filter 4.				
NHQ4 Notch shape selection 4	x	Machine resonance suppression filter 4 selection 0: Disabled 1: Enabled When the setting of this digit is "Enabled", [Pr. PB17 Shaft resonance suppression filter] is not available.	0h	0	0	0
	x_	Notch depth selection 0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0h	0	0	0
	_x	Notch width selection 0: α = 2 1: α = 3 2: α = 4 3: α = 5	0h	0	0	0
	x	For manufacturer setting	0h			
PB50 NH5 Machine resonance suppression		Set the notch frequency of the machine resonance suppression filter 5. To enable the setting value, set "Machine resonance suppression filter 5 selection" to "Enabled (1)" in [Pr. PB51].	4500 [Hz]	0	0	0
filter 5	<u> </u>	Setting range: 10 to 4500				

No./symbol/	Setting	Function	Initial value		Contro	
name	digit		[unit]	Р	S	Τ
PB51 NHQ5 Notch shape		hape of the machine resonance suppression filter 5. tobust filter selection" is "Enabled (1)" in [Pr. PE41], the machine resonance supp to be a control of the machine resonance supp to be a control of the machine resonance supp to be a control of the machine resonance supp to be a control of the machine resonance suppression of the machine resonance supplementation of the machine resonance suppression filters.	ression fi	Iter 5	is no	t
selection 5	x	Machine resonance suppression filter 5 selection 0: Disabled 1: Enabled	Oh	0	0	0
	x_	Notch depth selection 0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0h	0	0	0
	_x	Notch width selection 0: α = 2 1: α = 3 2: α = 4 3: α = 5	0h	0	0	0
	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. To enable the setting value, set "Vibration suppression mode selection" to "3 inertia mode (1)" in [Pr. PA24].	100.0 [Hz]	0		
PB53 VRF22 Vibration suppression control 2 - Resonance frequency		Setting range: 0.1 to 300.0 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. 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]	0		
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. 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	0		
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. 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	0		

No./symbol/ name	Setting digit	Function	Initial value [unit]		Contro mode	
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" in [Pr. PB26] is "Input device (gain switching (CDP)) (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops.	0.0 [Hz]	0	5	
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" in [Pr. PB26] is "Input device (gain switching (CDP)) (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops.	0.0 [Hz]	0		
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" in [Pr. PB26] is "Input device (gain switching (CDP)) (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops.	0.00	0		
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" in [Pr. PB26] is "Input device (gain switching (CDP)) (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops. Setting range: 0.00 to 0.30	0.00	0		

No./symbol/ name	Setting digit	Function	Initial value [unit]	_	ontro node S	
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" in [Pr. PB26] is "Input device (gain switching (CDP)) (1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops. Setting range: 0.0 to 2000.0	0.0 [rad/s]	0	0	

5.2.3 Extension setting parameters ([Pr. PC $_$])

No./symbol/	Setting digit	Function	Initial value	r	ontro	
Hamo	aigit		[unit]	Р	S	T
PC01 STA Acceleration time constant		Set the acceleration time required to reach the rated speed from 0 r/min or 0 mm/s for VC (Analog speed command) and [Pr. PC05 Internal speed command 1] to [Pr. PC11 Internal speed command 7]. Speed Rated speed lf the preset speed command is lower than the rated speed, acceleration/deceleration time will be shorter. Speed lf the preset speed command is lower than the rated speed, acceleration/deceleration time will be shorter. Speed lf the preset speed command is lower than the rated speed, acceleration/deceleration time will be shorter. Speed lf the preset speed command 1] to [Pr. PC01] setting range or row remains the rated speed, acceleration/deceleration time will be shorter. Setting range: 0 to 50000	0 [ms]		0	0
PC02 STB Deceleration time constant		Set the deceleration time required to reach 0 r/min or 0 mm/s from the rated speed for 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]		0	0

No./symbol/	Setting digit	Function	Initial value		Contro mode	
name	uigit		[unit]	Р	S	T
PC03 STC S-pattern acceleration/		Start/stop the servo motor or linear servo motor smoothly. Set the time of the arc part for S-pattern acceleration/deceleration. Setting "0" will make it linear acceleration/deceleration.	0 [ms]		0	0
acceleration/ deceleration time constant		Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command Speed command				
PC04	\	Setting range: 0 to 5000 Set the constant of a primary delay filter for the torque/thrust command.	0			0
TQC Torque/thrust command time constant		Torque command (Thrust command) Torque (Thrust) After filtering TQC Time	[ms])
		TQC: Torque/thrust command time constant Setting range: 0 to 50000				
PC05 SC1		Set the speed 1 of internal speed commands.	100 [r/min]/		0	
Internal		Setting range: 0 to permissible instantaneous speed	[mm/s]	$\bigsqcup \setminus$		$ldsymbol{igstyle igstyle igytyle igstyle igytyle igstyle igytyle $
speed command 1 Internal		Set the speed 1 of internal speed limits.		\setminus		0
speed limit 1		Setting range: 0 to permissible instantaneous speed		\		

No./symbol/	Setting		Initial	C	ontro	ol
name	digit	Function	value		node	
DCCC		Cat the arread 2 of internal proced commands	[unit]	Р	S	T
PC06 SC2		Set the speed 2 of internal speed commands.	500 [r/min]/		0	
Internal			[mm/s]			
speed		Setting range: 0 to permissible instantaneous speed	[\bigsqcup		_\
command 2		Set the speed 2 of internal speed limits.				0
Internal						
speed limit 2		Setting range: 0 to permissible instantaneous speed			\	
PC07		Set the speed 3 of internal speed commands.	1000		0	\setminus
SC3 Internal			[r/min]/ [mm/s]			$ \ $
speed		Setting range: 0 to permissible instantaneous speed	[IIIIII/3]			
command 3		Set speed 3 of internal speed limits.		\setminus	\	0
Internal						
speed limit 3		Setting range: 0 to permissible instantaneous speed		\	\	
PC08		Set the speed 4 of internal speed commands.	200		0	
SC4			[r/min]/			$ \ $
Internal		Setting range: 0 to permissible instantaneous speed	[mm/s]	\		$ \ $
speed	<u></u>	Set the speed 4 of internal speed limits.		<u> </u>		0
command 4 Internal						
speed limit 4		Setting range: 0 to permissible instantaneous speed		\	\	
PC09	<u> </u>	Set the speed 5 of internal speed commands.	300	Ι,	$\overline{}$	$\overline{}$
SC5		ost the operation of mitorial operation and	[r/min]/)	\
Internal		Setting range: 0 to permissible instantaneous speed	[mm/s]	\		$ \ $
speed		Set the speed 5 of internal speed limits.		\leftarrow	· ·	0
command 5		Set the speed 5 of internal speed limits.				
Internal		Outline and the second of the instantance of		\		
speed limit 5		Setting range: 0 to permissible instantaneous speed	500		\	
PC10 SC6		Set the speed 6 of internal speed commands.	500 [r/min]/		0	\setminus
Internal			[mm/s]			
speed		Setting range: 0 to permissible instantaneous speed	[\bigsqcup		
command 6		Set the speed 6 of internal speed limits.				0
Internal						
speed limit 6		Setting range: 0 to permissible instantaneous speed			\	
PC11		Set the speed 7 of internal speed commands.	800		0	
SC7			[r/min]/			
Internal speed		Setting range: 0 to permissible instantaneous speed	[mm/s]			
command 7		Set the speed 7 of internal speed limits.		\setminus	\	0
Internal						
speed limit 7		Setting range: 0 to permissible instantaneous speed		\	\	
PC12	\setminus	Set the speed of servo motor or linear servo motor at the maximum voltage (10 V)	0		0	
VCM	\	input to VC (Analog speed command).	[r/min]/	[\		
Analog speed	\	When "0" is set, the rated speed of the connected servo motor or linear servo motor	[mm/s]	\		\
command -	\	is used. When you input a command value of the normiscible speed or more to VC, the value				
Maximum speed	\	When you input a command value of the permissible speed or more to VC, the value is clamped at the permissible speed.		\		\
Analog speed	\	io diampos se trio portinociolo opoca.				\
limit -	\	Setting range: 0 to 50000		\		\
Maximum		Set the speed of servo motor or linear servo motor at the maximum voltage (10 V)		\	\	0
speed	\	input to VLA (Analog speed limit).		[\	\	
	\	When "0" is set, the rated speed of the connected servo motor or linear servo motor		[]	\	
	\	is used.			\	
Ì	\	When you input a limit value of the permissible speed or more to VLA, the value is		\	\	
	\	clamped at the permissible speed.		\	\	
Ì	\	Setting range: 0 to 50000		\		
	\	County range. V to 50000		<u> </u>	\	i .

No./symbol/ name	Setting digit	Function	Initial value	_	ontro	
	u.g.t		[unit]	Р	S	Т
PC13 TLC Analog torque/thrust command maximum output		Set the output torque/thrust at the analog torque/thrust command voltage (TC = ± 8 V) of +8 V on the assumption that the maximum torque/thrust is 100.0%. For example, set 50.0. The maximum torque or thrust $\times \frac{50.0}{100.0}$ is outputted. When you input a command value of the maximum torque/thrust or more to TC, the value is clamped at the maximum torque/thrust. Setting range: 0.0 to 1000.0	100.0			0

No./symbol/	Setting		Function					Initial value		ontro	-
name	digit							[unit]	Р	S	Т
PC14 MOD1 Analog monitor 1	x x	Select a si	onitor 1 output selection gnal to output to MO1 (Analog monitor 1). Refer to app. 7 ttput selection. lble 5.8 or table 5.9 for settings.	.3 fo	r de	tecti	on	00h	0	0	0
output	_x		acturer setting					0h			
	x	1 or manur	acturer setting					0h		$\overline{}$	$\overline{}$
		able 5.8 <i>F</i>	Analog monitor setting value (MR-J4A_(-RJ)					re)			
					Oper de (l						
		Setting	ltom	-	ue (NOIC	, 1)				
		value	Item	Standard	Full.	Lin.	DD				
		00	(Linear) servo motor speed (±8 V/max. speed)	0	0	0	0				
		01	Torque or thrust (±8 V/max. torque or max. thrust) (Note 3)	0	0	0	0				
		02	(Linear) servo motor speed (+8 V/max. speed)	0	0	0	0				
		03	Torque or thrust (+8 V/max. torque or max. thrust) (Note 3)	0	0	0	0				
		04	Current command (±8 V/max. current command)	0	0	0	0				
		05	Command pulse frequency (±10 V/±4 Mpulses/s)	0	0	0	0				
		06	Servo motor-side droop pulses (±10 V/100 pulses) (Note 2)	0	0	0	0				
		07	Servo motor-side droop pulses (±10 V/1000 pulses) (Note 2)	0	0	0	0				
		08	Servo motor-side droop pulses (±10 V/10000 pulses) (Note 2)	0	0	0	0				
		09	Servo motor-side droop pulses (±10 V/100000 pulses) (Note 2)	0	0	0	0				
		0A	Feedback position (±10 V/1 Mpulse) (Note 2)	0							
		0B	Feedback position (±10 V/10 Mpulses) (Note 2)	0							
		0C	Feedback position (±10 V/100 Mpulses) (Note 2)	0							
		0D	Bus voltage (200 V class and 100 V class: +8 V/400 V, 400 V class: +8 V/800 V)	0	0	0	0				
		0E	Speed command 2 (±8 V/max. speed)	0	0	0	0				
		10	Load-side droop pulses (±10 V/100 pulses) (Note 2)		0						
		11	Load-side droop pulses (±10 V/1000 pulses) (Note 2)		0	\geq					
		12	Load-side droop pulses (±10 V/10000 pulses) (Note 2)		0						
		13	Load-side droop pulses (±10 V/100000 pulses) (Note 2)		0						
		14	Load-side droop pulses (±10 V/1 Mpulse) (Note 2)	$\langle \ \rangle$	0						
		15	Servo motor-side/load-side position deviation (±10 V/100000 pulses)		0						
		16	Servo motor-side/load-side speed deviation (±8 V/max. speed)		0	\setminus					
		17	Internal temperature of encoder (±10 V/±128 °C)	0	0		0				
		Note 1.	Items with \circ are available for each operation mode.								
			Standard: Standard (semi closed loop system) use of the	rota	ry se	ervo	moto	or			
			Full.: Fully closed loop system use of the rotary servo mot	or							
			Lin.: Linear servo motor use								
	1		DD: Direct drive (DD) motor use								
			Encoder pulse unit								
		3.	The larger value of [Pr. PA11] or [Pr. PA12] will be the ma	ıximı	um t	orqu	ie or	the maxim	ium tl	nrust	

No./symbol/ name	Setting digit		Function	Initial value [unit]		Contro mode S	-
PC14				[a]	'	U	'
MOD1	٦ -	Table 5 0	Analog monitor setting value (MR-J4-03A6(-RJ))				
Analog	'		Analog Monitor Setting value (WIX-04-05/A0(-130))				
monitor 1		Setting value	Item				
output			Servo motor speed (5 V ± 3 V/max. speed)				
		00 01	Torque (5 V ± 3 V/max. torque) (Note 2)				
		02	Servo motor speed (5 V + 3 V/max. speed)				
		03	Torque (5 V + 3 V/max. torque) (Note 2)				
		04	Current command (5 V ± 3 V/max. current command)				
		05	Command pulse frequency (5 V ± 4 V/±4 Mpulses/s)				
		06	Servo motor-side droop pulses (5 V ± 4 V/100 pulses)				
			(Note 1)				
		07	Servo motor-side droop pulses (5 V ± 4 V/1000 pulses) (Note 1)				
		08	Servo motor-side droop pulses (5 V ± 4 V/10000 pulses) (Note 1)				
		09	Servo motor-side droop pulses (5 V ± 4 V/100000 pulses) (Note 1)				
		0A	Feedback position (5 V ± 4 V/1 Mpulses) (Note 1)				
		0B	Feedback position (5 V ± 4 V/10 Mpulses) (Note 1)				
		0C	Feedback position (5 V ± 4 V/100 Mpulses) (Note 1)				
		0D	Bus voltage (5 V + 4 V/100 V)				
		0E	Speed command 2 (5 V ± 3 V/max. speed)				
		17	Internal temperature of encoder (5 V ± 4 V/±128 °C)				
			Encoder pulse unit The larger value of [Pr. PA11] or [Pr. PA12] will be the maximum torque.				
PC15	xx	Analog mo	onitor 2 output selection	01h	0	0	0
MOD2	^ ^	•	gnal to output to MO2 (Analog monitor 2). Refer to app. 7.3 for detection	0111			
Analog			tput selection.				
monitor 2		Refer to [P	Pr. PC14] for settings.				
output	_x	For manufa	acturer setting	0h			
	x			0h			
PC16	\setminus		lay time between MBR (Electromagnetic brake interlock) and the base	0	0	0	0
MBR		drive circui	it is shut-off.	[ms]			
Electromagnetic							
brake sequence output		Setting ran	nge: 0 to 1000				
PC17			tput range of ZSP (Zero speed detection).	50	0	0	0
ZSP			speed detection) has hysteresis of 20 r/min or 20 mm/s.	[r/min]/			
Zero speed		,	, , , , , , , , , , , , , , , , , , , ,	[mm/s]			
		Setting ran	nge: 0 to 10000				
PC18	x	Alarm histo	ory clear selection	0h	0	0	0
*BPS			alarm history.				
Alarm history		0: Disable	d				
clear		1: Enabled					
			abled" is set, the alarm history will be cleared at the next power-on. After history is cleared, the setting is automatically disabled.				
	x_		acturer setting	0h			
		. or manan	acia. c. com. ig	0h			
	x			0h	$\overline{}$	$\overline{}$	
	^			VII			

No./symbol/	Setting	Function	Initial value		Contro	
name	digit	Tundion	[unit]	Р	S	Т
PC19 *ENRS Encoder output pulse selection	x	Encoder output pulse phase selection Select the encoder pulse direction. 0: A-phase 90° shift in CCW or positive direction 1: A-phase 90° shift in CW or negative direction	0h	0	0	0
Scientifi		Setting value Servo motor rotation direction/ linear servo motor travel direction CCW or positive direction CW or negative direction A-phase B-phase A-phase B-phase B-phase B-phase B-phase				
	x	Encoder output pulse setting selection 0: Output pulse setting When " 1 0 _" is set to this parameter, [AL. 37 Parameter error] will occur. 1: Dividing ratio setting 2: The same output pulse setting as the command pulse 3: A-phase/B-phase pulse electronic gear setting 4: A/B-phase pulse through output setting When you select "1", the setting 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] 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. Setting "4" will be enabled only when A/B/Z-phase differential output linear encoder is used. And "Encoder output pulse phase selection (x)" will be disabled. When another encoder is connected, [AL. 37 Parameter error] will occur. Setting "Standard control mode (0 _)" in [Pr. PA01] will trigger [AL. 37 Parameter error]. Selection of the encoders for encoder output pulse Select an encoder for servo amplifier output. 0: Servo motor encoder	Oh Oh	0	0	0
		1: Load-side encoder When "_ 1 0 _" is set to this parameter, [AL. 37 Parameter error] will occur. This is only for the fully closed loop system. If "1" is set other than in the fully closed loop system, [AL. 37 Parameter error] will occur.				
PC20 *SNO Station No. setting	x	For manufacturer setting Set a station No. of the servo amplifier for RS-422 and USB communication. Always set one station to one axis of the servo amplifier. Setting one station number to two or more stations will disable a normal communication. Setting range: 0 to 31	0h 0 [Station]	0	0	0
PC21	Select th	ne details of RS-422 communication function.				
*SOP	x	For manufacturer setting	0h			
RS-422 communication function selection	x_	RS-422 communication baud rate selection When using the parameter unit, set "1 " in [Pr. PF34]. 0: 9600 [bps] 1: 19200 [bps] 2: 38400 [bps] 3: 57600 [bps] 4: 115200 [bps]	0h	0	0	0
	-x	RS-422 communication response delay time selection 0: Disabled 1: Enabled (responding after 800 µs or longer delay time)	0h	0	0	0
	x	For manufacturer setting	0h			

	Setting					ol
	digit	Function	value [unit]	P	mode S	; T
PC22	v	For manufacturer setting	0h	_	\ \	_
_	X	1 of manufacturer setting	0h			
_ · · · · -	x		0h			
	x	Facedon cable accessive action weather allegation		$\overline{}$	$\stackrel{\circ}{-}$	$\stackrel{\sim}{\vdash}$
X		Encoder cable communication method selection Select the encoder cable communication method.	0h	0	0	0
		0: Two-wire type				
		1: Four-wire type				
		When using an encoder of A/B/Z-phase differential output method, set "0".				
		If the setting is incorrect, [AL. 16 Encoder initial communication error 1] or [AL. 20				
		Encoder normal communication error 1] occurs. Setting "1" will trigger [AL. 37] while				
		"Fully closed loop control mode (1 _)" is selected in [Pr. PA01] (except MR-J4-				
		_ARJ).				
		For MR-J4-03A6(-RJ) servo amplifiers, this digit cannot be used when a setting value other than the initial value is set. Also, it does not comply with encoders of				
		A/B/Z-phase differential output method.				
PC23	x	Servo-lock selection at speed control stop	0h		0	\
*COP2		Select the servo-lock selection at speed control stop.		\		\
Function		In the speed control mode, the servo motor shaft can be locked to prevent the shaft		\		\
selection C-2		from being moved by an external force.		\		l \
		0: Enabled (servo-lock) The energtion to maintain the step position is performed.		\		\
		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 or 0 mm/s is performed.		\		\
	_ x _	For manufacturer setting	0h			
-		VC/VLA voltage averaging selection	0h		0	0
		Select the VC/VLA voltage average.		\		
		Set the filtering time when VC (Analog speed command) or VLA (Analog speed limit)		\		
		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.		\		
		Tary the operation to vehage hactagen.		\		
		Setting value Filtering time [ms]				
		0 0				
		1 0.444				
		2 0.888		\		
		3 1.777		\		
		4 3.555 5 7.111				
				\		
×	×	Speed limit selection at torque control	0h		\	0
		Select the speed limit selection at torque control.		\	\	
		0: Enabled		\	\	
		1: Disabled		\	\	
D004		Do not use this function except when configuring an external speed loop.	Oh	_\	\	
PC24 *COP3	^x	In-position range unit selection Select a unit of in-position range.	0h	0	\	\
Function		0: Command input pulse unit			\	\
selection C-3		Servo motor encoder pulse unit			\	\
I -	x_	For manufacturer setting	0h			
	_ x		0h			
х	×	Error excessive alarm/error excessive warning level unit selection	0h	0	\	\
		Select units for error excessive alarm level setting with [Pr. PC43] and for error				\
		excessive warning level setting with [Pr. PC73]. 0: Per 1 rev or 1 mm			\	\
		1: Per 0.1 rev or 1 mm			\	\
		2: Per 0.01 rev or 0.01 mm			\	\
■				I	ı \	I \

No./symbol/	Setting	Function	Initial value		Contro	
name	digit		[unit]	Р	S	Τ
PC26	x	[AL. 99 Stroke limit warning] selection	0h	0	0	
*COP5		Enable or disable [AL. 99 Stroke limit warning].				
Function		0: Enabled				$ \ $
selection C-5		1: Disabled	O.I.			
	x	For manufacturer setting	0h			\rightarrow
	_x		0h			
DC27	x	[AL 40 Lindow oltowol detection method colection	0h		_	$\stackrel{\circ}{-}$
PC27 *COP6 Function selection C-6	x	[AL. 10 Undervoltage] detection method selection Set this parameter when [AL. 10 undervoltage] occurs due to power supply voltage distortion while using FR-RC-(H) or FR-CV-(H). 0: When [AL. 10] does not occur	0h	0	0	0
		1: When [AL. 10] occurs This digit is not available with MR-J4-03A6(-RJ) servo amplifiers.				
		When using the MR-J4A-RJ servo amplifier with the DC power supply input, set "1".	Oh		_	
	x_	Main circuit power supply selection Select a voltage to be connected to the main circuit power supply with an MR-J4- 03A6(-RJ) servo amplifier. 0: 48 V DC 1: 24 V DC When using 24 V DC for the main circuit power supply, set "1" to this digit. This digit is not available with MR-J4A_(-RJ) 100 W or more servo amplifiers. The characteristics of the servo motor vary depending on whether 48 V DC or 24 V DC is used. For details, refer to "Servo Motor Instruction Manual (Vol. 3)".	0h	0	0	0
	_x	Undervoltage alarm selection Select the alarm and warning for when the bus voltage drops to the undervoltage alarm level. 0: [AL. 10.2] regardless of servo motor speed 1: [AL. E9.1] at servo motor speed 50 r/min (50 mm/s) or less, [AL. 10.2] at over 50 r/min (50 mm/s)	0h	0	0	0
	x	For manufacturer setting	0h			
PC28	x	For manufacturer setting	0h			
*COP7	x_		0h			
Function	_x		0h			
selection C-7	x	Linear scale multipoint Z-phase input function selection When two or more reference marks exist during the full stroke of the linear encoder, set "1". 0: Disabled 1: Enabled This parameter setting is available with servo amplifiers with software version A5 or later. This digit is not available with MR-J4-03A6(-RJ) servo amplifiers.	0h	0	0	0
PC30 STA2 Acceleration time constant 2		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 or 0 mm/s for 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]		0	0
PC31 STB2 Deceleration time constant 2		To enable the parameter, turn on STAB2 (Speed acceleration/deceleration selection). Set the deceleration time required to reach 0 r/min or 0 mm/s from the rated speed for 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]		0	0

No./symbol/ name	Setting digit	Function	Initial value	ı	ontro	
PC32	\	To enable the parameter, select "Electronic gear (0)", "J3 electronic gear	[unit]	P	S	T
CMX2 Commanded pulse multiplication numerator 2		setting value compatibility mode (2)", or "J2S electronic gear setting value compatibility mode (3)" of "Electronic gear selection" in [Pr. PA21]. Setting range: 1 to 16777215	l l	0		
PC33 CMX3 Commanded pulse multiplication numerator 3		To enable the parameter, select "Electronic gear (0)", "J3 electronic gear setting value compatibility mode (2)", or "J2S electronic gear setting value compatibility mode (3)" of "Electronic gear selection" in [Pr. PA21]. Setting range: 1 to 16777215	1	0		
PC34 CMX4 Commanded pulse multiplication numerator 4		To enable the parameter, select "Electronic gear (0)", "J3 electronic gear setting value compatibility mode (2)", or "J2S electronic gear setting value compatibility mode (3)" of "Electronic gear selection" in [Pr. PA21]. Setting range: 1 to 16777215	1	0		
PC35 TL2 Internal torque limit 2/internal thrust limit 2		Set the parameter on the assumption that the maximum torque or thrust is 100.0%. The parameter is for limiting the torque of the servo motor or the thrust of the linear servo motor. No torque or thrust is generated when this parameter is set to "0.0". When TL1 (Internal torque limit selection) is turned on, Internal torque limits 1 and 2 are compared and the lower value will be enabled. Set the parameter referring to section 3.6.1 (5).	100.0	0	0	0

No./symbol/ name	Setting	Function	Initial value		ontro	
	digit	i diletion	[unit]	P		T
PC36 *DMD Status display selection	xx	Status display selection at power-on Select a status display shown at power-on. Setting "21" to "27" will trigger [AL. 37] in the mode other than the positioning mode. 00: Cumulative feedback pulses 01: Servo motor speed/linear servo motor speed 02: Droop pulses 03: Cumulative command pulses 04: Command pulse frequency 05: Analog speed command voltage (Note 1) 06: Analog torque command voltage (Note 2) 07: Regenerative load ratio 08: Effective load ratio 08: Effective load ratio 09: Peak load ratio 09: Peak load ratio 09: Note in one-revolution position/within virtual one-revolution position (1 pulse unit) 00: Within one-revolution position/within virtual one-revolution position (1000 pulses unit) 00: ABS counter/virtual ABS counter 00: Load to motor inertia ratio/load to motor mass ratio 06: Bus voltage 10: Internal temperature of encoder 11: Settling time 12: Oscillation detection frequency 13: Number of tough operations 14: Unit power consumption (increment of 1 Wh) 15: Unit total power consumption (increment of 1 Wh) 17: Unit total power consumption (increment of 100 kWh) 18: Load-side cumulative feedback pulses (Note 3, 5) 19: Load-side droop pulses (Note 3, 5) 19: Load-side encoder information 1 (1 pulse unit) (Note 3, 5) 18: Load-side encoder information 1 (1 pulse unit) (Note 3, 5) 18: Load-side encoder information 1 (1 pulse unit) (Note 3, 5) 19: Load-side encoder information 1 (1 pulse unit) (Note 4, 5) 10: Z-phase counter (1 pulse unit) (Note 4, 5) 11: Z-phase counter (1 pulse unit) (Note 4, 5) 12: Z-phase counter (1 pulse unit) (Note 4, 5) 13: Load-side encoder information 1 (1 pulse unit) (Note 4, 5) 14: Load-side encoder information 1 (1 pulse unit) (Note 4, 5) 15: Load-side encoder information 1 (1 pulse unit) (Note 4, 5) 16: Load-side encoder information 1 (1 pulse unit) (Note 4, 5) 16: Load-side encoder information 1 (1 pulse unit) (Note 4, 5) 17: Load-side encoder information 1 (1 pulse unit) (Note 4, 5) 18: Load-side encoder information 1 (1 pulse unit) (Note 4, 5) 19: Load-side encoder info	[unit] OOh	P		TO
	_x	This is not available with the MR-J4-03A6(-RJ) servo amplifier. Status display at power-on in corresponding control mode 0: Depends on the control mode	0h	0	0	0
		Control mode Status display at power-on				
		Position Cumulative feedback pulses				
		Position/speed Cumulative feedback pulses/servo motor speed				
		(linear servo motor speed)				
		Speed Servo motor speed (linear servo motor speed)				
		Speed/torque Servo motor speed (linear servo motor speed)/analog torque (thrust) command voltage				
		Torque Analog torque (thrust) command voltage				
		Torque/position Analog torque (thrust) command voltage/cumulative feedback pulses				
		1: Depends on the last 2 digits settings of the parameter				
	x	For manufacturer setting	0h			

No./symbol/	Setting digit	Function	Initial value		Controde	9
	. 5		[unit]	Р	S	Т
PC37 VCO Analog speed command offset/ Analog speed limit offset		Set the offset voltage of VC (Analog speed command). For example, if CCW rotation or positive direction travel is provided by switching on ST1 (Forward rotation start) while applying 0 V to VC, set a negative value. When automatic VC offset is used, the automatically offset value is set to this parameter. (Refer to section 4.5.4.) 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.		0	
		Set the offset voltage of VLA (Analog speed limit). For example, if CCW rotation or positive direction travel is provided by switching on RS1 (Forward rotation selection) while applying 0 V to VLA, set a negative value. When automatic VC offset is used, the automatically offset value is set to this parameter. (Refer to section 4.5.4.) The initial value is provided before shipment by the automatic VC offset function on condition that the voltage between VLA and LG is 0 V. Setting range: -9999 to 9999				0
PC38 TPO Analog torque		Set the offset voltage of TC (Analog torque command). Setting range: -9999 to 9999	0 [mV]			0
command offset/ Analog torque		Set the offset voltage of TLA (Analog torque limit).			0	
limit offset PC39		Setting range: -9999 to 9999	0	_\	_	
MO1 Analog monitor 1 offset		Set the offset voltage of MO1 (Analog monitor 1). Setting range: -9999 to 9999	[mV]	0	0	0
PC40	<u> </u>	Set the offset voltage of MO2 (Analog monitor 2).	0	0	0	0
MO2 Analog monitor 2 offset		Setting range: -9999 to 9999	[mV])
PC43	\	Set an error excessive alarm level.	0	0	1	\
ERZ Error excessive alarm level		You can change the setting unit with "Error excessive alarm/error excessive warning level unit selection" in [Pr. PC24]. Set this per rev. for rotary servo motors and direct drive motors. Setting "0" will be "3 rev", and setting over 200 rev will be clamped with 200 rev. Set this per mm for linear servo motors. Setting "0" will be 100 mm.	[rev]/ [mm]			
	\	Setting range: 0 to 1000			\	. \
PC44	x	For manufacturer setting	0h			
*COP9	x_	-	0h	\subset	\setminus	
Function	_x		0h			
selection C-9	x	Load-side encoder cable communication method selection Select the communication method of the encoder cable to be connected to the CN2L connector of MR-J4ARJ. 0: Two-wire type 1: Four-wire type When using a load-side encoder of A/B/Z-phase differential output method, set "0". Incorrect setting will trigger [AL. 70] and [AL. 71]. Setting "1" while using a servo amplifier other than MR-J4ARJ will trigger [AL. 37]. This digit is not available with MR-J4-03A6(-RJ) servo amplifiers.	0h	0		

No./symbol/	Setting digit			Function			Initial value		Contro mode	
	Ŭ						[unit]	Р	S	Τ
PC45 *COPA Function selection C-A	x_	Select a polarity of the linear encoder or load-side encoder. 0: Encoder pulse increases in the servo motor CCW or positive direction. 1: Encoder pulse decreases in the servo motor CCW or positive direction. This digit is not available with MR-J4-03A6(-RJ) servo amplifiers. For manufacturer setting					Oh Oh Oh	0	0	\bigcirc
		input interfact This function This digit is	on-signal detection so ce encoder used as a n is enabled only whe not available with MF Detection of	a linear encoder o en you use an A/B R-J4-03A6(-RJ) se	or load-side encod B/Z-phase input in	er.				
		Setting value	disconnection Z-phase-side non- signal	Fully closed loop system	Linear servo system					
		0	Enabled	[AL. 71.6] (Z-phase)	[AL. 20.6] (Z-phase)					
		1	Disabled			<u> </u>				
	Χ	For manufac	cturer settina				0h			
PC51 RSBR Forced stop deceleration time constant		Set the time 100 ms. Ra Servo mo (Linea	ted speed tor speed r servo speed) 0 r/min (0 mm/s)	•	n or 0 mm/s. Setti		100 [ms]	0	0	
		value dur to stop wi • [AL. 50 C stop dece • After an a lead to a cut, dyna	or motor torque or ling forced stop decel II be longer than the everload alarm 1] or [leteration, depending alarm that leads to a forced stop deceleramic braking will start e: 0 to 20000	leration because t set time constant. AL. 51 Overload a on the set value. forced stop deceletion occurs or if the	the set time is too alarm 2] may occu eration, if an alarn the control circuit p	short, the time or during forced on that does not ower supply is				

No./symbol/ name	Setting digit	Function	Initial value	ı	ontro)
PC54	Aigit	Set the compensation amount of the vertical axis freefall prevention function.	[unit]	P	S	Т
RSUP1 Vertical axis freefall prevention compensation amount		Set it be compensation amount of the vertical axis freefail prevention function. Set it per servo motor rotation amount or linear servo motor travel distance. When setting a positive value, the servo motor or linear servo motor moves in the direction set with [Pr. PA14] for the forward rotation pulse input. When setting a negative value, the servo motor or linear servo motor moves in the direction set with [Pr. PA14] for the reverse rotation pulse input. For example, if a positive compensation amount is set when the [Pr. PA14 Rotation direction selection/travel 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) Position control mode 2) The value of the parameter is other than "0". 3) The forced stop deceleration function is enabled. 4) Alarm occurs or EM2 turns off when the (linear) servo motor speed is zero speed or less. 5) MBR (Electromagnetic brake interlock) is enabled with [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47], and the base circuit shut-off delay time is set in [Pr. PC16]. Setting range: -25000 to 25000	[0.0001 rev]/ [0.01 mm]	0		
PC60 *COPD Function selection C-D	x	Motor-less operation selection This is used to select the motor-less operation. This is not used in the linear servo motor control mode, fully closed loop control, and DD motor control mode. 0: Disabled 1: Enabled	0h	0	0	0
	x_	High-resolution analog input selection Select the resolution of VC (analog speed command). When you change parameters, perform offset adjustment with [Pr. PC37 Analog speed command offset]. The offset adjustment can be performed by executing VC automatic offset. Setting "1" while using a servo amplifier other than MR-J4ARJ, MR-J4ARU, and MR-J4ARZ will trigger [AL. 37].	0h	0	0	
		Disabled High service and service				
	_x	For manufacturer setting	0h			
	x	 [AL. 9B Error excessive warning] selection 0: [AL. 9B Error excessive warning] disabled 1: [AL. 9B Error excessive warning] enabled The setting of this digit is used by servo amplifier with software version B4 or later. 	0h	0	0	0
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 this per rev. for rotary servo motors and direct drive motors. Setting "0" will be "1 rev", and setting over 200 rev will be clamped with 200 rev. Set this per mm for linear servo motors. Setting "0" will be 50 mm. 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] will occur earlier than the warning.: [Pr. PC73 Error excessive warning level] ≥ [Pr. PC43 Error excessive alarm level] This parameter is used by servo amplifier with software version B4 or later.	0 [rev]/ [mm]	0		

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

No./symbol/	Setting	Function		Initial value		ontro	
name	digit	i dilction		[unit]	Р	S	T
PD01	Select in	put devices to turn on them automatically.		[ac]	٠.	U	<u> </u>
*DIA1		x (BIN): For manufacturer setting		0h			$\overline{}$
Input signal	(HEX)	x _ (BIN): For manufacturer setting		- 011			
automatic on	(11274)	_ x _ (BIN): SON (Servo-on)					
selection 1		0: Disabled (Use for an external input signal.)			0		0
		1: Enabled (automatic on)					
		x (BIN): For manufacturer setting x (BIN): PC (Proportional control)		0h	\rightarrow		$\overline{}$
	(HEX)	0: Disabled (Use for an external input signal.)		011	0	0	
	(IILX)	1: Enabled (automatic on)					\
							-
		x _ (BIN): TL (External torque/external thrust limit selection)			0	0	\setminus
		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 x _ (BIN): For manufacturer setting		- Oh		\geq	
					\geq		
		_ x (BIN): LSP (Forward rotation stroke end)		0	0	\setminus	
		0: Disabled (Use for an external input signal.)					$ \ $
		1: Enabled (automatic on)					`
		x (BIN): LSN (Reverse rotation stroke end)			0	0	Λ
		0: Disabled (Use for an external input signal.)					$ \ $
		1: Enabled (automatic on)					\
	x	For manufacturer setting		0h			
	0	I I ∃ I I II Signal name ⊢	nitial v				
			_	HEX			
			0				
		0001/0	0	0			
		SON (Servo-on)	0				
			0				
		Signal name	nitial v	/alue			
		Signal name E	BIN	HEX			
		PC (Proportional control)	0				
		TL (External torque/external thrust limit selection)	0	0			
			0	١			
			0				
		le le	nitial v	roluo.			
		Signal name		HEX			
		T T T T	0	TILA			
			0				
		LSP (Forward rotation stroke end)	0	0			
		LSN (Reverse rotation stroke end)	0				
		BIN 0: Use for an external input signal. BIN 1: Automatic on	0				
	rotation	ou perform a magnetic pole detection without using LSP (Forward rotation stroke stroke end), setting [Pr. PL08 Linear servo motor/DD motor function selection 3] LSP and LSN.					

No./symbol/ name	Setting digit			Functio	n		Initial value [unit]	Control mode
PD03	Any innu	t device can he	e assigned to the	- CN1-15 nin			[ariit]	1 0 1
*DI1L Input device	x x		ol mode - Devic				02h	0 \
selection 1L	x x		mode - Device	selection			02h	
		Ta	ble 5.10 Sele	ectable input	devices			
		Setting	Inr	out device (Note	1)	1		
		value	Р	S	т			
		02	SON	SON	SON	Í		
		03	RES	RES	RES			
		04	PC	PC				
		05	TL	TL				
		06	CR					
		07		ST1	RS2			
		08		ST2	RS1	1		
		09	TL1	TL1]		
		0A	LSP	LSP	LSP (Note 3)			
		0B	LSN	LSN	LSN (Note 3)			
		0D	CDP	CDP				
		(Note 4) 0E	CLD					
		(Note 4) 0F	MECR					
		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			
		2. 3.	The diagonal lin When assigning In the torque coduring the magrontrol mode. At this signal will be	es indicate man LOP (Control sintrol mode, this letic pole detections, when the manager disabled.	ufacturer setting witching), assigr device cannot b on in the linear	e, T: Torque control months. Never change the set it to the same pin in a set used during normal control months. The control months in the torque control in the torque control in the torque control months.	etting. Il control moperation. It de and the	can be used DD motor
PD04	Any inpu	t device can be	assigned to the	e CN1-15 pin.				
*DI1H	x x		ol mode - Device				02h	\
Input device		Refer to table	5.10 in [Pr. PD0	03] for settings.				
selection 1H	x x	For manufacti					02h	
PD05			assigned to the				00h	
*DI2L Input device	x x Position control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings.							$ \circ \setminus \setminus$
selection 2L	x x	Speed contro	mode - Device	selection			21h	
DD06	A no i		5.10 for setting					
PD06 *DI2H			assigned to the				045	<u> </u>
Input device	xx	•	ol mode - Device 5.10 in [Pr. PD0				21h	
selection 2H	x x	For manufacti	urer setting				20h	

No./symbol/	Setting	Function	Initial	Control mode
name	digit	Function	value	
222			[unit]	P S T
PD07		t device can be assigned to the CN1-17 pin.		
*DI3L	_	1" is set in [Pr. PA03] and absolute position detection system by DIO is selected.	, the CN1-17	7 pin will
Input device		ABSM (ABS transfer mode).	1 011	
selection 3L	x x	Position control mode - Device selection	04h	$ \circ \setminus \setminus$
		Refer to table 5.10 in [Pr. PD03] for settings.		++
	x x	Speed control mode - Device selection	07h	\
	ļ	Refer to table 5.10 in [Pr. PD03] for settings.		
PD08		t device can be assigned to the CN1-17 pin.	1	<u> </u>
*DI3H	××	Torque control mode - Device selection	07h	
Input device selection 3H		Refer to table 5.10 in [Pr. PD03] for settings.	071	
	x x	For manufacturer setting	07h	
PD09		t device can be assigned to the CN1-18 pin.		
*DI4L		1" is set in [Pr. PA03] and absolute position detection system by DIO is selected.	, the CN1-18	3 pin will
Input device		ABSR (ABS transfer request).		- N N
selection 4L	x x		05h	$ \circ \setminus \setminus$
		Refer to table 5.10 in [Pr. PD03] for settings.		
	x x	Speed control mode - Device selection	08h	
	ļ	Refer to table 5.10 in [Pr. PD03] for settings.		
PD10		t device can be assigned to the CN1-18 pin.		
*DI4H	x x	Torque control mode - Device selection	08h	
Input device		Refer to table 5.10 in [Pr. PD03] for settings.		
selection 4H	x x	For manufacturer setting	08h	
PD11		t device can be assigned to the CN1-19 pin.		
*DI5L	x x	Position control mode - Device selection	03h	
Input device		Refer to table 5.10 in [Pr. PD03] for settings.		
selection 5L	x x	Speed control mode - Device selection	03h	$\setminus \circ \setminus$
		Refer to table 5.10 in [Pr. PD03] for settings.		
PD12	Any inpu	t device can be assigned to the CN1-19 pin.		
*DI5H	x x	Torque control mode - Device selection	03h	$\setminus \setminus \setminus \setminus \circ$
Input device		Refer to table 5.10 in [Pr. PD03] for settings.		
selection 5H	x x	For manufacturer setting	38h	
PD13	Any inpu	t device can be assigned to the CN1-41 pin.		
*DI6L	x x	Position control mode - Device selection	06h	$ \circ \wedge \wedge $
Input device		Refer to table 5.10 in [Pr. PD03] for settings.		
selection 6L	x x	Speed control mode - Device selection	20h	$\setminus \setminus \setminus \setminus$
		Refer to table 5.10 in [Pr. PD03] for settings.		
PD14	Any inpu	t device can be assigned to the CN1-41 pin.		
*DI6H	x x	Torque control mode - Device selection	20h	
Input device		Refer to table 5.10 in [Pr. PD03] for settings.		
selection 6H	x x	For manufacturer setting	39h	
PD17	Any inpu	t device can be assigned to the CN1-43 pin.		
*DI8L	x x	Position control mode - Device selection	0Ah	$\circ \land \land$
		Refer to table 5.10 in [Pr. PD03] for settings.		\ \
Input device		(
Input device selection 8L	x x	Speed control mode - Device selection	0Ah	
•	x x		0Ah	
•		Speed control mode - Device selection	0Ah	
selection 8L	Any inpu	Speed control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings.	0Ah	
selection 8L PD18		Speed control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings. t device can be assigned to the CN1-43 pin.		
PD18 *DI8H	Any inpu	Speed control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings. t device can be assigned to the CN1-43 pin. Torque control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings.		
PD18 *DI8H Input device	Any inpu	Speed control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings. t device can be assigned to the CN1-43 pin. Torque control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings. For manufacturer setting	00h	
PD18 *DI8H Input device selection 8H	Any inpu	Speed control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings. t device can be assigned to the CN1-43 pin. Torque control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings. For manufacturer setting t device can be assigned to the CN1-44 pin.	00h 0Ah	
PD18 *DI8H Input device selection 8H PD19 *DI9L	Any inpu	Speed control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings. t device can be assigned to the CN1-43 pin. Torque control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings. For manufacturer setting t device can be assigned to the CN1-44 pin. Position control mode - Device selection	00h	
PD18 *DI8H Input device selection 8H PD19	Any inpu	Speed control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings. t device can be assigned to the CN1-43 pin. Torque control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings. For manufacturer setting t device can be assigned to the CN1-44 pin.	00h 0Ah	

No./symbol/	Setting	Function	Initial value	1	Contro	
name	digit	Tureach	[unit]	Р	S	Т
PD20	Any inpu	tt device can be assigned to the CN1-44 pin.				
*DI9H	x x	Torque control mode - Device selection	00h			0
Input device		Refer to table 5.10 in [Pr. PD03] for settings.				
selection 9H	x x	For manufacturer setting	0Bh			
PD21	Any inpu	t device can be assigned to the CN1-45 pin.				
*DI10L	x x	Position control mode - Device selection	23h	0		
Input device		Refer to table 5.10 in [Pr. PD03] for settings.				
selection 10L	XX Speed control mode - Device selection		23h		0	
	Refer to table 5.10 in [Pr. PD03] for settings.					
PD22	Any inpu	t device can be assigned to the CN1-45 pin.		_	_	
*DI10H	x x	Torque control mode - Device selection	23h			0
Input device		Refer to table 5.10 in [Pr. PD03] for settings.				
selection 10H	x x	For manufacturer setting	2Bh			
PD23	x x	Device selection	04h	0	0	0
*DO1		Any output device can be assigned to the CN1-22 pin.				
Output device		When "Enabled (absolute position detection system by DIO) (1)" is selected in				
selection 1		[Pr. PA03], the CN1-22 pin will become ABSB0 (ABS send data bit 0) only during ABS transfer mode.				
		Refer to table 5.11 for settings.	06			
1		For manufacturer setting	0h			
	x		0h			

Table 5.11 Selectable output devices

Setting	Out	put device (Note	e 1)
value	Р	S	T
00	Always off	Always off	Always off
02	RD	RD	RD
03	ALM	ALM	ALM
04	INP	SA	Always off
05	MBR	MBR	MBR
(Note 2) 06	DB	DB	DB
07	TLC	TLC	VLC
08	WNG	WNG	WNG
09	BWNG	BWNG	BWNG
0A	Always off	SA	Always off
0B	Always off	Always off	VLC
0C	ZSP	ZSP	ZSP
(Note 2) 0D	MTTR	MTTR	MTTR
0F	CDPS	Always off	Always off
(Note 2) 10	CLDS	Always off	Always off
11	ABSV	Always off	Always off

Note 1. P: Position control mode, S: Speed control mode, T: Torque control mode

2. It cannot be set with MR-J4-03A6(-RJ) servo amplifiers.

No./symbol/	Setting	Function	Initial value		Contro	
name	digit		[unit]	Р	S	Т
PD24 *DO2 Output device selection 2	x x	Device selection Any output device can be assigned to the CN1-23 pin. When "Enabled (absolute position detection system by DIO) (1)" is selected in [Pr. PA03], the CN1-23 pin will become ABSB1 (ABS send data bit 1) only during ABS transfer mode. Refer to table 5.11 in [Pr. PD23] for settings.	0Ch	0	0	0
	_x	For manufacturer setting	0h			$\overline{}$
	x		0h		$\overline{}$	$\overline{}$
PD25 *DO3 Output device	xx	Device selection Any output device can be assigned to the CN1-24 pin. Refer to table 5.11 in [Pr. PD23] for settings.	04h	0	0	0
selection 3	_x	For manufacturer setting	0h			
	x		0h		abla	
PD26 *DO4 Output device selection 4	xx	Device selection Any output device can be assigned to the CN1-25 pin. When "Enabled (absolute position detection system by DIO) (1)" is selected in [Pr. PA03], the CN1-25 pin will become ABST (ABS send data ready) only during ABS transfer mode. Refer to table 5.11 in [Pr. PD23] for settings.	07h	0	0	0
	_x	For manufacturer setting	0h			
	x		0h			
PD28 *D06 Output device selection 6	_x	Device selection Any output device can be assigned to the CN1-49 pin. Refer to table 5.11 in [Pr. PD23] for settings. For manufacturer setting	02h 0h	0	0	
	x		0h			
PD29		filter for the input signal.	T			
*DIF Input filter setting	x	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	0	0	0
	x_	RES (Reset) dedicated filter selection 0: Disabled 1: Enabled (50 [ms])	0h	0	0	0
	-x	CR (Clear) dedicated filter selection 0: Disabled 1: Enabled (50 [ms])	0h	0	0	0
	х	For manufacturer setting	0h			$\overline{}$

No./symbol/	Setting	Function	Initial value		Contr mode	
name	digit		[unit]	Р	S	Т
PD30 *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. Setting "2" or "3" will trigger [AL. 37] in the mode other than the positioning mode. 0: Quick stop 1: Slow stop	0h	0	0	
	x_	Base circuit status selection for RES (Reset) on 0: Base circuit shut-off 1: No base circuit shut-off	0h	0	0	0
	_x	For manufacturer setting	0h			
	x	Enabled/disabled selection for a thermistor of servo motor or linear servo motor 0: Enabled 1: Disabled The setting in this digit will be disabled when using a servo motor or linear servo motor without thermistor. This parameter is used by servo amplifier with software version A5 or later.	0h	0	0	0
PD31	x	For manufacturer setting	0h			
*DOP2	x_		0h			
Function selection D-2	_x	INP (In-position) on condition selection Select a condition that INP (In-position) is turned on. 0: Droop pulses are within the in-position range. 1: The command pulse frequency is 0, and droop pulses are within the in-position range. When the position command is not inputted for about 1 ms, the command pulse frequency is decided as 0. This parameter is used by servo amplifier with software version B4 or later.	0h	0		
	x	For manufacturer setting	0h			
PD32 *DOP3 Function selection D-3	x	CR (Clear) selection Set CR (Clear). 0: Deleting droop pulses at the leading edge of turning on of CR 1: Continuous deleting of droop pulses while CR is on 2: Disabled (available for the software version B3 or later)	Oh	0		
	×_	For manufacturer setting	0h			
	_x		0h			
	x		0h			
PD33	x	For manufacturer setting	0h			
*DOP4	x_		0h			
Function selection D-4	_x	Rotation direction selection to enable torque limit/travel direction selection to enable thrust limit Select a direction which enables internal torque limit 2 or external torque limit. 0: Both of "CCW or positive direction" and "CW or negative direction" are enabled. 1: Enabled with "CCW or positive direction" 2: Enabled with "CW or negative direction" This parameter setting is used with servo amplifier with software version B3 or later.	0h	0	0	0
	x	For manufacturer setting	0h			

No./symbol/	Setting	Function	Initial value		Contro	
name	digit		[unit]	Р	S	Т
PD34 *DOP5 Function selection D-5	x	Alarm code output Select output status of alarm codes. Alarm codes are outputted to the pins CN1-22, CN1-23, and CN1-24. 0: Disabled 1: Enabled For details of the alarm codes, refer to chapter 8. When "Enabled (absolute position detection system by DIO) (1)" is selected in [Pr. PA03] and when MBR (Electromagnetic brake interlock) or ALM (Malfunction) is assigned to the CN1-22 pin, CN1-23 pin, or CN1-24 pin, selecting alarm code output will generate [AL. Parameter error].	Oh	0	0	0
	x_	Selection of output device at warning occurrence Select ALM (Malfunction) output status at warning occurrence.	0h	0	0	0
		Setting value Device status				
		0 WNG ON OFF ALM ON Warning occurrence				
		1 ALM OFF Warning occurrence				
		For manufacturer setting	0h			
	_ x	For mandiacturer setting	0h			
*DI11L Input device selection 11L	Setting " The para 1) For 1 CN1- CN1- 2) For 3 CN1-	10 pin/CN1-37 pin: Any software version and production month Position control mode - Device selection	7 or later 00h			
	x x	The setting is disabled. Speed control mode - Device selection Pefor to table 5.10 in IPr. PD031 for settings	00h		0	
PD44 *DI11H Input device selection 11H	Setting " The para 1) For 1 CN1- CN1- 2) For 3	Refer to table 5.10 in [Pr. PD03] for settings. It device can be assigned to the CN1-10 pin/CN1-37 pin. 00" will assign PP/PP2 (forward rotation pulse). It device can be assigned to the CN1-10 pin/CN1-37 pin. 00" will assign PP/PP2 (forward rotation pulse). It device can be assigned to the CN1-10 pin/CN1-37 pin. It device can be assigned to the CN1-10 pin/CN1-37 pin. It device can be assigned to the CN1-10 pin/CN1-37 pin. It device can be assigned to the CN1-37 pin. It device can be assigned to the CN1-37 pin. It device can be assigned to the CN1-37 pin. It device can be assigned to the CN1-37 pin. It device can be assigned to the CN1-37 pin. It device can be assigned to the CN1-37 pin. It device can be assigned to the CN1-37 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It device can be assigned to the CN1-30 pin. It	l 7 or later			
	x x	Torque control mode - Device selection	00h			0
		Refer to table 5.10 in [Pr. PD03] for settings.	2			
	x x	For manufacturer setting	3Ah			

No./symbol/	I FUNCTION		Initial value	_	ontro				
name	digit		[unit]	Р	S	Τ			
PD45 *DI12L Input device selection 12L	Setting " The para 1) For 1 CN1- CN1- 2) For 3 CN1-	It device can be assigned to the CN1-35 pin/CN1-38 pin. 00" will assign NP/NP2 (reverse rotation pulse). ameter is available for the following MR-J4ARJ servo amplifiers. 00 W or more 35 pin: Servo amplifiers with software version B3 or later 38 pin: Servo amplifiers manufactured in January 2015 or later with software version B 0 W 35 pin/CN1-38 pin: Any software version and production month Position control mode - Device selection	7 or later						
	^^	The setting is disabled.	0011						
	x x	Speed control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings.	00h		0				
PD46 *DI12H Input device selection 12H	Setting " The para 1) For 1 CN1- CN1- 2) For 3 CN1-	Any input device can be assigned to the CN1-35 pin/CN1-38 pin. Setting "00" will assign NP/NP2 (reverse rotation pulse/manual pulse generator). The parameter is available for the following MR-J4ARJ servo amplifiers. 1) For 100 W or more CN1-35 pin: Servo amplifiers with software version B3 or later CN1-38 pin: Servo amplifiers manufactured in January 2015 or later with software version B7 or later 2) For 30 W CN1-35 pin/CN1-38 pin: Any software version and production month							
	××	Torque control mode - Device selection Refer to table 5.10 in [Pr. PD03] for settings.	00h			0			
	x x	For manufacturer setting	3Bh		\leq				
PD47 *DO7 Output device	Any output device can be assigned to the CN1-13 pin and CN1-14 pin. This parameter is used by MR-J4ARJ servo amplifier with software version B3 or later. This parameter is not available with MR-J4-03A6(-RJ) servo amplifiers.								
selection 7	xx	Device selection Any output device can be assigned to the CN1-13 pin. Refer to table 5.11 in [Pr. PD23] for settings.	00h	0	0	0			
	x x	Device selection Any output device can be assigned to the CN1-14 pin. Refer to table 5.11 in [Pr. PD23] for settings.	00h	0	0	0			

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

No./symbol/ name	Setting digit			Function			Initial Control value mode [unit] P S			е
PE01	x	Fully closed	loop function sele	ection			0h	0	S	Т
*FCT1		The fully clo	sed loop function						\	\
Fully closed loop function selection 1		0: Always er 1: Switching		closed loop contro	selection)					
Selection 1		S	election using			7			1	$ \rangle $
			closed loop contellection (CLD)	trol Conf	rol method					
			Off	Semi clos	sed loop control					
			On	Fully clos	sed loop control					
		mode select	tion" in [Pr. PA01]			1 _)" of "operation				
		[AL. 37] whi position dete	le "absolute positi ection system by	ion detection syste DIO) (1)" in [em selection" is "E Pr. PA03]	Enabled (absolute				
	x_	_	cturer setting	MR-J4-03A6(-RJ)	servo ampimers.		0h			\forall
	_x		· ·				0h			
DEGG	x						0h			\triangle
PE03 *FCT2	x x	-		r detection function ontrol error detection			03h	0		
Fully closed				MR-J4-03A6(-RJ						
loop function selection 2				O. 5						
3CICCIIOTI Z		O: Error detection enabled -: Error detection disabled Position deviation error								
		Setting	Speed	During s		During servo-				
		value	deviation error	With command	Command 0	off				
		00	-	-	-	-				
		01	0	-	-	-				
		02 03	- 0	0	0	0				
		10	-	-	-	-				
		11	0	-	-	-				
		12	-	-	0	-				
		13	0	-	0	-				1
		20 21	-	-	-	-				
		22	<u> </u>	-	0	0				
		23	0	-	0	0				1
	_x		cturer setting				0h			\triangle
	x	_	loop control error	r reset selection owering off/on ena	bled)		0h	0	\	\setminus
		1: Reset ena		owening on/on ena	bieu)					
				MR-J4-03A6(-RJ	-				\	
PE04 *FBN	\setminus	Set a numer closed loop		gear for the servo	motor encoder p	ulse at the fully	1	0	\	\
Fully closed				t the number of se	ervo motor encode	er pulses for one			\	$ \rangle$
loop control -		servo motor	revolution is con-	verted to the resol	ution of the load-s	side encoder.			\	\
Feedback pulse		This parame	eter is not availab	le with MR-J4-03A	.6(-RJ) servo amp	olifiers.				
electronic gear 1 - Numerator		Setting rang	e: 1 to 65535							

No./symbol/	Setting	Function	Initial value		Contro	
name	digit	Tunction	[unit]	Р	S	T
PE05 *FBD Fully closed loop control - Feedback pulse electronic gear 1 -		Set a denominator of electronic gear for the servo motor encoder pulse at the fully closed loop control. Set the electronic gear so that the number of servo motor encoder pulses for one servo motor revolution is converted to the resolution of the load-side encoder. This parameter is not available with MR-J4-03A6(-RJ) servo amplifiers.	1	0		
PE06 BC1 Fully closed loop control - Speed deviation error detection level		Setting range: 1 to 65535 Set [AL. 42.9 Fully closed loop control error by speed deviation] of the fully closed loop control error detection. When the speed deviation between the servo motor encoder and load-side encoder becomes larger than the setting value, the alarm will occur. This parameter is not available with MR-J4-03A6(-RJ) servo amplifiers. Setting range: 1 to 50000	400 [r/min]	0		
PE07 BC2 Fully closed loop control - Position deviation error detection level		Set [AL. 42.8 Fully closed loop control error by position deviation] of the fully closed loop control error detection. When the position deviation between the servo motor encoder and load-side encoder becomes larger than the setting value, the alarm will occur. This parameter is not available with MR-J4-03A6(-RJ) servo amplifiers. Setting range: 1 to 20000	100 [kpulse]	0		
PE08 DUF Fully closed loop dual feedback filter		Set a dual feedback filter band. Refer to section 17.3.1 (7) for details. This parameter is not available with MR-J4-03A6(-RJ) servo amplifiers. Setting range: 1 to 4500	10 [rad/s]	0		
PE10	×	For manufacturer setting	0h		<u> </u>	\angle
FCT3 Fully closed loop function selection 3	x_	Fully closed loop control - Position deviation error detection level - Unit selection 0: 1 kpulse unit 1: 1 pulse unit This digit is not available with MR-J4-03A6(-RJ) servo amplifiers.	0h	0		
	_x	For manufacturer setting	0h			
PE34 *FBN2 Fully closed loop control - Feedback pulse electronic gear 2 -	×	Set a numerator of electronic gear for the servo motor encoder pulse at the fully closed loop control. Set the electronic gear so that the number of servo motor encoder pulses for one servo motor revolution is converted to the resolution of the load-side encoder. Refer to section 17.3.1 (5) for details. This parameter is not available with MR-J4-03A6(-RJ) servo amplifiers.	0h 1	0		
Numerator PE35 *FBD2 Fully closed loop control - Feedback pulse electronic gear 2 - Denominator		Setting range: 1 to 65535 Set a denominator of electronic gear for the servo motor encoder pulse at the fully closed loop control. Set the electronic gear so that the number of servo motor encoder pulses for one servo motor revolution is converted to the resolution of the load-side encoder. Refer to section 17.3.1 (5) for details. This parameter is not available with MR-J4-03A6(-RJ) servo amplifiers. Setting range: 1 to 65535	1	0		

No./symbol/	Setting	Firmation	Initial		Contro	
name	digit	Function	value [unit]	Р	mode S	T
PE41	x	Robust filter selection	0h	0	0	0
EOP3		0: Disabled				
Function		1: Enabled				
selection E-3		When you select "Enabled" of this digit, the machine resonance suppression filter 5				
	x_	set in [Pr. PB51] is not available. For manufacturer setting	0h			
		1 of manufacturer setting	0h			
	x		0h			
PE44		Set the lost motion compensation for when reverse rotation (CW) switches to	0	0	\	
LMCP		forward rotation (CCW) in increments of 0.01% assuming the rated torque as 100%.	[0.01%]		\	\
Lost motion compensation		This parameter is supported with software version B4 or later.				\
positive-side	\					\
compensation					\	$ \ $
value selection	\	Sotting range: 0 to 30000			\	$ \ $
PE45		Setting range: 0 to 30000 Set the lost motion compensation for when forward rotation (CCW) switches to	0	0	\ \	\vdash
LMCN		reverse rotation (CW) in increments of 0.01% assuming the rated torque as 100%.	[0.01%]		[\	\setminus
Lost motion		This parameter is supported with software version B4 or later.				$ \rangle$
compensation negative-side						$ \ $
compensation	\					$ \ $
value	\				\	\
selection	\	Setting range: 0 to 30000			\	\sqcup
PE46 LMFLT	\	Set the time constant of the lost motion compensation filter in increments of 0.1 ms.	0 [0.1 ms]	0	\	\
LiviFL1 Lost motion		If the time constant is "0", the torque is compensated with the value set in [Pr. PE44] and [Pr. PE45]. If the time constant is other than "0", the torque is compensated with	[U. I IIIS]		\	
filter setting	\	the high-pass filter output value of the set time constant, and the lost motion			\	$ \ $
	\	compensation will continue.			\	$ \ $
	\	This parameter is supported with software version B4 or later.			\	$ \ $
	\	Setting range: 0 to 30000				. ∖
PE47	\	Set this when canceling unbalanced torque of vertical axis. Set this assuming the	0	0	0	0
TOF		rated torque of the servo motor as 100%. The torque offset does not need to be set for a machine not generating unbalanced	[0.01%]			
Torque offset		torque. The torque offset cannot be used for linear servo motors and direct drive motors. Set 0.00%.				
	\	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.				
	\	This parameter is supported with software version B4 or later.				
	\					
		Setting range: -10000 to 10000				
PE48	x	Lost motion compensation selection	0h	0	\setminus	\setminus
*LMOP Lost motion		0: Disabled 1: Enabled			\	$ \setminus $
compensation		This parameter is supported with software version B4 or later.			$ \ $	$ \ $
function	x_	Unit setting of lost motion compensation non-sensitive band	0h	0	Γ,	\Box
selection	- -	0: 1 pulse unit		-	\	$ \setminus $
		1: 1 kpulse unit			\	$ \ $
		This parameter is supported with software version B4 or later.	Oh		\vdash	\vdash
	_ x	For manufacturer setting	0h 0h			\vdash
PE49	<u> </u>	Set the lost motion compensation timing in increments of 0.1 ms.	0	0	\vdash	\vdash
LMCD		You can delay the timing to perform the lost motion compensation for the set time.	[0.1 ms]		\	
Lost motion		This parameter is supported with software version B4 or later.			\	\
compensation		Setting range: 0 to 30000			\	\
timing		Setting range: 0 to 30000			L \	$ldsymbol{\sqcup}$

No./symbol/ name	Setting digit	Function	Initial value [unit]	_	ontr mode S	
PE50 LMCT Lost motion compensation non-sensitive band		Set the lost motion compensation non-sensitive band. When the fluctuation of the droop pulse is the setting value or less, the speed will be 0. Setting can be changed in [Pr. PE48]. Set the parameter per encoder unit. This parameter is supported with software version B4 or later. Setting range: 0 to 65535	0 [pulse]/ [kpulse]	0		

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

No./symbol/	Setting digit		Fun	ction	Initial value	_	Contro mode	-
name	digit		lectronic dynamic brake selection					
PF09 *FOP5 Function selection F-5	x	0: Automation 2: Disabled	ynamic brake selection c (enabled only for specified se following table for the specifie	•	0h	0	0	
				Servo motor				
		HG-KR		13/HG-KR23/HG-KR43				
		HG-MF		13/HG-MR23/HG-MR43				
		HG-SR						
		HG-AK	HG-AK0136/HG-AK	.0236/HG-AK0336				
	x_	For manufac	cturer setting		0h			
	_x				0h			
	x				0h			
PF15 DBT Electronic dynamic brake operating time		·	ating time for the electronic dynamic dynamic et a second control of the electronic dynamic dynamic et a second control of the electronic et a second control of elect	2000 [ms]	0	0	0	
PF18 *STOD STO diagnosis error detection time		the detection When 0 s is performed.	n of [AL. 68.1 Mismatched ST0	Mismatched STO signal error] is not	0 [s]	0	0	0
		Setting value	STO input diagnosis by TOFE output	Safety level				
		0	Execute	EN ISO 13849-1 category 3 PL d, IEC 61508 SIL 2, EN 62061 SIL CL2				
	\		Not execute		1			
	\	1 to 60	Execute	EN ISO 13849-1 category 3 PL e, IEC 61508 SIL 3, EN 62061 SIL CL3				
			Not execute	EN ISO 13849-1 category 3 PL d, IEC 61508 SIL 2, EN 62061 SIL CL2				
		parameter. Navailable. For Manual".	When MR-D30 functional safet or safety levels at the time of under the savailable with servo amp	cted to the CN8 connector, set "0" in the ty unit is used, the parameter is not sing MR-D30, refer to "MR-D30 Instruction blifiers with software version C1 or later.				

No./symbol/	Setting	Function	Initial value	_	ontro	-
name	digit		[unit]	Р	S	Т
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 settling 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]	0	0	0
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 [%]	0	0	
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	0	0	
	x_	For manufacturer setting	0h			
	_×		0h			
PF25 CVAT SEMI-F47 function - Instantaneous power failure detection time	X	Set the time of the [AL. 10.1 Voltage drop in the control circuit power] occurrence. This parameter setting range differs depending on the software version of the servo amplifier as follows. Software version C0 or earlier: Setting range 30 ms to 200 ms Software version C1 or later: Setting range 30 ms to 500 ms To comply with SEMI-F47 standard, it is unnecessary to change the initial value (200 ms). However, when the instantaneous power failure time exceeds 200 ms, and the instantaneous power failure voltage is less than 70% of the rated input voltage, the power may be normally turned off even if a value larger than 200 ms is set in the parameter. To disable the parameter, set "Disabled (_ 0)" of "SEMI-F47 function selection" in [Pr. PA20]. This parameter is not available with MR-J4-03A6(-RJ) servo amplifiers. Setting range: 30 to 500	0h 200 [ms]	0	0	0

No./symbol/ name	Setting digit	Function	Initial value [unit]	_	ontro mode S	
PF31 FRIC Machine diagnosis function - Friction judgement speed		Set a (linear) servo motor speed that divides a friction estimation area into high and low during the friction estimation process of the machine diagnosis. Setting "0" will set a value half of the rated speed. When your operation pattern is under the rated speed, we recommend that you set a half value of the maximum speed. Forward rotation direction (Positive direction) Servo motor speed (Union speed) Reverse rotation direction (Negative direction) Setting range: 0 to permissible speed	0 [r/min]/ [mm/s]	0	0	0
PF34	x	For manufacturer setting	0h			
*SOP3 RS-422	x		0h 0h		\langle	$\overline{}$
communi- cation function selection 3	x	MR-PRU03 selection Select this if using an MR-PRU03. 0: Disabled 1: Enabled This parameter setting is used with servo amplifier with software version B3 or later. This digit is not available with MR-J4-03A6(-RJ) servo amplifiers.	0h	0	/0	0

5.2.7 Linear servo motor/DD motor setting parameters ([Pr. PL_ _])

POINT

●Linear servo motor/DD motor setting parameters ([Pr. PL__]) cannot be used with MR-J4-03A6(-RJ) servo amplifiers.

No./symbol/	Setting digit			Function		Initial value	١	Contro mode)
	_					[unit]	Р	S	Τ
PL01 *LIT1 Linear servo motor/DD motor	x	The setting val 0: Magnetic po 1: Magnetic po	notor/DD motor magne lue "0" will be enabled ble detection disabled ble detection at first sel ble detection at every s	only with absolute po	ection sition linear encoders.	1h	0	0	0
function	x_	For manufactu	-			0h			
selection 1		Stop interval so	election at the home p rval of the home positi abled only for linear se pulses 72) pulses 14) pulses 176) pulses 1804) pulses 1804) pulses		3h	0	0	0	
	x	For manufactu				0h			
PL02 *LIM Linear encoder resolution -		Set the numera This is enabled	coder resolution with t ator in [Pr. PL02]. d only for linear servo	02] and [Pr. PL03].	1000 [µm]	0	0	0	
Numerator PL03	\	Setting range:	coder resolution with t	be estinge of IDs. DI	001 and IDs DI 001	1000		_	
*LID Linear encoder resolution - Denominator		Set the denom	inator in [Pr. PL03]. d only for linear servo		ozj anu (i 1. 1 E00).	[µm]	0	0	0
PL04 *LIT2	x	[AL. 42 Servo of Refer to the following statement of the following statemen	control error] detectior llowing table.	n function selection		3h	0	0	0
Linear servo motor/DD motor		Setting value d	Torque/thrust eviation error (Note)	Speed deviation error (Note)	Position deviation error (Note)				
function selection 2		0		Disabled	Disabled Enabled				
		3	Disabled	Enabled	Disabled Enabled				
		4 5		Disabled	Disabled Enabled				
		6 7	Enabled	Enabled	Disabled Enabled				
		Note. Refer	to chapter 15 and 16 f	or details of each dev	iation error.				
	x_	For manufactu	rer setting			0h 0h			
	x		led (reset by powering		eset condition selection	0h	0	0	/ 0

Setting	Function	Initial value	_	ontro node	-
digit		[unit]	Р	S	Т
	Set the position deviation error detection level of the servo control error detection. When the deviation between a model feedback position and actual feedback position is larger than the setting value, [AL. 42 Servo control error] will occur. However, when "0" is set, the level vary depending on the operation mode in [Pr. PA01]. Linear servo motor: 50 mm Direct drive motor: 0.09 rev Setting range: 0 to 1000	0 [mm]/ [0.01 rev]	0		
	Set the speed deviation error detection level of the servo control error detection. When the deviation between a model feedback speed and actual feedback speed is larger than the setting value, [AL. 42 Servo control error] will occur. However, when "0" is set, the level vary depending on the operation mode in [Pr. PA01]. Linear servo motor: 1000 mm/s Direct drive motor: 100 r/min Setting range: 0 to 5000	0 [mm/s]/ [r/min]	0	0	
	Set the torque/thrust deviation error detection level of the servo control error detection. When the deviation between a current command and current feedback is larger than the setting value, [AL. 42.3 Servo control error by torque/thrust deviation] will occur. Setting range: 0 to 1000	100 [%]	0	0	0
x	Magnetic pole detection method selection 0: Position detection method	0h	0	0	0
		46		_	
_x	Magnetic pole detection - Stroke limit enabled/disabled selection 0: Enabled 1: Disabled	0h	0	0	0
x	For manufacturer setting	0h		$\overline{}$	
	Set a direct current exciting voltage level during the magnetic pole detection. If [AL. 32 Overcurrent], [AL. 50 Overload 1], or [AL. 51 Overload 2] occurs during the magnetic pole detection, decrease the setting value. If [AL. 27 Initial magnetic pole detection error] occurs during the magnetic pole detection, increase the setting value.	30 [%]	0	0	0
	x	Set the position deviation error detection level of the servo control error detection. When the deviation between a model feedback position and actual feedback position is larger than the setting value, [AL. 42 Servo control error] will occur. However, when "0" is set, the level vary depending on the operation mode in [Pr. PA01]. Linear servo motor: 50 mm Direct drive motor: 0.09 rev Setting range: 0 to 1000 Set the speed deviation error detection level of the servo control error detection. When the deviation between a model feedback speed and actual feedback speed is larger than the setting value, [AL. 42 Servo control error] will occur. However, when "0" is set, the level vary depending on the operation mode in [Pr. PA01]. Linear servo motor: 1000 mm/s Direct drive motor: 1000 r/min Setting range: 0 to 5000 Set the torque/thrust deviation error detection level of the servo control error detection. When the deviation between a current command and current feedback is larger than the setting value, [AL. 42.3 Servo control error by torque/thrust deviation] will occur. Setting range: 0 to 1000 Magnetic pole detection method 4: Minute position detection method 5: Por manufacturer setting Magnetic pole detection - Stroke limit enabled/disabled selection 6: Enabled 7: Disabled 7: Disabled 7: Disabled 8: A direct current exciting voltage level during the magnetic pole detection. If [AL. 27 Initial magnetic pole detection error] occurs during the magnetic pole	Set the position deviation error detection level of the servo control error detection. When the deviation between a model feedback position and actual feedback position is larger than the setting value, [AL. 42 Servo control error] will occur. However, when "0" is set, the level vary depending on the operation mode in [Pr. PA01]. Linear servo motor: 50 mm Direct drive motor: 0.09 rev Setting range: 0 to 1000 Set the speed deviation between a model feedback speed and actual feedback speed is larger than the setting value, [AL. 42 Servo control error] will occur. However, when "0" is set, the level vary depending on the operation mode in [Pr. PA01]. Linear servo motor: 1000 mm/s Direct drive motor: 1000 mm/s Direct drive motor: 100 r/min Setting range: 0 to 5000 Set the torque/thrust deviation error detection level of the servo control error detection. When the deviation between a current command and current feedback is larger than the setting value, [AL. 42.3 Servo control error by torque/thrust deviation] will occur. Setting range: 0 to 1000 x Magnetic pole detection method selection 0: Position detection method 4: Minute position detection method x For manufacturer setting X For manufacturer setting Set a direct current exciting voltage level during the magnetic pole detection. If [AL. 32 Overcurent], [AL. 50 Overload 1], or [AL. 51 Overload 2] occurs during the magnetic pole detection, increase the setting value.	Set the position deviation error detection level of the servo control error detection. When the deviation between a model feedback position and actual feedback position is larger than the setting value, [AL. 42 Servo control error] will occur. However, when "0" is set, the level vary depending on the operation mode in [Pr. PA01]. Linear servo motor: 50 mm Direct drive motor: 0.09 rev Setting range: 0 to 1000 Set the speed deviation error detection level of the servo control error detection. When the deviation between a model feedback speed and actual feedback speed is larger than the setting value, [AL. 42 Servo control error] will occur. However, when "0" is set, the level vary depending on the operation mode in [Pr. PA01]. Linear servo motor: 1000 mm/s Direct drive motor: 1000 mm/s Direct drive motor: 100 r/min Setting range: 0 to 5000 Set the torque/thrust deviation error detection level of the servo control error detection. When the deviation between a current command and current feedback is larger than the setting value, [AL. 42.3 Servo control error by torque/thrust deviation] will occur. Setting range: 0 to 1000 x Magnetic pole detection method 4: Minute position detection method 4: Minute position detection method -x- For manufacturer setting Magnetic pole detection - Stroke limit enabled/disabled selection 0: Position detection method 1: Disabled Set the position deviation error detection level of the servo control error detection. When the deviation between a model feedback position and actual feedback position is larger than the setting value, [AL. 42 Servo control error] will occur. However, when "0" is set, the level vary depending on the operation mode in [Pr. PA01]. Linear servo motor: 50 mm Direct drive motor: 0.09 rev Setting range: 0 to 1000 Set the speed deviation error detection level of the servo control error detection. When the deviation between a model feedback speed and actual feedback speed is larger than the setting value, [AL. 42 Servo control error] will occur. However, when "0" is set, the level vary depending on the operation mode in [Pr. PA01]. Linear servo motor: 1000 mm/s Direct drive motor: 1000 r/min Setting range: 0 to 5000 Set the torque/thrust deviation error detection level of the servo control error detection. When the deviation between a current command and current feedback is larger than the setting value, [AL. 42.3 Servo control error by torque/thrust deviation] will occur. Setting range: 0 to 1000 x Magnetic pole detection method 4: Minute position detection method 4: Minute position detection method 4: Minute position detection method 1: Disabled The part of the servo control error by torque/thrust deviation] will occur. Set a direct current exiting Set a direct current exiting voltage level during the magnetic pole detection. If [AL. 27 Initial magnetic pole detection error] occurs during the magnetic pole detection, increase the setting value.	

No./symbol/	Setting digit	Function	Initial value		ontro	
name	digit		[unit]	Р	S	Τ
PL17 LTSTS Magnetic pole detection - Minute	x	Response selection Set a response of the minute position detection method. When reducing a travel distance at the magnetic pole detection, increase the setting value. Refer to table 5.12 for settings.	0h	0	0	0
position	x_	Load to motor mass ratio/load to motor inertia ratio selection	0h	0	0	0
detection method - Function selection		Select a load to mass of the linear servo motor primary-side ratio or load to mass of the direct drive motor inertia ratio used at the minute position detection method. Set a closest value to the actual load. Refer to table 5.13 for settings.				
	_x	For manufacturer setting	0h		$\overline{}$	
	x		0h			
		Table 5.12 Response of minute position detection method at magnetic pole detection		0	0	0
		Setting value Response Setting value Response				
		0 Low response 8 Middle response				
		A				
		B				
		4				
		<u></u>				
		7 Middle responseF High response				
		Table 5.13 Load to motor mass ratio/load to motor inertia ratio				
		Setting value Load to motor mass ratio/load to motor inertia ratio Setting value Load to motor mass ratio/load to motor inertia ratio				
		0 _ 10 times or less 8 _ 80 times				
		1_ 10 times9_ 90 times				
		2_ 20 timesA_ 100 times				
		3_ 30 timesB_ 110 times				
		4_ 40 times C_ 120 times				
		5 50 timesD 130 times				
		6 60 timesE 140 times				
		7_ 70 timesF_ 150 times or more				
PL18 IDLV Magnetic pole detection - Minute position detection method - Identification signal amplitude		Set an identification signal amplitude used in the minute position detection method. This parameter is enabled only when the magnetic pole detection is the minute position detection method. Setting "0" will be 100% amplitude. Setting range: 0 to 100	0 [%]	0	0	0

5.2.8 Option setting parameters ([Pr. Po $_$])

No./symbol/ name	Setting digit			Functio	n		Initial value [unit]		Controde	е
Po02		device can be assigned to the CN10-21 pin and CN10-26 pin.						Р	S	Т
*ODI1 MR-D01 input device selection 1	x x	CN10-21 select Select an input Refer to table	ction t signal function 5.14 for setting er setting is ava	n of the CN10-21	1 pin.	amplifiers with software	02h	0	0	0
	x x	CN10-26 select Select an input Refer to table	ction t signal function 5.14 for setting er setting is ava			amplifiers with software	03h	0	0	0
		Tal		ectable input		_				
		Setting								
		value	P	S	T	ł				
		02 03	SON RES	SON RES	SON RES					
		03	PC	PC PC	RES					
		05	TL	TL						
		06	CR							
		07		ST1	ST1					
		08		ST2	011					
		09	TL1	TL1						
		0A	LSP	LSP	RS2					
		0B	LSN	LSN	RS1					
		0D	CDP	CDP						
		0E	CLD							
		0F	MECR							
		20		SP1	SP1					
		21		SP2	SP2					
		22		SP3	SP3					
		23	LOP	LOP	LOP					
		24	CM1							
		25	CM2							
		26		STAB2	STAB2					ļ
				•		: Torque control mode lever change the setting	ļ.			
Po03	Any inpu			e CN10-27 pin a	and CN10-28 pin		1			
*ODI2 MR-D01 input device	x x		t signal function	n of the CN10-27			05h	0	0	0
selection 2			r setting is ava	02] for setting va ilable with MR-J		amplifiers with software				
	x x	CN10-28 sele					09h	0	0	0
		Select an inpu	t signal function	n of the CN10-28	3 pin.					
			r setting is ava	02] for setting va ilable with MR-J		amplifiers with software				

No./symbol/ name	Setting digit	Function	Initial value		Contro	
name	digit		[unit]	Р	S	Т
Po04		t device can be assigned to the CN10-29 pin and CN10-30 pin.				
*ODI3 MR-D01 input device selection 3	xx	CN10-28 selection Select an input signal function of the CN10-28 pin. Refer to table 5.14 in [Pr. Po02] for setting values. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	24h	0	0	0
	x x	CN10-30 selection Select an input signal function of the CN10-30 pin. Refer to table 5.14 in [Pr. Po02] for setting values. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	25h	0	0	0
Po05	Any inpu	t device can be assigned to the CN10-31 pin and CN10-32 pin.		_	_	
*ODI4 MR-D01 input device selection 4	xx	CN10-31 selection Select an input signal function of the CN10-31 pin. Refer to table 5.14 in [Pr. Po02] for setting values. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	26h	0	0	0
	xx	CN10-32 selection Select an input signal function of the CN10-32 pin. Refer to table 5.14 in [Pr. Po02] for setting values. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	20h	0	0	0
Po06	Any inpu	t device can be assigned to the CN10-33 pin and CN10-34 pin.		1		1
*ODI5 MR-D01 input device selection 5	xx	CN10-33 selection Select an input signal function of the CN10-33 pin. Refer to table 5.14 in [Pr. Po02] for setting values. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	27h	0	0	0
	x x	CN10-34 selection Select an input signal function of the CN10-34 pin. Refer to table 5.14 in [Pr. Po02] for setting values. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	04h	0	0	0
Po07	Any inpu	t device can be assigned to the CN10-35 pin and CN10-36 pin.				
*ODI6 MR-D01 input device selection 6	x x	CN10-35 selection Select an input signal function of the CN10-35 pin. Refer to table 5.14 in [Pr. Po02] for setting values. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	07h	0	0	0
	x x	CN10-36 selection Select an input signal function of the CN10-36 pin. Refer to table 5.14 in [Pr. Po02] for setting values. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	08h	0	0	0

No./symbol/ name	Setting digit		Function						Contro	
Hame	digit		[unit]	Р	S	T				
Po08	Any output device can be assigned to the CN10-46 pin and CN10-47 pin. x x CN10-46 selection									
*ODO1	x x	26h	0	0	0					
MR-D01			-	on of the CN10-4	l6 pin.					
output device selection 1			5.15 for setting							
3CICCIOII I		This paramete version B7 or		ilable with MR-J4	IARJ servo	amplifiers with software				
	V V	CN10-47 sele					27h	0	0	
	x x			on of the CN10-4	17 nin		2711			0
			5.15 for setting		,, biii.					
					I- A -RJ servo	amplifiers with software				
		version B7 or								
		Tab	ole 5.15 Sele	ctable output	devices					
				utput device (No		1				
		Setting value	P	S	.e, T					
		00	Always off	Always off	Always off					
		02	RD	RD	RD					
		03	ALM	ALM	ALM					
		04	INP	SA	Always off					
		05	MBR	MBR	MBR					
		06	DB	DB	DB					
		07	TLC	TLC	VLC					
		08	WNG	WNG	WNG					
		09	BWNG	BWNG	BWNG					
		0A	Always off	SA	Always off					
		0B	Always off	Always off	VLC					
		0C	ZSP	ZSP	ZSP					
		0D	MTTR	MTTR	MTTR					
		0F	CDPS	Always off	Always off					
		10	CDLS	Always off	Always off					
		11	ABSV	Always off	Always off					
				· ·	•	: Torque control mode				
						lever change the setting				
Po09				he CN10-48 pin	and CN10-49 pi	n.	001	Ι_		
*ODO9 MR-D01	x x	CN10-48 sele		f th ONIAO /	10		23h	0	0	0
output device			5.15 in [Pr. Po0	on of the CN10-4	ιο μπ.					
selection 2			•		I- A -R.I servo	amplifiers with software				
		version B7 or	-			and a man continue				
	x x	CN10-49 sele	ction				04h	0	0	0
				on of the CN10-4	19 pin.					
			5.15 in [Pr. Po0							
				ilable with MR-J	IARJ servo	amplifiers with software				
		version B7 or	later.							

No./symbol/ name	Setting digit	Function	Initial value [unit]	_	Contro mode	
Po11	Select th	e input devices of the analog speed command, analog speed limit and torque limit.		1		
*OOP2	x	For manufacturer setting	0h			
Function selection O-2	x_	Override input CN1-2/CN20-2 switching selection 0: CN1-2 pin enabled 1: CN20-2 pin enabled Setting "1" when no MR-D01 has been connected will trigger [AL. 37]. This parameter setting is available with MR-J4- A -RJ servo amplifiers with software	0h	0	0	0
		version B7 or later.				
	_x	Torque limit CN1-27/CN20-12 switching selection 0: CN1-27 pin enabled 1: CN20-12 pin enabled Setting "1" when no MR-D01 has been connected will trigger [AL. 37]. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	0h	0	0	0
	x	For manufacturer setting	0h			
Po12	Select ar	n alarm code output setting and an M code output setting.				
*OOP3 Function selection O-3	x	MR-D01 alarm code output 0: Disabled 1: Enabled Selecting "1" in this digit will output an alarm code when an alarm occurs. This parameter setting is available with servo amplifiers with software version B7 or later. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	Oh	0	0	0
	x_	For manufacturer setting	0h	0		
	_x		0h			
	x		0h			

No./symbol/	Setting	Function Initial Control value mode									
name	digit		i unction					[unit]	P	S	Т
Po13	Set a sig	nal to outpu	ut to Analog monitor 1.					•			
*OMOD1	x x		Analog monitor 1 output selection						0	0	0
MR-D01 analog			ble 5.16 for settings.			61					
monitor 1		This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.									
output	_ x For manufacturer setting					0h					
selection	x		,					0h			abla
			Table 5.16 Analog monitor setting value					1			
			3 1 1 1		Oper	atio	n				
					de (
		Setting	Item	ard	Full.	Lin.	DD				
		value		Standard	ш						
		00	(Linear) servo motor speed (±8 V/max. speed)	0	0	0	0				
		01	Torque or thrust (±8 V/max. torque or max. thrust) (Note 3)	0	0	0	0				
		02	(Linear) servo motor speed (+8 V/max. speed)	0	0	0	0				
		03	Torque or thrust (+8 V/max. torque or max. thrust) (Note 3)	0	0	0	0				
		04	Current command (±8 V/max. current command)	0	0	0	0				
		05	Command pulse frequency (±10 V/±4 Mpulses/s)	0	0	0	0				
		⁰⁶	Servo motor-side droop pulses (±10 V/100 pulses) (Note 2)	0	0	0	0				
		07	Servo motor-side droop pulses (±10 V/1000 pulses) (Note 2)	0	0	0	0				
		08	Servo motor-side droop pulses (±10 V/10000 pulses) (Note 2)	0	0	0	0				
		09	Servo motor-side droop pulses (±10 V/100000 pulses) (Note 2)	0	0	0	0				
		0 A	Feedback position (±10 V/1 Mpulses) (Note 2)	0							
			Feedback position (±10 V/10 Mpulses) (Note 2)	0							
			Feedback position (±10 V/100 Mpulses) (Note 2)	0	$\stackrel{\circ}{\nearrow}$	$\stackrel{\circ}{\nearrow}$	$\stackrel{\circ}{\searrow}$				
		⁰ D	Bus voltage (200 V class and 100 V class: +8 V/400 V, 400 V class: +8 V/800 V)	0	0	0	0				
		0E	Speed command 2 (±8 V/max. speed)	0	0	0	0				
			Load-side droop pulses (±10 V/100 pulses) (Note 2)		0						
		11	Load-side droop pulses (±10 V/1000 pulses) (Note 2)		0						
			Load-side droop pulses (±10 V/10000 pulses) (Note 2)		0						
			Load-side droop pulses (±10 V/100000 pulses) (Note 2)		0						
			Load-side droop pulses (±10 V/1 M pulses) (Note 2)		0						
			Servo motor-side/load-side position deviation (±10 V/100000 pulses)		0						
		16	Servo motor-side/load-side speed deviation (±8 V/max. speed)		0						
		17	Internal temperature of encoder (±10 V/±128 °C)	0	0		0				
		2.	Items with \bigcirc are available for each operation mode. Standard: Standard (semi closed loop system) use of the Full.: Fully closed loop system use of the rotary servo mod Lin.: Linear servo motor use DD: Direct drive (DD) motor use Encoder pulse unit	tor							
			8 V is outputted at the maximum torque. However, when [torque, 8 V is output at the torque highly limited.	Pr. I	PA1	1] ar	nd [Pi	r. PA12] a	re set	to lir	nit

No./symbol/ name	Setting	Setting digit Function			Contro	
Hame	digit		[unit]	Р	S	Т
Po14 OMOD2 MR-D01	Set a sig	nal to output to Analog monitor 2. Analog monitor 2 output selection Select a signal to output to MO2 (Analog monitor 2).	00h	0	0	0
analog monitor 2 output		Refer to [Pr. Po13] for settings. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.				
selection	_ x	For manufacturer setting	0h 0h			
Po15 OMO1 MR-D01 analog monitor 1 offset		This is used to set the offset voltage of MO1 (Analog monitor 1). This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later. Setting range: -9999 to 9999	0 [mV]	0	0	0
Po16 OMO2 MR-D01 analog monitor 2 offset		This is used to set the offset voltage of MO2 (Analog monitor 2). This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later. Setting range: -9999 to 9999	0 [mV]	0	0	0
Po21 OVCO MR-D01 analog speed command offset/Analog speed limit		This is used to set the offset voltage of the analog speed command offset and Analog speed limit offset. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	0 [mV]		0	0
Po22 OTLO MR-D01 analog torque		Setting range: -9999 to 9999 This is used to set the offset voltage of the analog torque limit. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	0 [mV]	0	0	0
limit offset Po27	Anvinnu	Setting range: -9999 to 9999 t device can be assigned to the CN10-18 pin and CN10-19 pin.				<u> </u>
*ODI7 MR-D01 input device selection 7	x x	CN10-18 selection Select an input signal function of the CN10-18 pin. Refer to table 5.14 in [Pr. Po02] for setting values. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	2Ch	0	0	0
	x x	CN10-19 selection Select an input signal function of the CN10-19 pin. Refer to table 5.14 in [Pr. Po02] for setting values. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	2Dh	0	0	0
Po28	Any inpu	t device can be assigned to the CN10-20 pin.		1		
*ODI8 MR-D01 input device selection 8		CN10-20 selection Select an input signal function of the CN10-20 pin. Refer to table 5.14 in [Pr. Po02] for setting values. This parameter setting is available with MR-J4ARJ servo amplifiers with software version B7 or later.	2Eh	0	0	0
	x x	For manufacturer setting	00h			\setminus

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.
- ■When you use a linear servo motor, replace the following left words to the right words.

Load to motor inertia ratio \rightarrow Load to motor mass ratio

Torque \rightarrow Thrust

(Servo motor) speed → (Linear servo motor) speed

6.1 Different adjustment methods

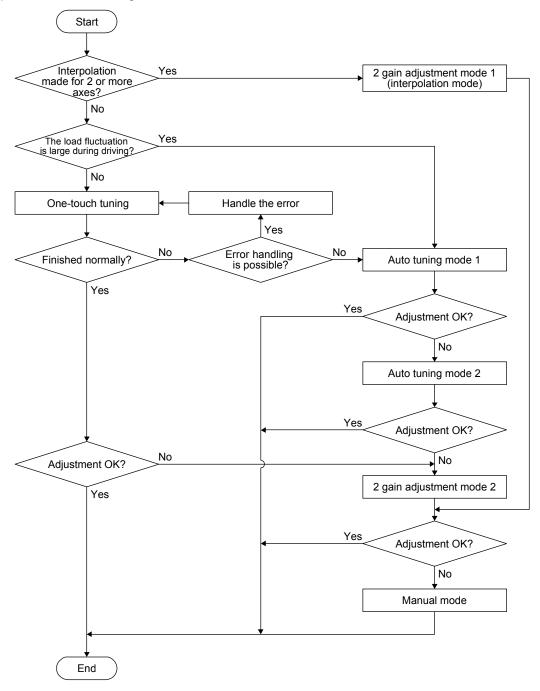
6.1.1 Adjustment on a single servo amplifier

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

- ●When executing the one-touch tuning, check the [Pr. PA21 One-touch tuning function selection] is "_ _ 1" (initial value).
- 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.
- ■The amplifier command method can be used with the servo amplifier with software version C1 or later and MR Configurator2 with software version 1.45X or later.
- ■When the one-touch tuning is executed in the amplifier command method, MR Configurator2 is required.
- For MR-J4-03A6(-RJ) servo amplifier, one-touch tuning by the amplifier command method is not available.

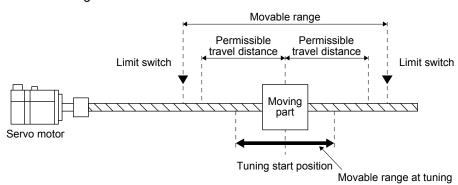
The one-touch tuning includes two methods: the user command method and the amplifier command method.

(1) User command method

You can execute the one-touch tuning with MR Configurator2 or push buttons. The user command method performs one-touch tuning by inputting commands from outside the servo amplifier.

(2) Amplifier command method

You can execute the one-touch tuning with MR Configurator2. 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].

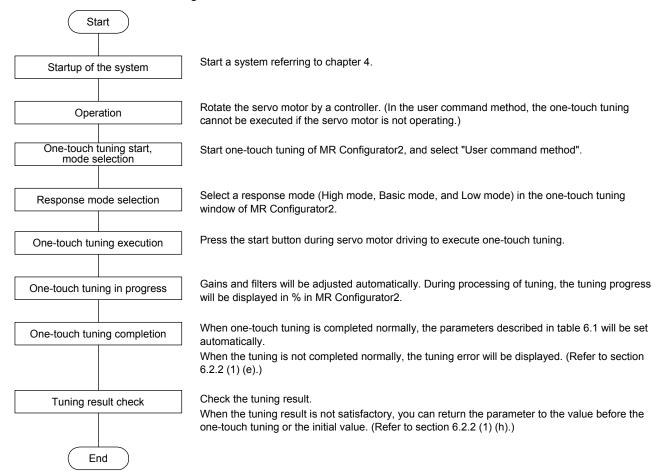
Table 6.1 List of parameters automatically set with one-touch tuning

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

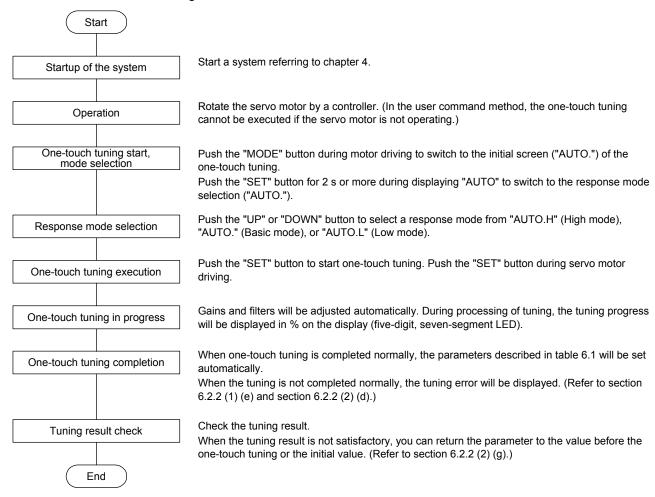
Parameter	Symbol	Name
PB15	NH2	Machine resonance suppression filter 2
PB16	NHQ2	Notch shape selection 2
PB17	NHF	Shaft resonance suppression filter
PB18	LPF	Low-pass filter setting
PB19	VRF11	Vibration suppression control 1 - Vibration frequency
PB20	VRF12	Vibration suppression control 1 - Resonance 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

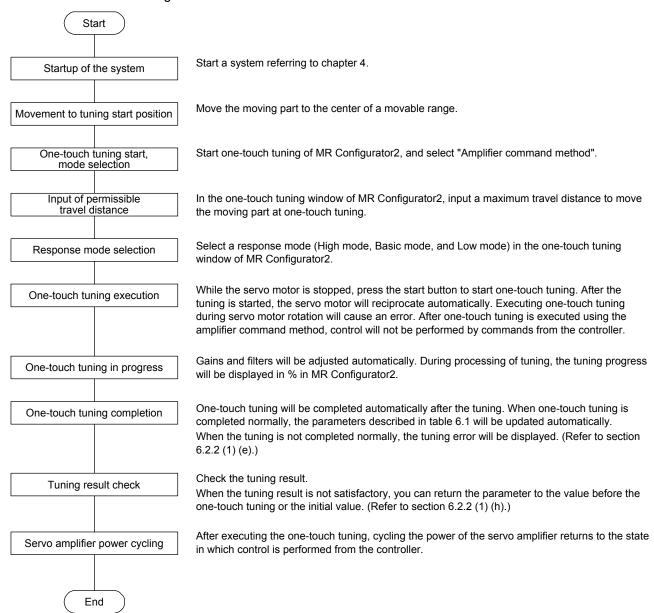
- (1) User command method
 - (a) When you use MR Configurator2Make one-touch tuning as follows.



(b) When you use push buttonsMake one-touch tuning as follows.

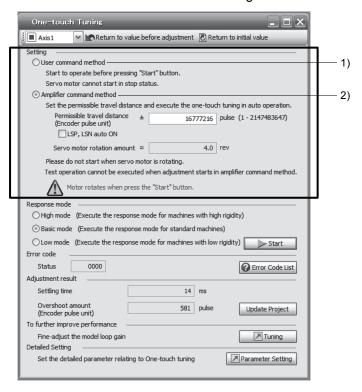


(2) Amplifier command method Make one-touch tuning as follows.



- 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.

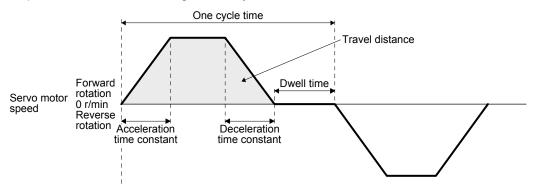


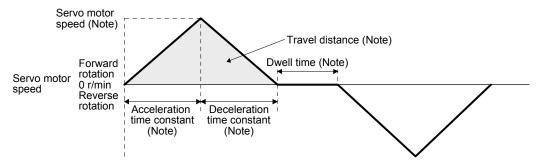
Fig. 6.1 Recommended command for one-touch tuning in the user command method

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 (mm/s) 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 (mm/s) 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 load-side resolution unit for the fully closed loop control mode, and in the servo motor-side resolution unit for other control modes. In the amplifier command method, the servo motor will be operated in a range between "current value \pm 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.

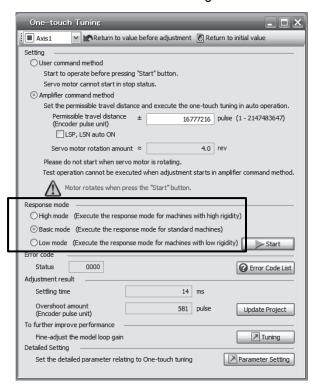
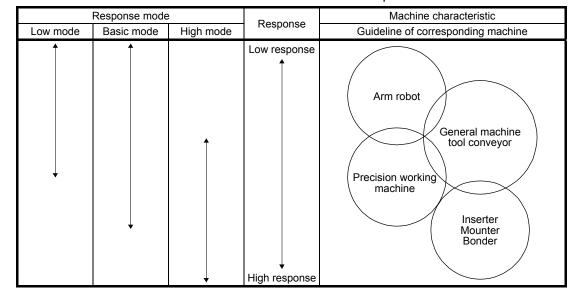


Table 6.2 Response mode explanations

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



(c) One-touch tuning execution

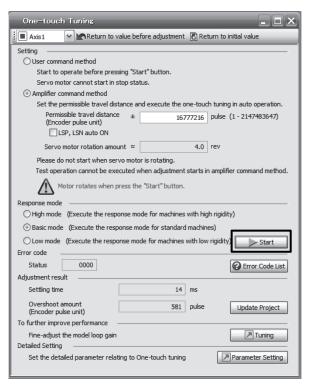
POINT

- 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 you turn off EM2, LSP, and LSN 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.
- ■When one-touch tuning is executed in the amplifier command method while magnetic pole detection is not being performed, magnetic pole detection will be performed, and then one-touch tuning will start after the magnetic pole detection is completed.

After the response mode is selected in (1) (b) in this section, clicking the start button will start one-touch tuning. If the start button 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 the start button to start the one-touch tuning in the amplifier command method with 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.

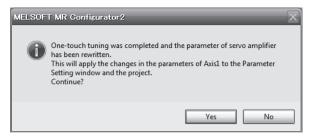
After one-touch tuning is executed using the amplifier command method, control will not be performed by commands from the controller. To return to the state in which control is performed from the controller, cycle the power.



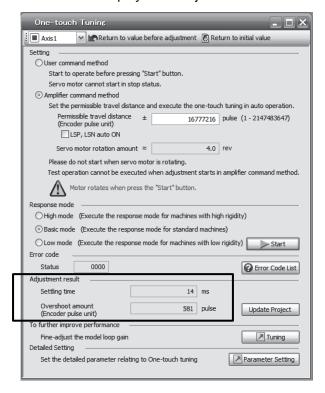
During processing of one-touch tuning, the progress will be displayed as follows. Tuning will be completed at 100%.



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. If the one-touch tuning is stopped, "C000" will be 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. To stop one-touch tuning, and execute it 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	The one-touch tuning was attempted while the torque control mode was selected in the control modes. During one-touch tuning, the control mode was attempted to change from the position control mode to the speed control mode.	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.
C004	Time-out	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.
		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	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 (mm/s) is 5 s or less. Speed is 150 r/min (mm/s) or higher. The load to servo motor (mass of linear servo motor's primary side or direct drive motor) inertia ratio is 100 times or less. The acceleration/deceleration torque is 10% or more of the rated torque.
		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]. • Set [Pr. PB06 Load to motor inertia ratio/load to motor mass ratio] properly with manual setting.

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 (mm/s) 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 (mm/s) (50 r/min for direct drive motor) 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 (mm/s) (50 r/min for direct drive motor) 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 (mm/s) (50 r/min for direct drive motor) or higher, select "Auto tuning mode 2 (2)", "Manual mode (3)", or "2 gain adjustment mode selection" in [Pr. PA08].
0000	0,	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 tuning, one-touch 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.

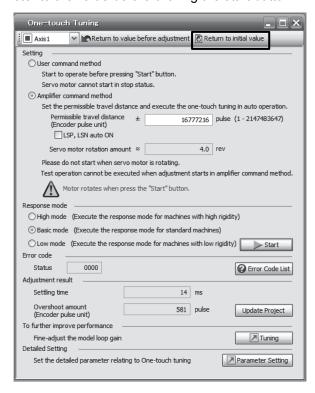
(g) If a warning occurs

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 the start button.



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



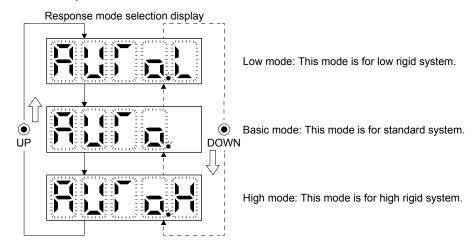
(2) When you use push buttons

POINT

- Push the "MODE" and "SET" buttons at the same time for 3 s or more to switch to the response mode selection ("AUTO.") without going through the initial screen of the one-touch tuning ("AUTO").
- •When you use push buttons, one-touch tuning can be executed in the user command method only. Tuning cannot be executed in the amplifier command method with the buttons.

(a) Response mode selection

Select a response mode of the one-touch tuning from 3 modes with "UP" or "DOWN". Refer to (1) (b) of this section for a guideline of response mode.

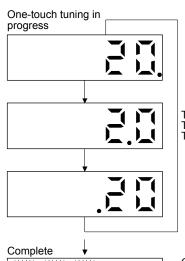


(b) One-touch tuning execution

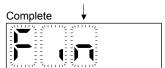
POINT

● 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.

After the response mode is selected in (a), pushing the "SET" button will start one-touch tuning.

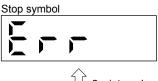


The one-touch tuning progress is displayed with 0% to 100%. The decimal point moves left to right in rotation during the tuning. To switch the display to the status display during the tuning, push the "MODE" button.



Completing the one-touch tuning will start writing the auto-tuned parameters to the servo amplifier.

(c) Stop of one-touch tuning



The one-touch tuning mode can be stopped by pushing the "SET" button regardless of displayed item.



The stop symbol and error code "C 000" (cancel during tuning) will be displayed by turns with 2 s interval.



Pushing the "SET" button will switch to the initial screen.



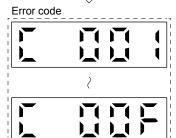


(d) If an error occurs

Stop symbol

If an error occurs during the one-touch tuning, the tuning will be forcibly terminated and the stop symbol and error code from "C 001" to "C 00F" will be displayed by turns with 2 s interval

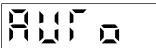




Check the error cause referring to the table 6.2 of (1) (e) of this section.

↓ Pushing the "SET" button will switch to the initial screen.

Initial screen



(e) If an alarm occurs

One-touch tuning in progress



If an alarm occurs during tuning, one-touch tuning will be forcibly terminated and the alarm No. will be displayed.



(f) If a warning occurs

One-touch tuning in progress



If a warning occurs during tuning, the alarm No. of the warning will be displayed. When the warning is one which continue the motor driving, the one-touch tuning will be continued.

Alarm display (warning)

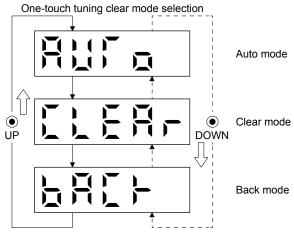


(g) Clearing one-touch tuning

Refer to table 6.1 for the parameters which you can clear.

You can initialize the parameters changed by the one-touch tuning with the clear mode. You can reset the parameters to before tuning with the back mode.

- 1) Switch to the initial screen "AUTO" of the one-touch tuning with the "MODE" button.
- 2) Select the clear mode or back mode with the "UP" or "DOWN" button.



↓ To clear the one-touch tuning, push the "SET" button for 2 s.

One-touch tuning clear mode display (initializing)



The one-touch tuning clear mode is in progress. The clear mode symbol flickers for 3 s.

Clearing one-touch tuning is completed, the initial screen will be displayed.

Initial screen



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 "o".

		Test	operation mode		
How to one-touch tuning	Output signal (DO) forced output	JOG operation	Positioning operation	Motor-less operation	Program operation
MR Configurator2		0	0		0
Push buttons					

- (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) During one-touch tuning, the permissible travel distance may be exceeded due to overshoot, set a value sufficient to prevent machine collision.
 - (d) 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/load to motor mass 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.
 - (e) 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.
 - (f) 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.
 - The acceleration/deceleration time constant to reach 2000 r/min (mm/s) is 5 s or less.
 - Speed is 150 r/min (mm/s) or higher.
 - The load to servo motor (mass of linear servo motor's primary side or direct drive 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

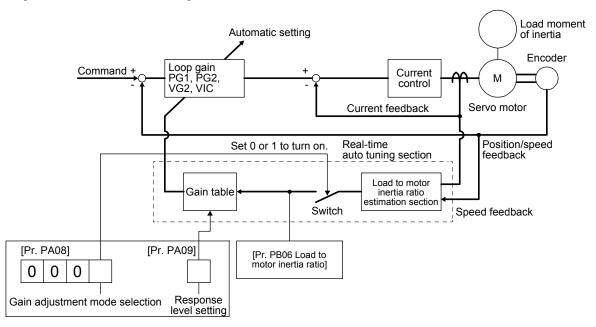
Use the auto tuning mode 2 when proper gain adjustment cannot be made by auto tuning mode 1. Since the load to motor inertia ratio is not estimated in this mode, set the value of a correct load to motor inertia ratio in [Pr. PB06].

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.

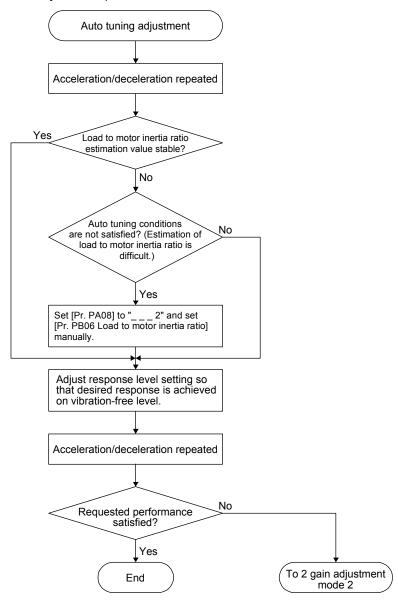
The auto tuning results are saved in the EEP-ROM of the servo amplifier every 60 minutes since power-on. At power-on, auto tuning is performed with the value of each loop gain saved in the EEP-ROM being used as an initial value.

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 track ability and settling time for a command decreases, but a too high response level will generate vibration. Hence, make setting until desired response is obtained 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], [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 7.2 and 7.3 for settings of the adaptive tuning mode and machine resonance suppression filter.

[Pr. PA09]

	Mach	ine characteristic	Reference
Setting value	Response	Guideline for machine resonance frequency [Hz]	(setting value of MR-J3)
1	Low	2.7	
2	response	3.6	
3	1	4.9	
4		6.6	
5		10.0	1
6		11.3	2
7		12.7	3
8		14.3	4
9		16.1	5
10		18.1	6
11		20.4	7
12		23.0	8
13		25.9	9
14		29.2	10
15		32.9	11
16		37.0	12
17		41.7	13
18	↓	47.0	14
19	Middle	52.9	15
20	response	59.6	16

	Mach	ine characteristic	Reference
Setting value	Response	Guideline for machine resonance	(setting value of
10.00	Теоропос	frequency [Hz]	MR-J3)
21	Middle	67.1	17
22	response	75.6	18
23	1 1	85.2	19
24		95.9	20
25		108.0	21
26		121.7	22
27		137.1	23
28		154.4	24
29		173.9	25
30		195.9	26
31		220.6	27
32		248.5	28
33		279.9	29
34		315.3	30
35		355.1	31
36		400.0	32
37		446.6	
38]	501.2	
39	High	571.5	
40	response	642.7	

6.4 Manual mode

If you are not satisfied with the adjustment of auto tuning, you can make simple manual adjustment with three parameters.

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. (Refer to section 7.2 to 7.3.)

(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 6.2.3.	
2	Change the setting of auto tuning to the manual mode ([Pr. PA08]: 3).	
3	Set the 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 slightly smaller value to the model loop gain Set a slightly larger 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 7.2 and 7.3.
9	While checking the motor status, fine-adjust each gain.	Fine adjustment

6. NORMAL GAIN ADJUSTMENT

(c) Parameter adjustment

1) [Pr. PB09 Speed loop gain]

This parameter determines the response level of the speed control loop. Increasing this value enhances response but a too high value will make the mechanical system liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

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.

3) [Pr. PB07 Model loop gain]

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

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

(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 6.2.3.	
2	Change the setting of auto tuning to the manual mode ([Pr. PA08]: 3).	
3	Set the 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 slightly smaller value to the model loop gain and the position loop gain. Set a slightly larger 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 Refer to section 7.2 and 7.3.
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 this value enhances response but a too high value will make the mechanical system liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

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.

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

3) [Pr. PB08 Position loop gain]

This parameter determines the response level to a disturbance to the position control loop. Increasing the value increases the response level to the disturbance, but a too high value will increase vibration of the mechanical system.

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 track ability to a position command, but a too high value will make overshoot liable to occur at settling.

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

6.5 2 gain adjustment mode

The 2 gain adjustment mode is used 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 track ability. Other parameters for gain adjustment are set automatically.

(1) 2 gain adjustment mode 1 (interpolation mode)

The 2 gain adjustment mode 1 manually set the model loop gain that determines command track ability. 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
Ì	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 position loop gain.
7	Considering the interpolation characteristic and motor status, fine-adjust the model loop gain and response level setting.	Fine adjustment

6. NORMAL GAIN ADJUSTMENT

(4) Parameter adjustment

[Pr. PB07 Model loop gain]

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

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

Position command frequency differs depending on the operation mode.

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.
- When you use a linear servo motor, replace the following left words to the right words.

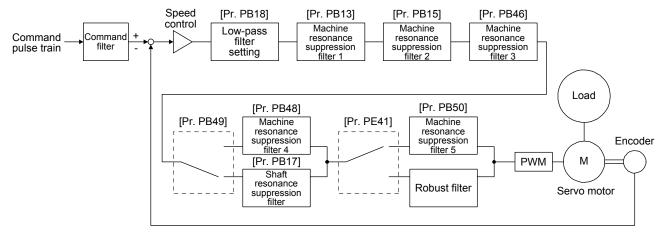
Load to motor inertia ratio → Load to motor mass ratio

Torque \rightarrow Thrust

(Servo motor) speed → (Linear servo motor) speed

7.1 Filter setting

The following filters are available with MR-J4 servo amplifiers.



7.1.1 Machine resonance suppression filter

POINT

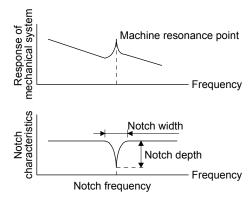
- ●The machine resonance suppression filter is a delay factor for the servo system. Therefore, vibration may increase if you set an incorrect resonance frequency or set notch characteristics too deep or too wide.
- ●If the frequency of machine resonance is unknown, decrease the notch frequency from higher 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 deeper 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 natural resonance point, increasing the servo system response level may cause the mechanical system to produce resonance (vibration or unusual noise) 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.

7. SPECIAL ADJUSTMENT FUNCTIONS

(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

7. SPECIAL ADJUSTMENT FUNCTIONS

(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

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]).

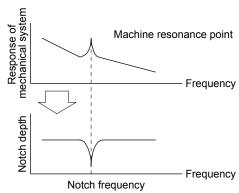
7.1.2 Adaptive filter II

POINT

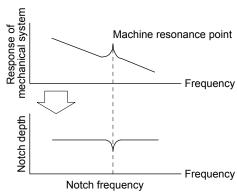
- ■The machine resonance frequency which adaptive filter II (adaptive tuning) can respond to is about 100 Hz to 2.25 kHz. As for the resonance frequency out of the range, set manually.
- ●When adaptive tuning is executed, vibration sound increases as an excitation signal is forcibly applied for several seconds.
- •When adaptive tuning is executed, machine resonance is detected for a maximum of 10 seconds 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.
- ◆Adaptive tuning in the high accuracy mode is available with servo amplifiers with software version C5 or later. 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.

(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

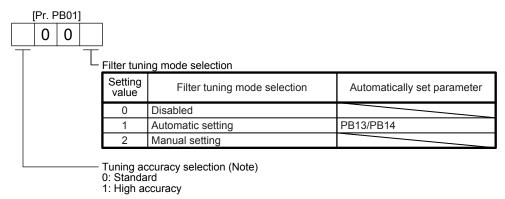


When machine resonance is small and frequency is high

7. SPECIAL ADJUSTMENT FUNCTIONS

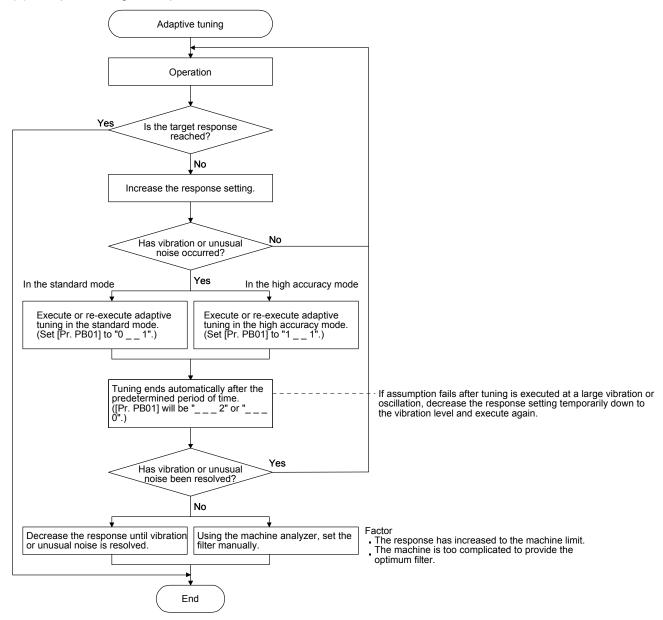
(2) Parameter

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



Note. This digit is available with servo amplifier with software version C5 or later.

(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. For [Pr. PB23], "___0" (automatic setting) is recommended because setting "Shaft resonance suppression filter selection" in [Pr. PB23] or setting [Pr. PB17 Shaft resonance suppression filter] can degrades in performance.

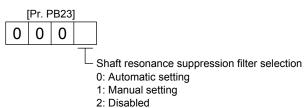
(1) Function

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 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]	
00	Disabled	
01	Disabled	
02	4500	
03	3000	
04	2250	
05	1800	
06	1500	
07	1285	
08	1125	
09	1000	
0 A	900	
0B	818	
0C	750	
0D	692	
0E	642	
0F	600	

Setting value	Frequency [Hz]	
10	562	
11	529	
12	500	
13	473	
14	450	
15	428	
16	409	
17	391	
18	375	
19	360	
1 A	346	
1B	333	
1C	321	
1 D	310	
1E	300	
1F	290	

7. SPECIAL ADJUSTMENT FUNCTIONS

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 a default. The filter frequency of the low-pass filter is automatically adjusted to the value in the following equation.

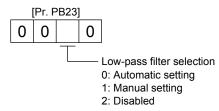
Filter frequency ([rad/s]) =
$$\frac{\text{VG2}}{1 + \text{GD2}} \times 10$$

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].



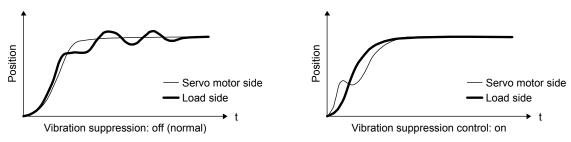
7.1.5 Advanced vibration suppression control II

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

Vibration suppression control is used 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.

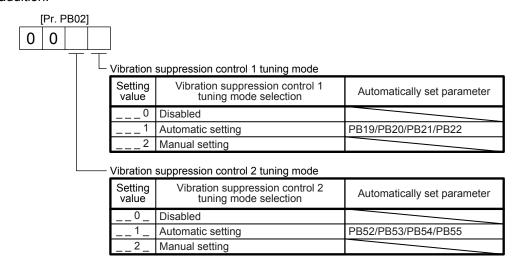


When the advanced vibration suppression control II ([Pr. PB02 Vibration suppression control tuning mode]) is executed, the vibration frequency at load side is automatically estimated to suppress machine side vibration two times at most.

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].

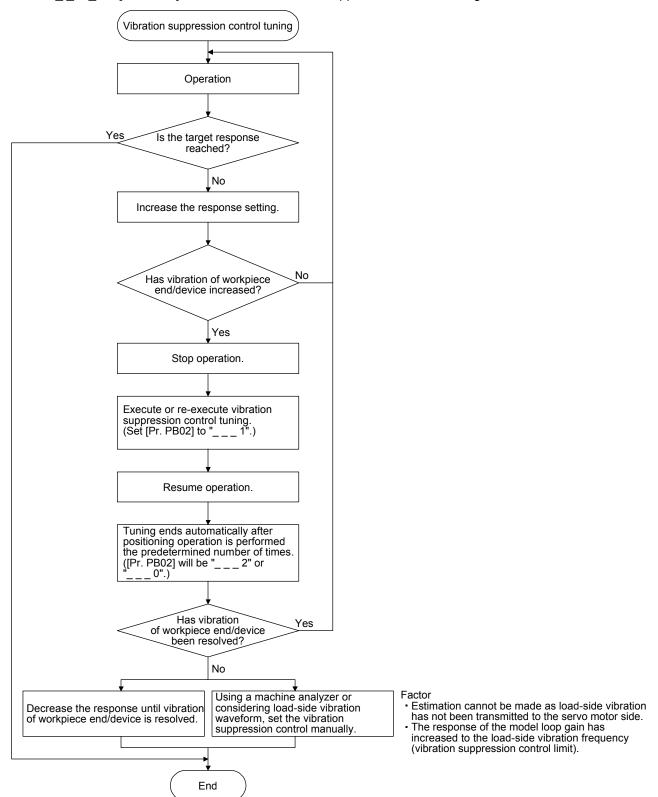
(2) Parameter

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.



(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.



7. SPECIAL ADJUSTMENT FUNCTIONS

(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.

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.

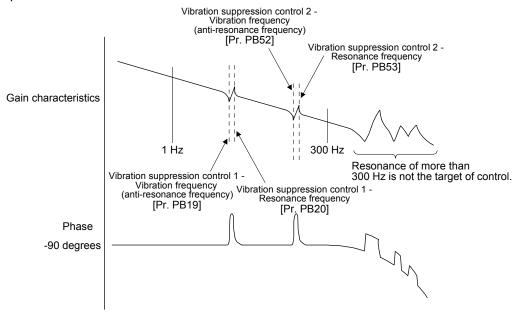
Setting item	Vibration suppression control 1	Vibration suppression control 2	
Vibration suppression control - Vibration frequency	[Pr. PB19]	[Pr. PB52]	
Vibration suppression control - Resonance frequency	[Pr. PB20]	[Pr. PB53]	
Vibration suppression control - Vibration frequency damping	[Pr. PB21]	[Pr.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

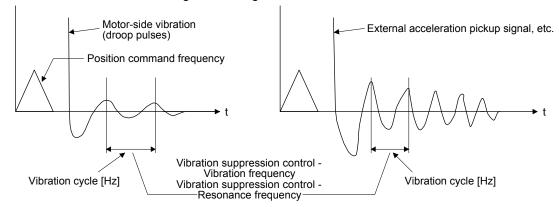
However, the value of [Pr. PB07 Model loop gain], vibration frequency, and resonance frequency have the following usable range and recommended range.

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".

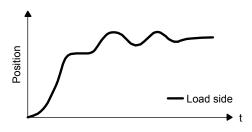
7.1.6 Command notch filter

POINT

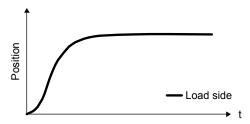
- ■By using the advanced vibration suppression control II and the command notch filter, the load-side vibration of three frequencies can be suppressed.
- ●The frequency range of machine vibration, which can be supported by the command notch filter, is between 4.5 Hz and 2250 Hz. Set a frequency close 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

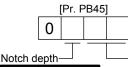


Command notch filter: enabled

7. SPECIAL ADJUSTMENT FUNCTIONS

(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.



Notch depth—			
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		
Α	-4.1		
В	-3.3		
С	-2.5		
D	-1.8		
Е	-1.2		
F	-0.6		

Command notch filter setting frequency					
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.

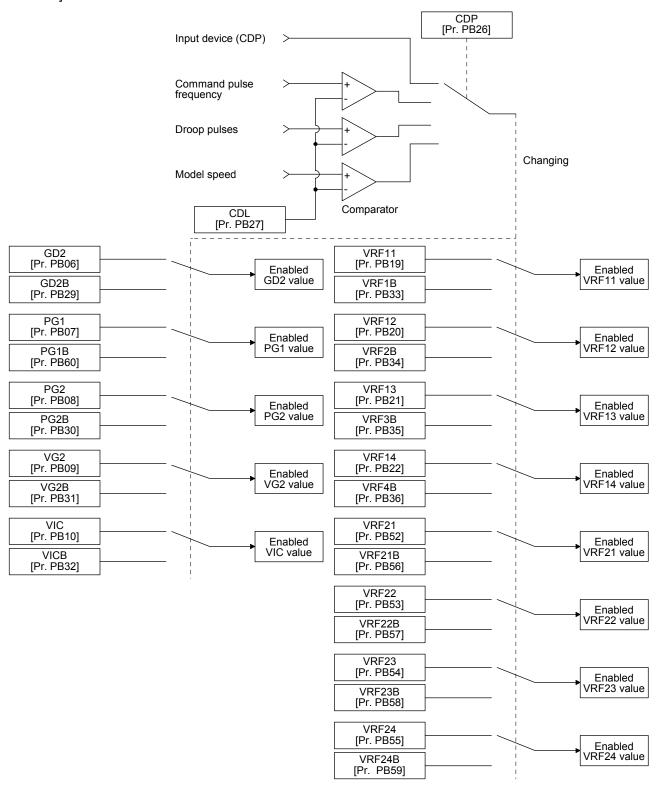
7.2.1 Applications

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

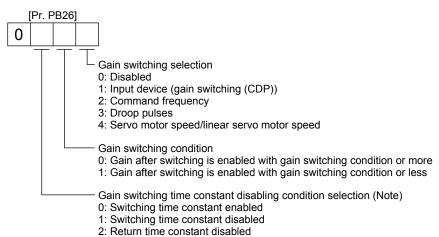
When using the gain switching function, always select "Manual mode (___3)" of "Gain adjustment mode selection" in [Pr. PA08 Auto tuning mode]. The gain switching function cannot be used in the auto tuning mode.

(1) Parameter for setting gain switching condition

Parameter	Symbol	Name	Unit	Description
PB26	CDP	Gain switching selection		Select a switching condition.
PB27	CDL	Gain switching condition	[kpulse/s]	Set a switching condition values.
			/[pulse]	
			/[r/min]	
PB28	CDT	Gain switching time constant	[ms]	Set the filter time constant for a gain change at switching.

(a) [Pr. PB26 Gain switching function]

Used to set the gain switching condition. Select the switching condition in the first to third digits.



Note. This parameter setting is available with servo amplifiers with software version B4 or

(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" with the gain switching selection in [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. This parameter is used to suppress shock given to the machine if the gain difference is large at gain switching, for example.

(2) Switchable gain parameter

l ann main		Befor	e switching	After switching			
Loop gain	Parameter	Symbol	Name	Parameter	Symbol	Name	
Load to motor inertia ratio/ load to motor mass ratio	PB06	GD2	Load to motor inertia ratio/ load to motor mass ratio	PB29	GD2B	Load to motor inertia ratio/ load to motor mass ratio	
Model loop gain	PB07	PG1	Model loop gain	PB60	PG1B	Model loop gain after gain switching	
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	Speed integral compensation after gain switching	
Vibration suppression control 1 - Vibration frequency	PB19	VRF11	Vibration suppression control 1 - Vibration frequency	PB33	VRF1B	Vibration suppression control 1 - Vibration frequency after gain switching	
Vibration suppression control 1 - Resonance frequency	PB20	VRF12	Vibration suppression control 1 - Resonance frequency	PB34	VRF2B	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	VRF3B	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	VRF4B	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. Executing gain switching while the servo motor stops, You can change vibration frequency, resonance frequency, vibration frequency damping, and resonance frequency damping.

- (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]), and [Pr. PB60 Model loop gain after gain switching]
 - The gain switching vibration suppression control and gain switching model loop gain are used only 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

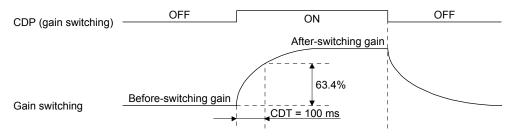
This operation will be described by way of setting examples.

(1) When you choose switching by input device (CDP)

(a) Setting example

Parameter	Symbol	Name	Setting value	Unit
PB06	GD2	Load to motor inertia ratio/load to motor mass 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/load to motor mass 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 (Switch by input device (CDP) on/off.)	
PB28	CDT	Gain switching time constant	100	[ms]
PB33	VRF1B	Vibration suppression control 1 - Vibration frequency after gain switching	60	[Hz]
PB34	VRF2B	Vibration suppression control 1 - Resonance frequency after gain switching	60	[Hz]
PB35	VRF3B	Vibration suppression control 1 - Vibration frequency damping after gain switching	0.15	
PB36	VRF4B	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	\rightarrow	50	\rightarrow	100
Load to motor inertia ratio/load to motor mass ratio	4.00	\rightarrow	10.00	\rightarrow	4.00
Position loop gain	120	\rightarrow	84	\rightarrow	120
Speed loop gain	3000	\rightarrow	4000	\rightarrow	3000
Speed integral compensation	20	\rightarrow	50	\rightarrow	20
Vibration suppression control 1 - Vibration frequency	50	\rightarrow	60	\rightarrow	50
Vibration suppression control 1 - Resonance frequency	50	\rightarrow	60	\rightarrow	50
Vibration suppression control 1 - Vibration frequency damping	0.20	\rightarrow	0.15	\rightarrow	0.20
Vibration suppression control 1 - Resonance frequency damping	0.20	\rightarrow	0.15	\rightarrow	0.20
Vibration suppression control 2 - Vibration frequency	20	\rightarrow	30	\rightarrow	20
Vibration suppression control 2 - Resonance frequency	20	\rightarrow	30	\rightarrow	20
Vibration suppression control 2 - Vibration frequency damping	0.10	\rightarrow	0.05	\rightarrow	0.10
Vibration suppression control 2 - Resonance frequency damping	0.10	\rightarrow	0.05	\rightarrow	0.10

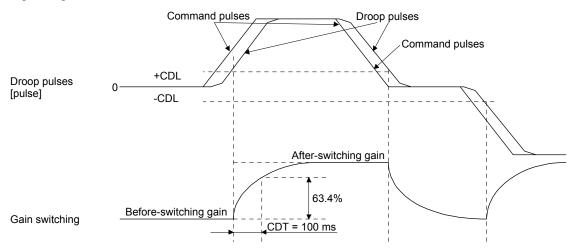
(2) When you choose switching by droop pulses

The vibration suppression control after gain switching and model loop gain after gain switching cannot be used.

(a) Setting example

Parameter	Symbol	Name	Setting value	Unit
PB06	GD2	Load to motor inertia ratio/load to motor mass 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/load to motor mass 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 selection	0003	
			(switching by droop pulses)	
PB27	CDL	Gain switching condition	50	[pulse]
PB28	CDT	Gain switching time constant	100	[ms]

(b) Switching timing chart

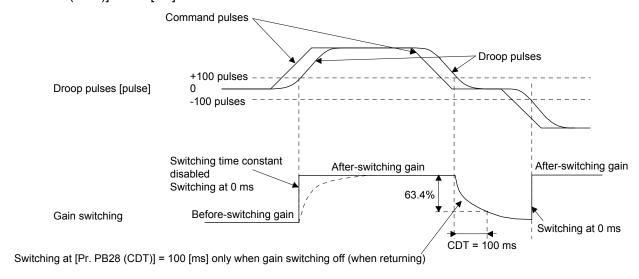


Load to motor inertia ratio	4.00	\rightarrow	10.00	\rightarrow	4.00	\rightarrow	10.00
Position loop gain	120	\rightarrow	84	\rightarrow	120	\rightarrow	84
Speed loop gain	3000	\rightarrow	4000	\rightarrow	3000	\rightarrow	4000
Speed integral compensation	20	\rightarrow	50	\rightarrow	20	\rightarrow	50

(3) When the gain switching time constant is disabled

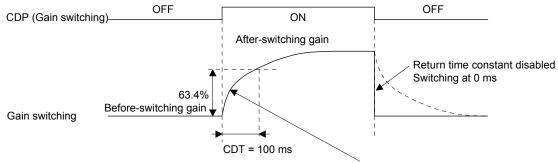
(a) Gain switching time constant disabled was selected.

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) Gain 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].



Switching at [Pr. PB28 (CDT)] = 100 [ms] only when gain switching on (when switching)

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 prevent from vibrating by resetting a filter instantaneously when machine resonance occurs due to varied vibration frequency caused 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 6.1)
- (2) Manual setting (section 4.2.2)

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].

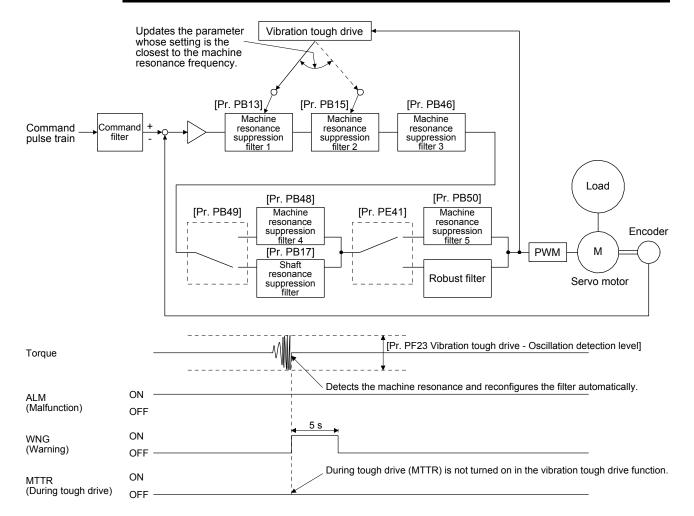
POINT

- 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 control circuit power] detection time for the control circuit power supply can be changed by [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time]. In addition, [AL. 10.2 Voltage drop in the main circuit power] 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.
- When selecting "Enabled (___1)" for "Torque limit function selection at instantaneous power failure" in [Pr. PA26], if an instantaneous power failure occurs during operation, you can save electric energy charged in the capacitor in the servo amplifier by limiting torque at acceleration. You can also delay the time until the occurrence of [AL. 10.2 Voltage drop in the main circuit power]. Doing this will enable you to set a longer time in [Pr. PF25 SEMI-F47 function Instantaneous power failure detection time].
- ●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 SEMI-F47 function Instantaneous power failure detection time].
- ●The external dynamic brake cannot be used for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs.
- •MR-J4-03A6(-RJ) servo amplifier is not compatible with instantaneous power failure tough drive.
- ●The setting range of [Pr. PF25 SEMI-F47 function Instantaneous power failure detection time] differs depending on the software version of the servo amplifier as follows.
 - Software version C0 or earlier: Setting range 30 ms to 200 ms
 - Software version C1 or later: Setting range 30 ms to 500 ms

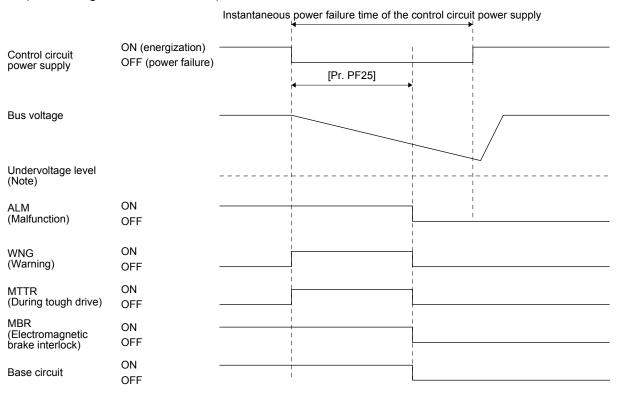
To comply with SEMI-F47 standard, it is unnecessary to change the initial value (200 ms). However, when the instantaneous power failure time exceeds 200 ms, and the instantaneous power failure voltage is less than 70% of the rated input voltage, the power may be normally turned off even if a value larger than 200 ms is set in the parameter.

(1) Instantaneous power failure time of the control circuit power supply > [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time]

The alarm occurs when the instantaneous power failure time of the control circuit power supply exceeds [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time].

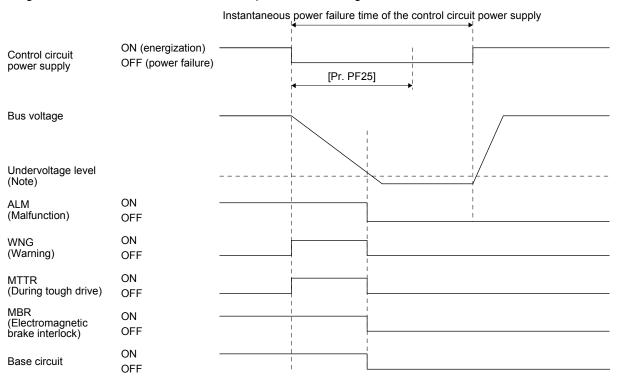
MTTR (During tough drive) turns on after detecting the instantaneous power failure.

MBR (Electromagnetic brake interlock) turns off when the alarm occurs.



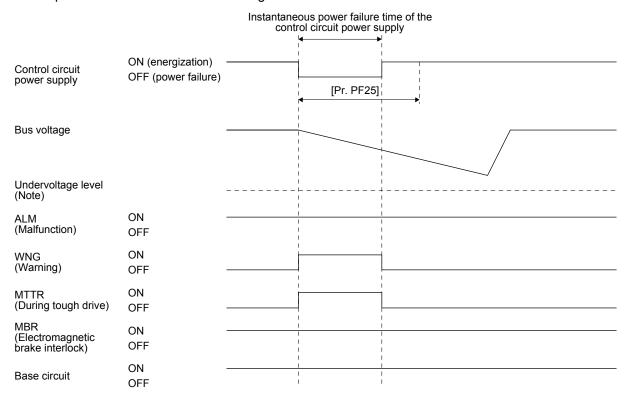
Note. Refer to table 7.1 for the undervoltage level.

- (2) Instantaneous power failure time of the control circuit power supply < [Pr. PF25 SEMI-F47 function Instantaneous power failure detection time]
 - Operation status differs depending on how bus voltage decrease.
 - (a) When the bus voltage decrease lower than undervoltage level within the instantaneous power failure time of the control circuit power supply
 - [AL. 10 Undervoltage] occurs when the bus voltage decrease lower than undervoltage level regardless of the enabled instantaneous power failure tough drive.



Note. Refer to table 7.1 for the undervoltage level.

(b) When the bus voltage does not decrease lower than 158 V DC within the instantaneous power failure time of the control circuit power supply The operation continues without alarming.



Note. Refer to table 7.1 for the undervoltage level.

7.4 Compliance with SEMI-F47 standard

POINT

- ■The control circuit power supply of the MR-J4-_A_(-RJ) 100 W or more servo amplifier can comply with SEMI-F47 standard. However, a back-up capacitor may be necessary for instantaneous power failure in the main circuit power supply depending on the power supply impedance and operating situation.
- ■Use a 3-phase for the input power supply of the servo amplifier. Using a 1-phase 100 V AC/200 V AC for the input power supply will not comply with SEMI-F47 standard.
- The external dynamic brake cannot be used for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs.
- ■Be sure to perform actual machine tests and detail checks for power supply instantaneous power failure of SEMI-F47 standard with your equipment.
- The MR-J4-03A6(-RJ) servo amplifier is not compatible with SEMI-F47 standard.

The following explains the compliance with "SEMI-F47 semiconductor process equipment voltage sag immunity test" of MR-J4 series.

This function enables to avoid triggering [AL. 10 Undervoltage] using the electrical energy charged in the capacitor in case that an instantaneous power failure occurs during operation.

(1) Parameter setting Setting [Pr. PA20] and [Pr. PF25] as follows will enable SEMI-F47 function.

Parameter	Setting value	Description
PA20	_1	Enable SEMI-F47 function selection.
PF25	200	Set the time [ms] of the [AL. 10.1 Voltage drop in the control circuit power] occurrence.

Enabling SEMI-F47 function will change operation as follows.

- (a) The voltage will drop in the control circuit power at "Rated voltage × 50% or less". After 200 ms, [AL. 10.1 Voltage drop in the control circuit power] will occur.
- (b) [AL. 10.2 Voltage drop in the main circuit power] will occur when bus voltage is as follows.

Table 7.1 Voltages which trigger [AL. 10.2 Voltage drop in the main circuit power]

Servo amplifier	Bus voltage which triggers alarm
MR-J4-10A(-RJ)	
to	158 V DC
MR-J4-700A(-RJ)	
MR-J4-11KA(-RJ)	
to	200 V DC
MR-J4-22KA(-RJ)	
MR-J4-60A4(-RJ)	
to	380 V DC
MR-J4-22KA4(-RJ)	

(c) MBR (Electromagnetic brake interlock) will turn off when [AL. 10.1 Voltage drop in the control circuit power] occurs.

(2) Requirements conditions of SEMI-F47 standard
Table 7.2 shows the permissible time of instantaneous power failure for instantaneous power failure of SEMI-F47 standard.

Table 7.2 Requirements conditions of SEMI-F47 standard

Instantaneous power failure voltage	Permissible time of instantaneous power failure [s]
Rated voltage × 80%	1
Rated voltage × 70%	0.5
Rated voltage × 50%	0.2

(3) Calculation of tolerance against instantaneous power failure Table 7.3 shows tolerance against instantaneous power failure when instantaneous power failure voltage is "rated voltage × 50%" and instantaneous power failure time is 200 ms.

Table 7.3 Tolerance against instantaneous power failure (instantaneous power failure voltage = rated voltage × 50%, instantaneous power failure time = 200 ms)

Servo amplifier	Instantaneous maximum output [W]	Tolerance against instantaneous power failure [W] (voltage drop between lines)
MR-J4-10A(-RJ)	350	250
MR-J4-20A(-RJ)	700	420
MR-J4-40A(-RJ)	1400	630
MR-J4-60A(-RJ)	2100	410
MR-J4-70A(-RJ)	2625	1150
MR-J4-100A(-RJ)	3000	1190
MR-J4-200A(-RJ)	5400	2040
MR-J4-350A(-RJ)	10500	2600
MR-J4-500A(-RJ)	15000	4100
MR-J4-700A(-RJ)	21000	5900
MR-J4-11KA(-RJ)	40000	2600
MR-J4-15KA(-RJ)	50000	3500
MR-J4-22KA(-RJ)	56000	4300
MR-J4-60A4(-RJ)	1900	190
MR-J4-100A4(-RJ)	3500	200
MR-J4-200A4(-RJ)	5400	350
MR-J4-350A4(-RJ)	10500	730
MR-J4-500A4(-RJ)	15000	890
MR-J4-700A4(-RJ)	21000	1500
MR-J4-11KA4(-RJ)	40000	2400
MR-J4-15KA4(-RJ)	50000	3200
MR-J4-22KA4(-RJ)	56000	4200

Instantaneous maximum output means power which servo amplifier can output in maximum torque at rated speed. You can examine margins to compare the values of following conditions and instantaneous maximum output.

Even if driving at maximum torque with low speed in actual operation, the motor will not drive with the maximum output. This can be handled as a margin.

The following shows the conditions of tolerance against instantaneous power failure.

(a) Delta connection

For the 3-phase (L1/L2/L3) delta connection, an instantaneous power failure occurs in the voltage between a pair of lines (e.g. between L1 and L2) among voltages between three pairs of lines (between L1 and L2, L2 and L3, or L3 and L1).

(b) Star connection

For the 3-phase (L1/L2/L3/neutral point N) star connection, an instantaneous power failure occurs in the voltage between a pair of lines (e.g. between L1 and N) among voltages at six locations, between three pairs of lines (between L1 and L2, L2 and L3, or L3 and L1) and between one of the lines and the neutral point (between L1 and N, L2 and N, or L3 and N).

7.5 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.
- This is used with servo amplifiers with software version B4 or later. Check the software version of the servo amplifier with MR Configurator2.

(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.
Super trace control ([Pr. PA22])	The super trace control uses the model adaptive control. Disabling the model adaptive control will also disable the super trace control.

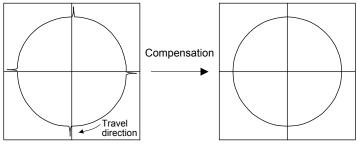
7.6 Lost motion compensation function

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.



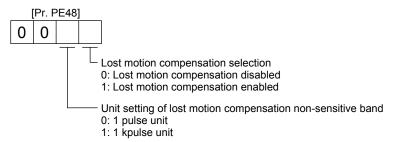
The locus before compensation

The locus after compensation

(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. The torque offset cannot be used for linear servo motors and direct drive motors. Set 0.00%.

occurrence timing.

- (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
- (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 pulse 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) of this section and set a value twice the friction torque in [Pr. PE44] and [Pr. PE45] as lost motion compensation.

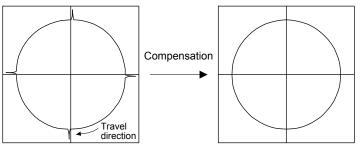
Friction torque [%] = |(load current during feed in the forward rotation direction [%]) - (load current during feed in the reverse rotation direction [%])|

(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).

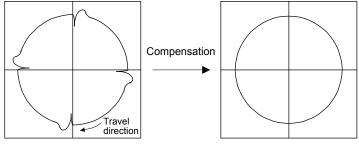


The locus before compensation

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.

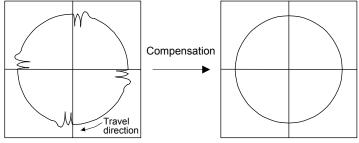


Before timing delay compensation

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) of this section.



Before timing delay compensation

After timing delay compensation

7.7 Super trace control

(1) Summary

In the normal position control, droop pulses are generated against the position control command from the controller. Using the feed forward gain sets droop pulses at a constant speed to almost 0. However, droop pulses generated during acceleration/deceleration cannot be suppressed.

With the ideal model in the servo amplifier, the super trace control enables to set constant speed and uniform acceleration/deceleration droop pulses to almost 0 that cannot be coped with by the feed forward gain.

Control	Position command (the same command)	Droop pulses
Normal control	Servo motor speed	Droop pulses
		Droop pulses are always generated.
Feed forward gain	Seed of the second seco	Time Droop pulses are generated during acceleration/ deceleration.
Super trace control	Service and the service and th	Time Droop pulses are almost 0 including the time of acceleration or deceleration.

(2) Adjustment procedure

POINT

- ●In the super trace control, droop pulses are near 0 during the servo motor control. Thus, the normal INP (In-position) may always be turned on. Be sure to set "INP (In-position) on condition selection" in [Pr. PD31] to "_1__".
- ●When you use the super trace control, it is recommended that the acceleration time constant up to the rated speed be set to 1 s or more.

The following shows the adjustment procedure.

Step	Operation
1	Execute the gain adjustment with one-touch tuning, auto tuning, etc. Refer to chapter 6 for details.
2	Change the setting of auto tuning mode to the manual mode ([Pr. PA08]: 3).
3	Change the setting of feed forward gain ([Pr. PB04]), and adjust that droop pulses will be 0 at a constant speed.
4	Set the setting of INP (In-position) on condition selection ([Pr. PD31]) to "_1".
5	Enable the super trace control. ([Pr. PA22]: 2 _)
6	Change the setting of model loop gain ([Pr. PB07]), and adjust droop pulses during acceleration/deceleration.

MEMO	

8. TROUBLESHOOTING

POINT

- Refer to "MELSERVO-J4 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 and warning are displayed. When an alarm or warning is displayed, refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" to remove the failure. When an alarm occurs, ALM will turn off.

8.1 Explanation for the lists

(1) No./Name/Detail No./Detail name Indicates each 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 its cause has been removed, the alarm can be deactivated in any of the methods marked \circ in the alarm deactivation column. Warnings are automatically canceled after the cause of occurrence is removed. Alarms are deactivated with alarm reset or cycling the power.

Alarm deactivation	Explanation
Alarm reset	Turning on RES (Reset) with input device Pushing the "SET" button while the display of the servo amplifier is the current alarm display status Pushing "Occurring Alarm Reset" in the "Alarm Display" window of MR Configurator2
Cycling the power	Turning off the power and on again

(4) Alarm code

To output alarm codes, set [Pr. PD34] to "___ 1". Alarm codes are outputted by on/off of bit 0 to bit 2. Warnings ([AL. 91] 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. When using an MR-D01 extension IO unit, you can output alarm codes by setting [Pr. Po12] to "___ 1". Alarm codes are outputted by on/off of bit 0 to bit 3.

8.2 Alarm list

\setminus			D . "		Stop		arm ivation		Alarm	code					
\mathbb{I}	No.	Name	Detail No.	Detail name	Type	A I =	Cycling	VCD3	ACD2	ACD1	ACD0				
$\mathbb{I}\setminus$			INO.		(Note 2, 3)	Alarm reset	the		(Bit 2)						
					0)	10001	power	(Dit 3)	(Dit 2)	(Dit 1)	(Dit 0)				
Alarm	10	Undervoltage	10.1	Voltage drop in the control circuit power	EDB	0	0	0	0	1	0				
	10	ondervoltage	10.2	Voltage drop in the main circuit power	SD	0	0	Ů	O	'	J				
	11	Custob potting arror	11.1	Axis number setting error/station number setting error	DB		0								
	11	Switch setting error	11.2	Disabling control axis setting error	DB		0								
			12.1	RAM error 1	DB		0								
			12.2	RAM error 2	DB		0								
	40	Memory error 1	12.3	RAM error 3	DB		0	0	0	0	0				
	12	(RAM)	12.4	RAM error 4	DB		0								
			12.5	RAM error 5	DB		0								
			12.6	RAM error 6	DB		0								
	40	Clock orror	13.1	Clock error 1	DB		0		,						
	13	Clock error	13.2	Clock error 2	DB		0	0	0	0	0				
			14.1	Control process error 1	DB		0								
		Control process	14.2	Control process error 2	DB		0								
			14.3	Control process error 3	DB		0								
							14.4	Control process error 4	DB		0				
			14.5	Control process error 5	DB		0	0	_	0	0				
	14		14.6	Control process error 6	DB		0	0	0	0					
		error	14.7	Control process error 7	DB		0								
			14.8	Control process error 8	DB		0								
			14.9	Control process error 9	DB		0								
				14.A	Control process error 10	DB		0							
			14.B	Control process error 11	DB		0								
			15.1	EEP-ROM error at power on	DB		0	`	,	`					
	15	Memory error 2	15.2	EEP-ROM error during operation	DB		0	0	_	_	0				
	15	(EEP-ROM)	15.4	Home position information read error	DB		0	U	0	0	0				
			16.1	Encoder initial communication - Receive data error 1	DB		0								
			16.2	Encoder initial communication - Receive data error 2	DB		0								
			16.3	Encoder initial communication - Receive data error 3	DB		0								
			16.5	Encoder initial communication - Transmission data error 1	DB		0								
			16.6	Encoder initial communication - Transmission data error 2	DB		0								
	40	Encoder initial	16.7	Encoder initial communication - Transmission data error 3	DB		0								
	16	communication error 1	16.A	Encoder initial communication - Process error 1	DB		0	0	1	1	0				
			16.B	Encoder initial communication - Process error 2	DB		0								
			16.C	Encoder initial communication - Process error 3	DB		0								
			16.D	Encoder initial communication - Process error 4	DB		0								
			16.E	Encoder initial communication - Process error 5	DB		0								
			16.F	Encoder initial communication - Process error 6	DB		0								

I\ I					Stop		ırm vation		Alarm	code	
$ \setminus $	No.	Name	Detail No.	Detail name	Type	A1	Cycling	ACD3	A CD2	ACD1	A C D O
$ \ $			INO.		(Note 2, 3)	Alarm reset	the		-	_	
\setminus					3)	reset	power	(BIL 3)	(Bit 2)	(BIL I)	(BIL U)
гш			17.1	Board error 1	DB		0				
Alarm			17.3	Board error 2	DB		0				
			17.4	Board error 3	DB		0				
	17	Board error	17.5	Board error 4	DB		0	0	0	0	0
	17	Board error	17.6	Board error 5	DB		0				
			17.7	Board error 7	DB		0				
			17.8	Board error 6	EDB		0				
			17.9	Board error 8	DB		0				
		Momony orror 2	19.1	Flash-ROM error 1	DB		0	0	0	0	0
	19	Memory error 3 (Flash-ROM)	19.2	Flash-ROM error 2	DB		0	Ü	U	V	U
			19.3	Flash-ROM error 3	DB		0				
			1A.1	Servo motor combination error 1	DB		0				
	1A	Servo motor combination error	1A.2	Servo motor control mode combination error	DB		0	0	1	1	0
			1A.4	Servo motor combination error 2	DB		0				
	1B	Converter alarm	1B.1	Converter unit error	DB		0	0	0	1	0
	1E	Encoder initial communication	1E.1	Encoder malfunction	DB		0	0	1	1	0
		error 2	1E.2	Load-side encoder malfunction	DB		0				
		Encoder initial	1F.1	Incompatible encoder	DB		0				
	1F	communication error 3	1F.2	Incompatible load-side encoder	DB		0	0	1	1	0
			20.1	Encoder normal communication - Receive data error 1	EDB		0				
			20.2	Encoder normal communication - Receive data error 2	EDB		0				
		Encoder normal communication error 1	20.3	Encoder normal communication - Receive data error 3	EDB		0				
	00		20.5	Encoder normal communication - Transmission data error 1	EDB		0				
	20		20.6	Encoder normal communication - Transmission data error 2	EDB		0	0	1	1	0
			20.7	Encoder normal communication - Transmission data error 3	EDB		0				
			20.9	Encoder normal communication - Receive data error 4	EDB		0				
			20.A	Encoder normal communication - Receive data error 5	EDB		0				
			21.1	Encoder data error 1	EDB		0				
			21.2	Encoder data update error	EDB		0				
		Encoder normal	21.3	Encoder data waveform error	EDB		0				
	21	communication	21.4	Encoder non-signal error	EDB		0	0	1	1	0
		error 2	21.5	Encoder hardware error 1	EDB		0				
			21.6	Encoder hardware error 2	EDB		0				
			21.9	Encoder data error 2	EDB		0				
	24	Main aircuit	24.1	Ground fault detected at hardware detection circuit	DB		0	4	4		
	24	Main circuit error	24.2	Ground fault detected by software detection function	DB	0	0	1	1	0	0
		Absolute position	25.1	Servo motor encoder - Absolute position erased	DB						
	25	erased	25.2	Scale measurement encoder - Absolute position erased	DB		0	1	1	1	0

\setminus			D . "		Stop		arm ivation		Alarm	code	
	No.	Name	Detail No.	Detail name	Type (Note 2,	Alarm	Cycling	ACD3	ACD2	ACD1	ACD0
$ \ $					3)	reset	the power	(Bit 3)	(Bit 2)	(Bit 1)	(Bit 0)
Alarm			27.1	Initial magnetic pole detection - Abnormal termination	DB	0	0				
,			27.2	Initial magnetic pole detection - Time out error	DB	0	0				
			27.3	Initial magnetic pole detection - Limit switch error	DB	0	0				
	27	Initial magnetic pole detection error	27.4	Initial magnetic pole detection - Estimated error	DB	0	0	1	1	1	0
			27.5	Initial magnetic pole detection - Position deviation error	DB	0	0				
			27.6	Initial magnetic pole detection - Speed deviation error	DB	0	0				
			27.7	Initial magnetic pole detection - Current error	DB	0	0				
	28	Linear encoder error 2	28.1	Linear encoder - Environment error	EDB		0	0	1	1	0
		0.10. 2	2A.1	Linear encoder error 1-1	EDB		0				
			2A.2	Linear encoder error 1-2	EDB		0				
			2A.3	Linear encoder error 1-3	EDB		0				
		Linear encoder	2A.4	Linear encoder error 1-4	EDB		Ö				_
	2A	error 1	2A.5	Linear encoder error 1-5	EDB		0	0	1	1	0
			2A.6	Linear encoder error 1-6	EDB		0				
			2A.7	Linear encoder error 1-7	EDB		0				
			2A.8	Linear encoder error 1-8	EDB		0				
		Encoder counter	2B.1	Encoder counter error 1	EDB		0				
	2B	error	2B.2	Encoder counter error 2	EDB		0	1	1	1	0
		5.16.	30.1	Regeneration heat error	DB	O (Note 1)	O (Note 1)				
	30	Regenerative error	30.2	Regeneration signal error	DB	O (Note 1)	O (Note 1)	0	0	0	1
			30.3	Regeneration feedback signal error	DB	O (Note 1)	O (Note 1)				
	31	Overspeed	31.1	Abnormal motor speed	SD	0	0	0	1	0	1
			32.1	Overcurrent detected at hardware detection circuit (during operation)	DB		0				
			32.2	Overcurrent detected at software detection function (during operation)	DB	0	0				
	32	Overcurrent	32.3	Overcurrent detected at hardware detection circuit (during a stop)	DB		0	0	1	0	0
			32.4	Overcurrent detected at software detection function (during a stop)	DB	0	0				
	33	Overvoltage	33.1	Main circuit voltage error	EDB	0	0	1	0	0	1
		- 3	34.1	SSCNET receive data error	SD	0	0				
			34.2	SSCNET connector connection error	SD	0	0				
			34.3	SSCNET communication data error	SD	0	0				
	34	SSCNET receive	34.4	Hardware error signal detection	SD	0	0	$\overline{}$	$\overline{}$	$\overline{}$	
		error 1		SSCNET receive data error						$\overline{}$	
			34.5	(safety observation function)	SD	0	0				
			34.6	SSCNET communication data error (safety observation function)	SD	0	0				
	35	Command frequency error	35.1	Command frequency error	SD	0	0	1	1	0	1
			36.1	Continuous communication data error	SD	0	0				
	36	SSCNET receive error 2	36.2	Continuous communication data error (safety observation function)	SD	0	0				

\					Stop		arm vation		Alarm	code	
\setminus	No.	Name	Detail No.	Detail name	Type (Note 2,	Alarm	Cycling	ACD3	ACD2	ACD1	ACD0
					3)	reset	the power	(Bit 3)	(Bit 2)	(Bit 1)	(Bit 0)
Alarm			37.1	Parameter setting range error	DB		0				
Ala	37	Parameter error	37.2	Parameter combination error	DB		0	1	0	0	0
			37.3	Point table setting error	DB		0				
			39.1	Program error Instruction argument external	DB		0				
	20	D	39.2	error	DB		0		_	0	0
	39	Program error	39.3	Register No. error	DB		0	0	0	0	0
			39.4	Non-correspondence instruction error	DB		0				
	3A	Inrush current suppression circuit error	3A.1	Inrush current suppression circuit error	EDB		0	0	0	0	0
	9	Parameter setting	3D.1	Parameter combination error for driver communication on slave	DB		0				
	3D	error for driver communication	3D.2	Parameter combination error for driver communication on master	DB		0				
	3E	Operation mode	3E.1	Operation mode error	DB		0				
	JĽ	error	3E.6	Operation mode switch error	DB		0	1	0	0	0
		Servo control error	42.1	Servo control error by position deviation	EDB	(Note 4)	0				
		(for linear servo motor and direct drive motor)	42.2	Servo control error by speed deviation	EDB	(Note 4)	0			1	
			42.3	Servo control error by torque/ thrust deviation	EDB	(Note 4)	0				
	42	5 II	42.8	Fully closed loop control error by position deviation	EDB	(Note 4)	0	0	1		0
		Fully closed loop control error (for fully closed	42.9	Fully closed loop control error by speed deviation	EDB	(Note 4)	0				
		loop control)	42.A	Fully closed loop control error by position deviation during command stop	EDB	(Note 4)	0				
	45	Main circuit device	45.1	Main circuit device overheat error 1	SD	O (Note 1)	O (Note 1)	0	0	1	1
	45	overheat	45.2	Main circuit device overheat error 2	SD	O (Note 1)	O (Note 1)	_	O	ı	'
			46.1	Abnormal temperature of servo motor 1	SD	O (Note 1)	O (Note 1)				
			46.2	Abnormal temperature of servo motor 2	SD	O (Note 1)	O (Note 1)				
	46	Servo motor	46.3	Thermistor disconnected error	SD	O (Note 1)	O (Note 1)	0	0	1	1
	.0	overheat	46.4	Thermistor circuit error	SD	O (Note 1)	O (Note 1)		Ü		·
			46.5	Abnormal temperature of servo motor 3	DB	O (Note 1)	O (Note 1)				
			46.6	Abnormal temperature of servo motor 4	DB	O (Note 1)	O (Note 1)				
		O a li	47.1	Cooling fan stop error	SD		0	_	_		
	47	Cooling fan error	47.2	Cooling fan speed reduction error	SD		0	0	0	1	1
			50.1	Thermal overload error 1 during operation	SD	O (Note 1)	O (Note 1)				
			50.2	Thermal overload error 2 during operation	SD	O (Note 1)	O (Note 1)				
	50	Overload 1	50.3	Thermal overload error 4 during operation	SD	O (Note 1)	O (Note 1)	0	0	1	1
	30	Ovenuau I	50.4	Thermal overload error 1 during a stop	SD	O (Note 1)	O (Note 1)	-	U	'	'
			50.5	Thermal overload error 2 during a stop	SD	O (Note 1)	O (Note 1)				
			50.6	Thermal overload error 4 during a stop	SD	O (Note 1)	O (Note 1)				

\					Stop	_	arm ivation		Alarm	ı code	
$ \setminus $	No.	Name	Detail No.	Detail name	Type (Note 2, 3)	Alarm reset	Cycling the power		ACD2 (Bit 2)		
Alarm	5 4	0	51.1	Thermal overload error 3 during operation	DB	O (Note 1)	O (Note 1)			4	,
4	51	Overload 2	51.2	Thermal overload error 3 during a stop	DB	O (Note 1)	O (Note 1)	0	0	1	1
			52.1	Excess droop pulse 1	SD	0	0				
			52.3	Excess droop pulse 2	SD	0	0				
	52	Error excessive	52.4	Error excessive during 0 torque limit	SD	0	0	0	1	0	1
			52.5	Excess droop pulse 3	EDB	0	0				
	54	Oscillation detection	54.1	Oscillation detection error	EDB	0	0	0	0	1	1
			56.2	Over speed during forced stop	EDB	0	0				
	56	Forced stop error	56.3	Estimated distance over during forced stop	EDB	0	0	0	1	1	0
	61	Operation error	61.1	Point table setting error	DB	0	0	0	1	0	1
1			63.1	STO1 off	DB	0	0				
	63	STO timing error	63.2	STO2 off	DB	0	0	0	1	1	0
			63.5	STO by functional safety unit	DB	0	0				
			64.1	STO input error	DB		0				
	64	Functional safety unit setting error	64.2	Compatibility mode setting error	DB		0	1	0	0	0
		unit setting entit	64.3	Operation mode setting error	DB		0				
		Functional safety unit connection error	65.1	Functional safety unit communication error 1	SD		0				
			65.2	Functional safety unit communication error 2	SD		0				
			65.3	Functional safety unit communication error 3	SD		0				
			65.4	Functional safety unit communication error 4	SD		0				
	65		65.5	Functional safety unit communication error 5	SD		0	0	0	0	0
			65.6	Functional safety unit communication error 6	SD		0				
			65.7	Functional safety unit communication error 7	SD		0				
			65.8	Functional safety unit shut-off signal error 1	DB		0				
			65.9	Functional safety unit shut-off signal error 2	DB		0				
			66.1	Encoder initial communication - Receive data error 1 (safety observation function)	DB		0				
		Encoder initial	66.2	Encoder initial communication - Receive data error 2 (safety observation function)	DB		0				
	66	communication error (safety observation	66.3	Encoder initial communication - Receive data error 3 (safety observation function)	DB		0	0	1	1	0
		function)	66.7	Encoder initial communication - Transmission data error 1 (safety observation function)	DB		0				
			66.9	Encoder initial communication - Process error 1 (safety observation function)	DB		0				

\setminus					Stop		arm vation		Alarm	code	
	No.	Name	Detail No.	Detail name	Type (Note 2, 3)	Alarm reset	Cycling the power		ACD2 (Bit 2)		
Alarm			67.1	Encoder normal communication - Receive data error 1 (safety observation function)	DB		0				
		Encoder normal	67.2	Encoder normal communication - Receive data error 2 (safety observation function)	DB		0				
	67	communication error 1 (safety observation function)	67.3	Encoder normal communication - Receive data error 3 (safety observation function)	DB		0	0	1	1	0
		function)	67.4	Encoder normal communication - Receive data error 4 (safety observation function)	DB		0				
			67.7	Encoder normal communication - Transmission data error 1 (safety observation function)	DB		0				
	68	STO diagnosis error	68.1	Mismatched STO signal error	DB		0	0	0	0	0
			69.1	Forward rotation-side software limit detection - Command excess error	SD	0	0				
			69.2	Reverse rotation-side software limit detection - Command excess error	SD	0	0				
	69	Command error	69.3	Forward rotation stroke end detection - Command excess error	SD	0	0				
			69.4	Reverse rotation stroke end detection - Command excess error	SD	0	0				
			69.5	Upper stroke limit detection - Command excess error	SD	0	0				
			69.6	Lower stroke limit detection - Command excess error	SD	0	0				
			70.1	Load-side encoder initial communication - Receive data error 1	DB		0				
			70.2	Load-side encoder initial communication - Receive data error 2	DB		0				
			70.3	Load-side encoder initial communication - Receive data error 3	DB		0				
			70.5	Load-side encoder initial communication - Transmission data error 1	DB		0				
		Load-side encoder	70.6	Load-side encoder initial communication - Transmission data error 2	DB		0				
	70	initial communication error 1	70.7	Load-side encoder initial communication - Transmission data error 3	DB		0	0	1	1	0
			70.A	Load-side encoder initial communication - Process error 1	DB		0				
			70.B	Load-side encoder initial communication - Process error 2	DB		0				
			70.C	Load-side encoder initial communication - Process error 3	DB		0				
			70.D	Load-side encoder initial communication - Process error 4	DB		0				
			70.E	Load-side encoder initial communication - Process error 5	DB		0				
			70.F	Load-side encoder initial communication - Process error 6	DB		0				

I l l l l l l l l l l l l l l l l l l l	ACD2 ACD1 Bit 2) (Bit 1)	
No. (Note 2, Alarm the power ACD3 Alarm the power Reset ACD3 Alarm the power ACD3 Alarm the p	Bit 2) (Bit 1)) (Bit 0)
Load-side encoder normal communication error 1	1 1	0
1.2	1 1	0
71.3 communication - Receive data error 3 71.5 communication - Transmission data error 1 11 communication error 1 71.6 communication - Transmission data error 1 12 communication - Transmission data error 2 13 communication - Transmission data error 2 14 communication - Transmission data error 3 15 communication - Transmission data error 3 16 communication - Transmission data error 3 17.7 communication - Receive data error 4 17.8 communication - Receive data error 4 17.9 communication - Receive data error 1 17.0 communication - Receive data error 1 17.1 coad-side encoder normal communication - Receive data error 4 17.2 communication - Receive data error 1 17.3 communication - Transmission data error 3 18.0 communication - Transmission data error 3 19.0 communication - Receive data error 3 10 communication - Receive data error 1 10 communication - Receive data error 1 11 coad-side encoder normal error 4 12 coad-side encoder data error 1 13 communication - Receive data error 1 14 coad-side encoder data error 1 15 coad-side encoder data error 1 16 coad-side encoder data error 1 17 coad-side encoder normal error 2 17 coad-side encoder normal error 2 18 coad-side encoder data error 1 19 coad-side encoder normal error 2 10 coad-side encoder normal error 2 10 coad-side encoder data error 2 10 coad-side encoder normal error 2 10 coad-side encoder normal error 2 10 coad-side encoder data error 2 10 coad-side encoder normal error 2 10 coad-side encoder normal error 2 10 coad-side encoder normal error 2 10 coad-side encoder data error 2 10 coad-side encoder normal error 2 10 coad-side encoder normal error 2 11 coad-side encoder normal error 2 12 coad-side encoder normal error 2 13 coad-side encoder normal error 2 14 coad-side encoder normal error 2 15 coad-side encoder normal error 2 16 coad-side encoder normal error 2 17 coad-side encoder normal error 2 18 coad-side encoder normal error 2 19 coad-side encoder normal error 2 10 coad-side encoder normal error 2 10 coad-side	1 1	0
Coad-side encoder normal communication error 1	1 1	0
Communication error 1 71.6 Communication - Transmission data error 2 Conduction - Transmission data error 2 Conduction - Transmission data error 3 Conduction - Receive data error 4 Conduction - Receive data error 4 Conduction - Receive data error 5 Conduction - Receive data error 1 EDB Conduction - Receive data error 2 EDB Conduction - Receive data error 3 Conduction - Receive data error 4 Conduction - Receive data error -		
71.7 communication - Transmission EDB O data error 3		
71.9 communication - Receive data EDB O		
71.A communication - Receive data error 5 72.1 Load-side encoder data error 1 EDB O 172.2 Load-side encoder data update error 72.3 Load-side encoder data update error 72.4 Load-side encoder data waveform error 72.4 Load-side encoder non-signal error 72.5 Load-side encoder hardware error 1 72.6 Load-side encoder hardware error 2 72.9 Load-side encoder hardware error 2 72.9 Load-side encoder data error 2 EDB O 74.1 Option card error 1 74.2 Option card error 1 75. Option card error 2 75.3 Option card error 2 75.4 Option card error 2 75.5 Option card error 2 75.5 Option card error 2 75.5 Option card error 2 75.6 Option card error 2 75.7 Option card error 2 75.7 Option card error 2 75.8 Option card error 2 75.8 Option card error 2 75.8 Option card error 2		
T2.2 Load-side encoder data update error T2.3 Load-side encoder data waveform error T2.4 Load-side encoder data waveform error T2.5 Load-side encoder non-signal error 1 T2.6 Load-side encoder hardware error 2 T2.9 Load-side encoder hardware error 2 T2.9 Load-side encoder hardware error 2 T2.9 Load-side encoder data error 2 T2.9 Load-side encoder data error 2 T3.9 Load-side encoder hardware error 2 T4.1 Option card error 1 T4.2 Option card error 2 T4.3 Option card error 2 T4.4 Option card error 3 T5. Option card error 2 T5.3 Option card error 5 Option card error 2 T5.3 Option card error EDB O O O O O O O O O O O O O		
T2.2 error T2.3 Load-side encoder data waveform error T2.4 Load-side encoder non-signal error T2.5 Load-side encoder non-signal error T2.6 Load-side encoder hardware error 1 T2.6 Load-side encoder hardware error 2 T2.9 Load-side encoder hardware error 2 T2.9 Load-side encoder hardware error 2 T2.9 Load-side encoder data error 2 EDB T3.1 Option card error 1 T4.2 Option card error 2 T4.3 Option card error 3 T4.4 Option card error 4 T5.0 Option card error 2 T5.3 Option card error 5 T5.3 Option card error 2 T5.3 Option card error 5 T5.3 Option card error 2 T5.3 Option card error EDB		
1/2		0
72		
72.5 Contion card error 2 Contion card error 3 Contion card error 2 Contion card error 3 Contion card error 3 Contion card error 4 Continuation card error 5 Continuation card error 6 Continuation card error 7 Continuation card error 8 Continuation card error 9 Continuation card error 9 Continuation card error 9 Continuation card error 1 Continuation card error 2 Continuation card error 3 Continuation card error 2 Continuation card error 3 Continuation card error 4 Continuation card error 5 Continuation card error 5 Continuation card error 2 Continuation card error 2 Continuation card error 2 Continuation card error 3 Continuation card error 4 Continuation card error 4 Continuation card error 5 Continuation card error 2 Continuation card	1 1	
72.6 error 2 EDB		
74.1 Option card error 1 74.2 Option card error 2 74.3 Option card error 3 74.4 Option card error 3 75. Option card error 2 75. Option card error 2 76.1 Option card error 2 76.2 Option card error 2 77.3 Option card error 2 77.3 Option card error 2 78.3 Option card error 5 78.3 Option card error 6 79.4 Option card error 7 79. Option card error 2		
74 Option card error 1 74.2 Option card error 2 74.3 Option card error 3 74.4 Option card error 3 75. Option card error 2 75.3 Option card error 2 75.3 Option card error 2 76.4 Option card error 5 77.5 Option card error 2 77.5 Option card error 2 78.5 Option card error 2		
74 Option card error 1 74.3 Option card error 3 74.4 Option card error 4 75. Option card error 2 75. Option card error 2 76. Option card error 2 77. Option card error 2 78. Option card error 2 78. Option card error 2		
74.4 Option card error 4 DB O 74.5 Option card error 5 DB O 75.3 Option card error 2 75.3 Option card connection error EDB O		
74.5 Option card error 5 DB O 75. Option card error 2 75.3 Option card connection error EDB O		
75 Option card error 2 75.3 Option card connection error EDB O		
1 /5 Option card error 2		
75.4 Option card disconnected DB O		
79.1 Functional safety unit power voltage error DB (Note 5) O		
79.2 Functional safety unit internal DB O		
Functional safety unit diagnosis error unit diagnos	1 1	1
79.4 Servo amplifier error SD O		
79.5 Input device error SD O		
79.6 Output device error SD O		
79.7 Mismatched input signal error SD O		
79.8 Position feedback fixing error DB O		
7A.1 Parameter verification error (safety observation function) DB O		0
Parameter setting Parameter setting TA.2 Parameter setting range error (safety observation function)		
7A error (safety observation function) 7A.3 Parameter combination error (safety observation function) DB O	0 0	
Functional safety unit 7A.4 combination error (safety observation function) DB O		

\setminus					Stop Type	Alarm deactivation		Alarm code						
\setminus	No.	No. Name Detail No.		Detail name		Alarm reset	Cycling the power	ACD3 (Bit 3)		ACD1 (Bit 1)				
Alarm			7B.1	Encoder diagnosis error 1 (safety observation function)			0							
,	7B	Encoder diagnosis	7B.2	Encoder diagnosis error 2 (safety observation function)	DB		0	0	1	1	0			
	76	error (safety observation function)	7B.3	Encoder diagnosis error 3 (safety observation function)	DB		0		'		U			
			7B.4	Encoder diagnosis error 4 (safety observation function)	DB		0							
	7C	Functional safety unit communication diagnosis error (safety observation function)	7C.1	Functional safety unit communication cycle error (safety observation function)	SD	O (Note 5)	0	0	0		0			
	70		7C.2	Functional safety unit communication data error (safety observation function)	SD	O (Note 5)	0			0	O			
	7D	Safety observation	7D.1	Stop observation error	DB	O (Note 3)	0	1	1	1	1			
	70	error	7D.2	Speed observation error	DB	O (Note 5)	0	ı	1	'	1			
	82	Master-slave operation error 1 82.1		Master-slave operation error 1	EDB	0	0							
-		Network module initialization error	84.1	Network module undetected error	DB		0							
	84		84.2	Network module initialization error 1	DB		0							
			84.3	Network module initialization error 2	DB		0							
	85	Network module error	85.1	Network module error 1	SD		0							
			85.2	Network module error 2	SD		0							
			85.3	Network module error 3	SD		0							
		Network	86.1	Network communication error 1	SD	0	0							
	86	communication error	86.2	Network communication error 2	SD	0	0							
			86.3	Network communication error 3	SD	0	0							
	8A	USB communication time-out error/serial communication	8A.1	USB communication time-out error/Serial communication time-out error	SD	0	0	0	0	0	0			
		OA	-	time-out error/Modbus-RTU communication time-out error	error/Modbus-RTU communication 8A	8A.2	Modbus-RTU communication time-out error	SD	0	0	Ů	Ů	Ů	O
		CC-Link IE communication error	8D.1	CC-Link IE communication error 1	SD	0	0							
			8D.2	CC-Link IE communication error 2	SD	0	0							
			8D.3	Master station setting error 1	DB	0	0							
	8D		8D.5	Master station setting error 2	DB		0							
			8D.6	CC-Link IE communication error 3	SD	0	0							
			8D.7	CC-Link IE communication error 4	SD	0	0							
			8D.8	CC-Link IE communication error 5	SD	0	0							
				Synchronization error 1	SD		0							
L			8D.A	Synchronization error 2	SD		0							

\setminus		o. Name	Detail No.		Stop	Alarm deactivation		Alarm code			
	No.			Detail name	Type (Note 2, 3)	Alarm reset	Cycling the power	ACD3			ACD0 (Bit 0)
Alarm				USB communication receive error/Serial communication receive error	SD	0	0				
		USB communication error/serial communication error/Modbus-RTU communication error	8E.2	USB communication checksum error/Serial communication checksum error	SD	0	0	0		0	
			8E.3	USB communication character error/serial communication character error	SD	0	0				
8E	8E		8E.4	USB communication command error/Serial communication command error	SD	0	0		0		0
			8E.5	USB communication data number error/Serial communication data number error	SD	0	0				
			8E.6	Modbus-RTU communication receive error	SD	0	0				
			8E.7	Modbus-RTU communication message frame error	SD	0	0				
			8E.8	Modbus-RTU communication CRC error	SD	0	0				
	88888	Watchdog	8888	Watchdog	DB		0				

Note 1. Leave for about 30 minutes of cooling time after removing the cause of occurrence.

- 2. The following shows three stop methods of DB, EDB, and SD.
 - DB: Stops with dynamic brake. (Coasts for the servo amplifier without dynamic brake.)

Coasts for MR-J4-03A6(-RJ).

Note that EDB is applied when an alarm below occurs:

[AL. 30.1], [AL. 32.2], [AL. 32.4], [AL. 51.1], [AL. 51.2]

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 will be DB.

Series	Servo motor
HG-KR	HG-KR053/HG-KR13/HG-KR23/HG-KR43
HG-MR	HG-MR053/HG-MR13/HG-MR23/HG-MR43
HG-SR	HG-SR51/HG-SR52
HG-AK	HG-AK0136/HG-AK0236/HG-AK0336

SD: Forced stop deceleration

- 3. This is applicable when [Pr. PA04] is set to the initial value. The stop system of SD can be changed to DB using [Pr. PA04].
- 4. The alarm can be canceled by setting as follows:

For the fully closed loop control: set [Pr. PE03] to "1 $_$ _ _ ".

When a linear servo motor or direct drive motor is used: set [Pr. PL04] to "1 $_$ $_$ ".

5. Reset this while all the safety observation functions are stopped.

8.3 Warning list

\setminus	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)		
Бſ			90.1	Home position return incomplete			
Warning	90	Home position return incomplete warning	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	92.1	Encoder battery cable disconnection warning			
ŀ		warning	92.3	Battery degradation			
	93	ABS data transfer warning	93.1	Magnetic pole detection incomplete warning at ABS data transfer request			
			95.1	STO1 off detection	DB		
			95.2	STO2 off detection	DB		
	95	STO warning	95.3	STO warning 1 (safety observation function)	DB		
			95.4	STO warning 2 (safety observation function)	DB		
			95.5	STO warning 3 (safety observation function)	DB		
			96.1	In-position warning at home positioning			
		Home position setting warning	96.2	Command input warning at			
	96		96.3	home positioning Servo off warning at home			
			90.3	positioning Magnetic pole detection			
			96.4	incomplete warning at home positioning			
	97	Positioning	97.1	Program operation disabled warning			
		specification warning	97.2	Next station position warning			
	98	Software limit warning	98.1	Forward rotation-side software stroke limit reached			
	50		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)		
			99.4	Upper stroke limit off			
		Ontional unit innut	99.5 9A.1	Lower stroke limit off Optional unit input data sign error			
	9A		Optional unit input data error warning		9A.2	Optional unit BCD input data error	
		Error excessive warning	9B.1	Excess droop pulse 1 warning			
	0.0		9B.3	Excess droop pulse 2 warning			
	9B		9B.4	Error excessive warning during 0 torque limit			
	9C	Converter warning	9C.1	Converter unit warning			
		CC-Link IE warning	9D.1	Station number switch change warning			
	9D		9D.2	Master station setting warning			
			9D.3	Overlapping station number warning			
			9D.4	Mismatched station number warning			
	9E	CC-Link IE warning 2	9E.1	CC-Link IE communication warning			
	9F	Battery warning	9F.1	Low battery			
	JΙ	Dattory warning	9F.2	Battery degradation warning			

\setminus	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)
Warning	E0	Excessive regeneration warning	E0.1	Excessive regeneration warning	
Wa	Wa		E1.1	Thermal overload warning 1 during operation	
			E1.2	Thermal overload warning 2 during operation	
			E1.3	Thermal overload warning 3 during operation	
	5 4	0 . 1 . 1	E1.4	Thermal overload warning 4 during operation	
	E1	Overload warning 1	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	
	E2	Servo motor overheat warning	E2.1	Servo motor temperature warning	
			E3.1	Multi-revolution counter travel distance excess warning	
			E3.2	Absolute position counter warning	
	E3 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	
			E5.1	Time-out during ABS data transfer	
	E5	ABS time-out warning	E5.2	ABSM off during ABS data transfer	
			E5.3	SON off during ABS data transfer	
			E6.1	Forced stop warning	SD
	E6	Servo forced stop	E6.2	SS1 forced stop warning 1 (safety observation function)	SD
		warning	E6.3	SS1 forced stop warning 2 (safety observation function)	SD
	E7	Controller forced stop warning	E7.1	Controller forced stop input warning	SD
	E8	Cooling fan speed	E8.1	Decreased cooling fan speed warning	
	LO	reduction warning	E8.2	Cooling fan stop	
			E9.1	Servo-on signal on during main circuit off	DB
	E9	Main circuit off	E9.2	Bus voltage drop during low speed operation	DB
		warning	E9.3	Ready-on signal on during main circuit off	DB
			E9.4	Converter unit forced stop	DB
	EA	ABS servo-on warning	EA.1	ABS servo-on warning	
	EB	The other axis error warning	EB.1	The other axis error warning	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	
		ŭ	F0.3	Vibration tough drive warning	

\setminus	No.	Name	Detail No.	Detail name	Stop method (Note 2, 3)
Warning	F2	Drive recorder -	F2.1	Drive recorder - Area writing time-out warning	
Wa	ΓZ	Miswriting warning	F2.2	Drive recorder - Data miswriting warning	
	F3	Oscillation detection warning	F3.1	Oscillation detection warning	
			F4.4	Target position setting range error warning	
	F4 Positioning warning	Positioning warning	F4.6	Acceleration time constant setting range error warning	
		F4.7	Deceleration time constant setting range error warning		
		Simple cam		Cam data - Area writing time-out warning	
	F5		F5.2	Cam data - Area miswriting warning	
			F5.3	Cam data checksum error	
		Simple cam	F6.1	Cam axis one cycle current value restoration failed	
	F6		F6.2	Cam axis feed current value restoration failed	
		function - Cam	F6.3	Cam unregistered error	
		control warning	F6.4	Cam control data setting range error	
			F6.5	Cam No. external error	
			F6.6	Cam control inactive	

Note 1. Leave for about 30 minutes of cooling time after removing the cause of occurrence.

- 2. The following shows two stop methods of DB and SD.
 - DB: Stops with dynamic brake. (Coasts for the servo amplifier without dynamic brake.) Coasts for MR-J4-03A6(-RJ).
 - SD: Forced stop deceleration
- 3. This is applicable when [Pr. PA04] is set to the initial value. The stop system of SD can be changed to DB using [Pr. PA04].
- 4. Quick stop or slow stop can be selected using [Pr. PD30].

8. TROUBLESHOOTING

MEMO		

9. DIMENSIONS

9. DIMENSIONS

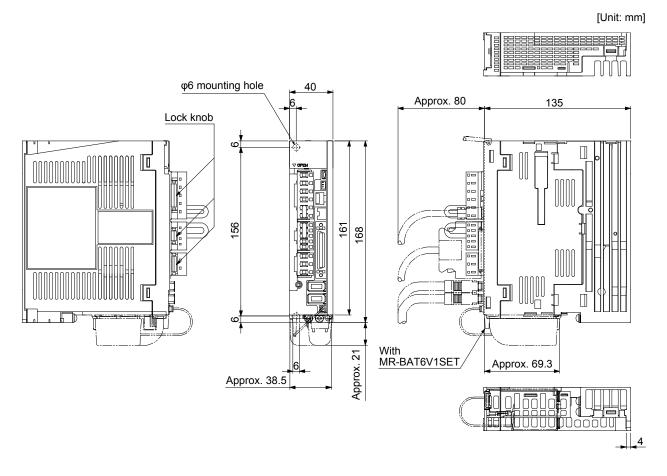
9.1 Servo amplifier

POINT

●Only MR-J4-_A_-RJ are shown for dimensions. MR-J4-_A_ does not have CN2L, CN7 and CN9 connectors. The dimensions of MR-J4-_A_ are the same as those of MR-J4-_A_-RJ except CN2L, CN7 and CN9 connectors.

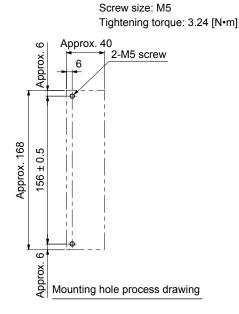
(1) 200 V class

(a) MR-J4-10A(-RJ)/MR-J4-20A(-RJ)



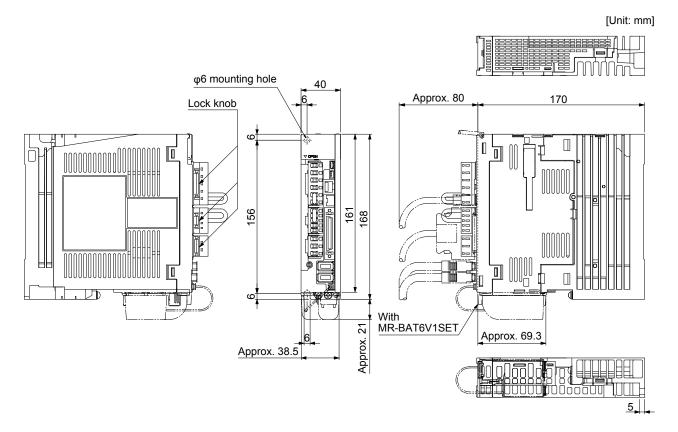
Mass: 0.8 [kg]

- Terminal CNP1 L1 L2 L3 N-P3 P4 CNP2 С D L11 L21 CNP3 U ٧ W PE Screw size: M4 **(1)** \oplus Tightening torque: 1.2 [N•m]



Mounting screw

(b) MR-J4-40A(-RJ)/MR-J4-60A(-RJ)



Terminal CNP1 L1 L2 L3 N-P3 P4 CNP2 P+ С D L11 L21 CNP3 U ٧ W PE Screw size: M4 **(** Tightening torque: 1.2 [N•m]

Screw size: M5
Tightening torque: 3.24 [N•m]

9 Approx. 40
6 2-M5 screw

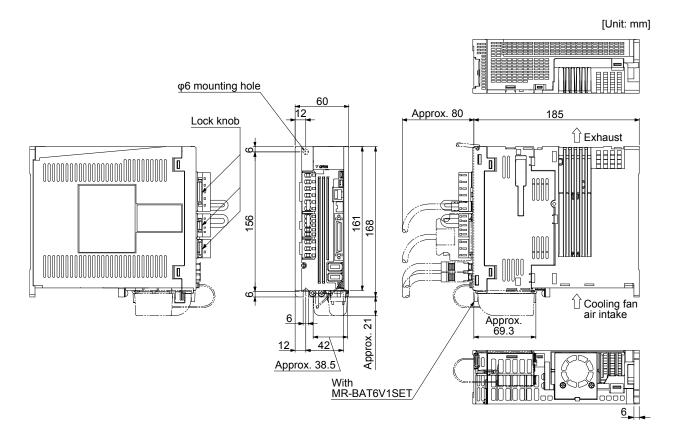
Mounting hole process drawing

9

Mounting screw

Mass: 1.0 [kg]

(c) MR-J4-70A(-RJ)/MR-J4-100A(-RJ)



Mass: 1.4 [kg]

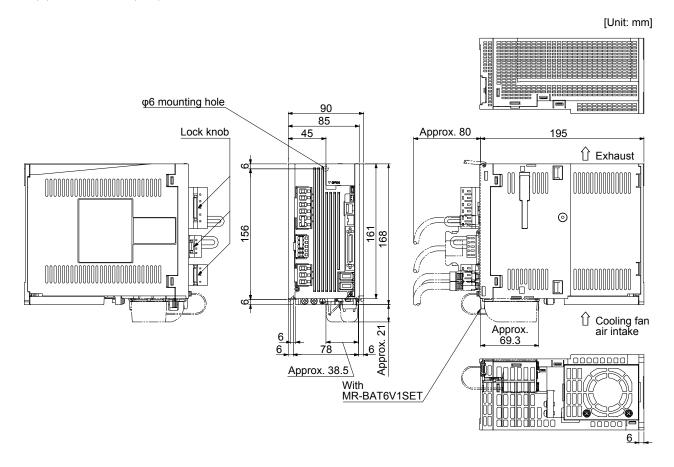
Terminal CNP1 L1 L2 L3 N-P3 P4 CNP2 P+ С D L11 L21 CNP3 U ٧ W PE Screw size: M4 \oplus \oplus Tightening torque: 1.2 [N•m]

Approx. 12 42 ± 0.3 Approx. 6

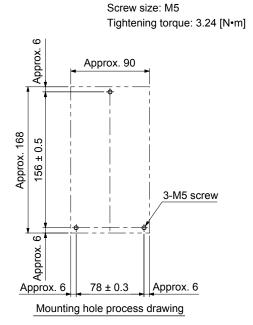
Mounting hole process drawing

Mounting screw

(d) MR-J4-200A(-RJ)



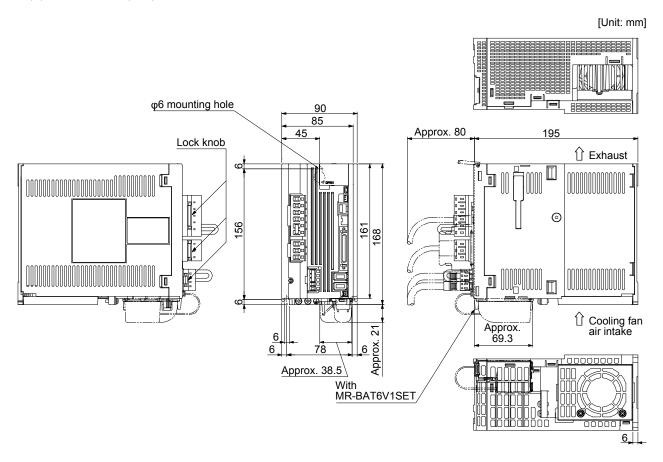
Terminal CNP1 L1 L2 L3 N-P3 P4 CNP2 P+ C D L11 L21 CNP3 U ٧ W PE Screw size: M4 Tightening torque: 1.2 [N•m]

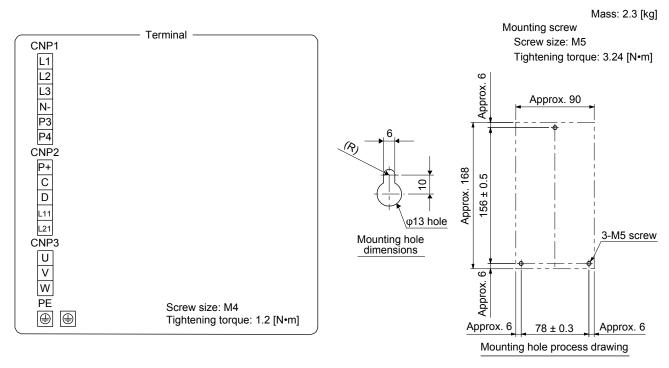


Mounting screw

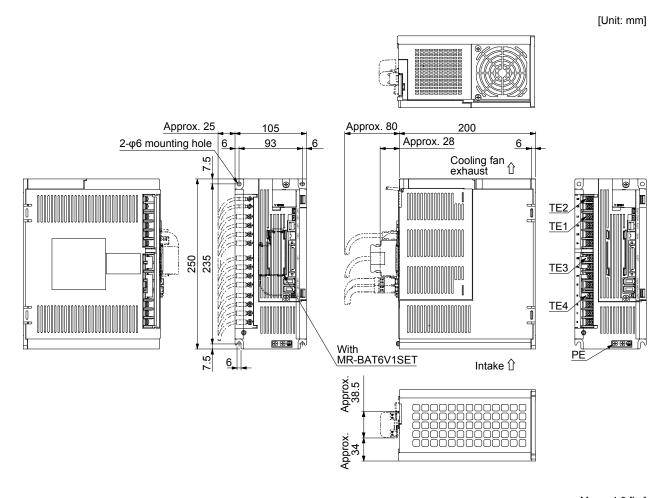
Mass: 2.1 [kg]

(e) MR-J4-350A(-RJ)



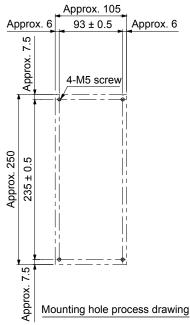


(f) MR-J4-500A(-RJ)

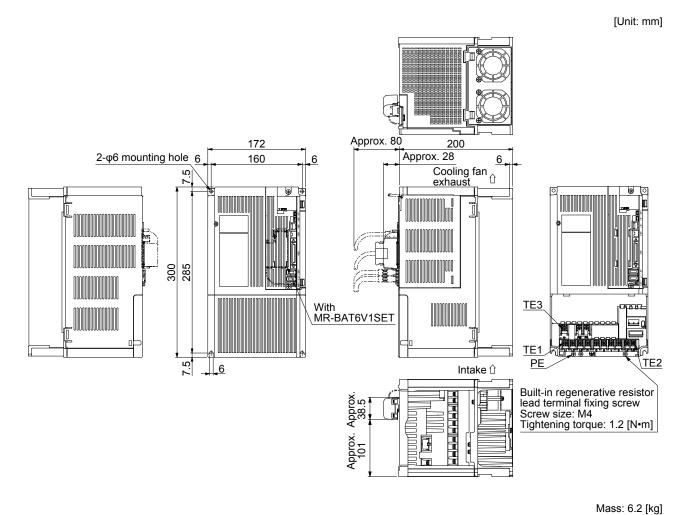


Terminal TE2 L11 TE2 Screw size: M3.5 Tightening torque: 0.8 [N•m] L21 TE1 L1 TE1 Screw size: M4 Tightening torque: 1.2 [N•m] N-TE3 TE3 Screw size: M4 P3 Tightening torque: 1.2 [N•m] P4 С TE4 TE4 Screw size: M4 D Tightening torque: 1.2 [N•m] U ٧ PE Screw size: M4 W Tightening torque: 1.2 [N•m]

Mass: 4.0 [kg]
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



(g) MR-J4-700A(-RJ)



Approx. 172

Approx. 6

Approx. 6

Approx. 6

4-M5 screw

9:00

4-M5 screw

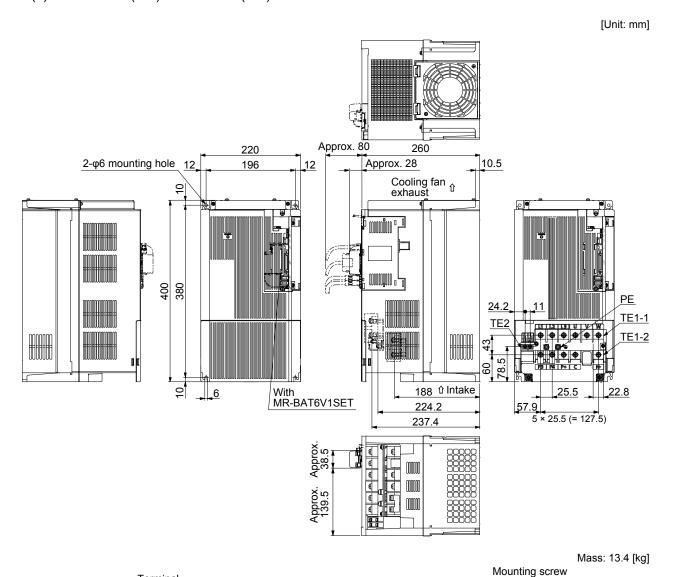
4-M5 screw

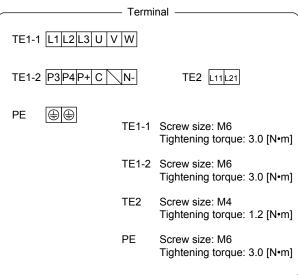
Mounting hole process drawing

Mounting screw

9 - 8

(h) MR-J4-11KA(-RJ)/MR-J4-15KA(-RJ)





Approx. 220

Approx. 12 196 ± 0.5 Approx. 12

4-M5 screw

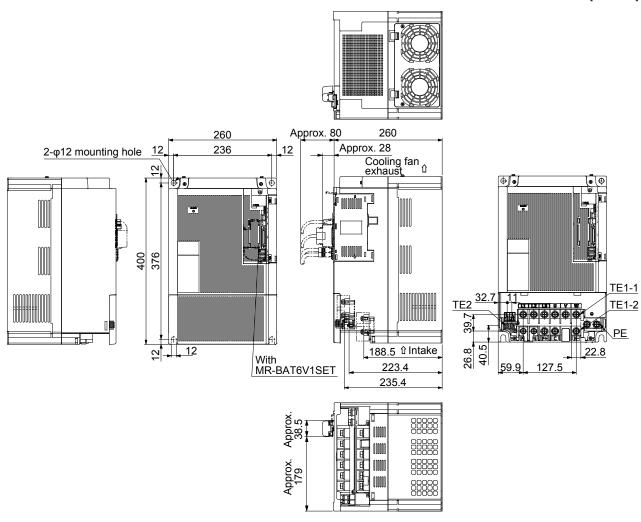
Would W

Mounting hole process drawing

(i) MR-J4-22KA(-RJ)

[Unit: mm]

Mass: 18.2 [kg]



- Terminal -TE1-1 L1 L2 L3 U V W TE1-2 P3 P4 P+ C N-⊕ ⊕ TE2 L11 L21 PΕ TE1-1 Screw size: M8 Tightening torque: 6.0 [N•m] TE1-2 Screw size: M8 Tightening torque: 6.0 [N•m] TE2 Screw size: M4 Tightening torque: 1.2 [N•m] PΕ Screw size: M8 Tightening torque: 6.0 [N•m]

Approx. 260

Approx. 12

236 ± 0.5

Approx. 12

4-M10 screw

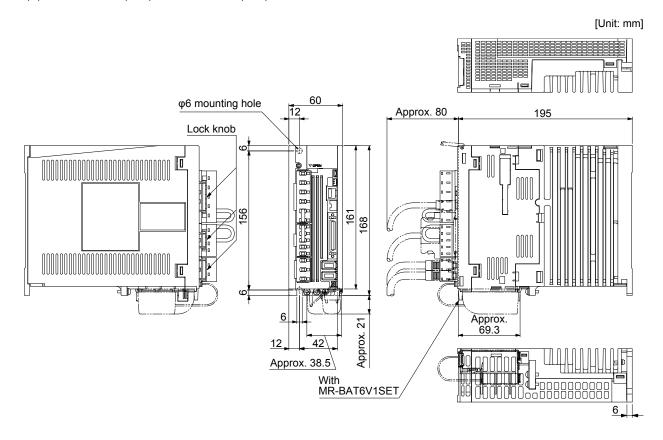
4-M10 screw

Mounting hole process drawing

Mounting screw

(2) 400 V class

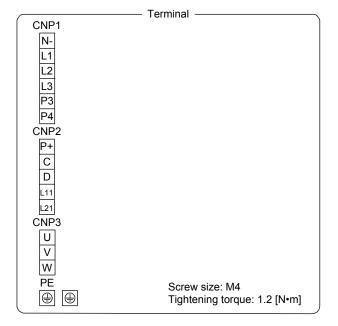
(a) MR-J4-60A4(-RJ)/MR-J4-100A4(-RJ)

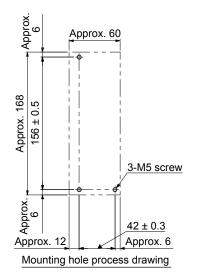


Mass: 1.7 [kg]

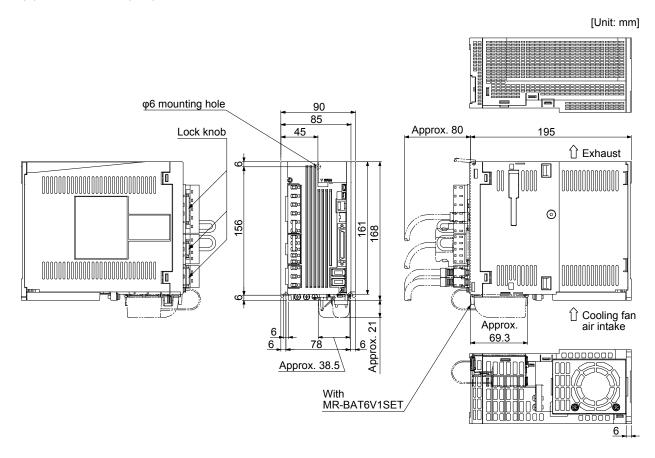
Mounting screw Screw size: M5

Tightening torque: 3.24 [N•m]





(b) MR-J4-200A4(-RJ)



Terminal CNP1 N-L1 L2 L3 P3 P4 CNP2 P+ С D L11 L21 CNP3 U ٧ W PE Screw size: M4 Tightening torque: 1.2 [N•m] \oplus

Approx. 90

Approx. 90

Solution

Approx. 90

Approx. 90

3-M5 screw

Approx. 6

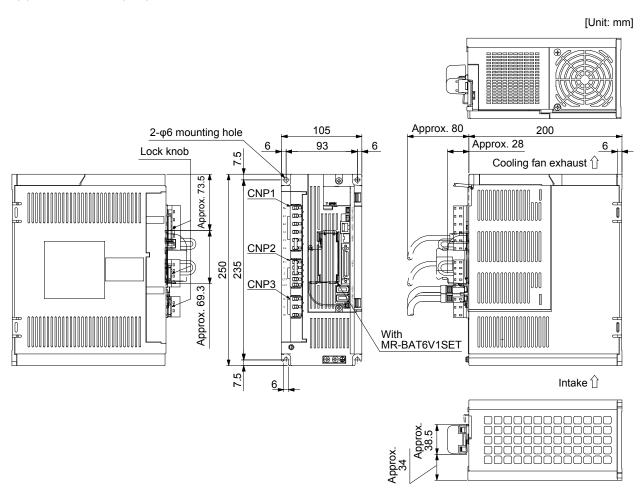
Mounting hole process drawing

Mounting screw

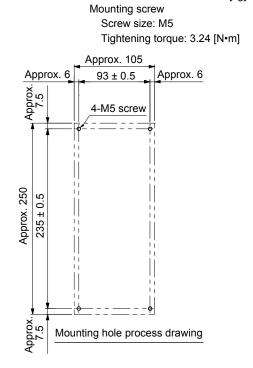
Screw size: M5

Mass: 2.1 [kg]

(c) MR-J4-350A4(-RJ)

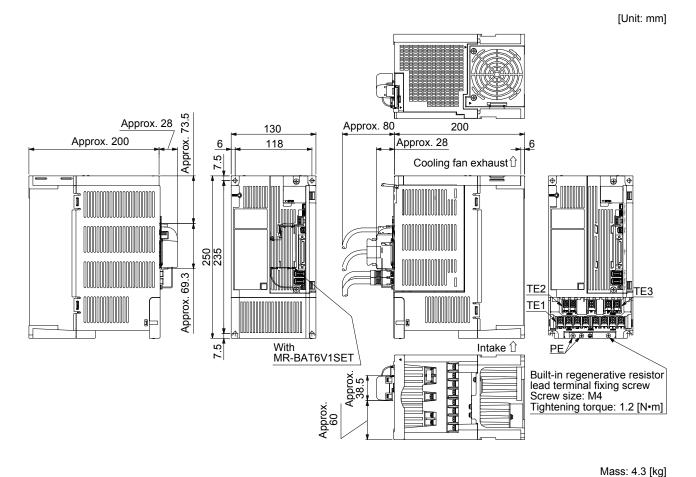


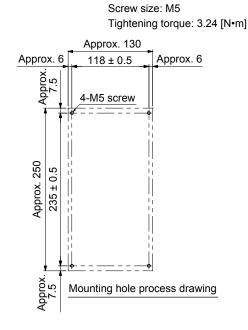
Terminal CNP1 N-L1 L2 L3 РЗ P4 CNP2 P+ С D L11 L21 CNP3 U ٧ W PE Screw size: M4 Tightening torque: 1.2 [N•m] **(1)** \oplus



Mass: 3.6 [kg]

(d) MR-J4-500A4(-RJ)

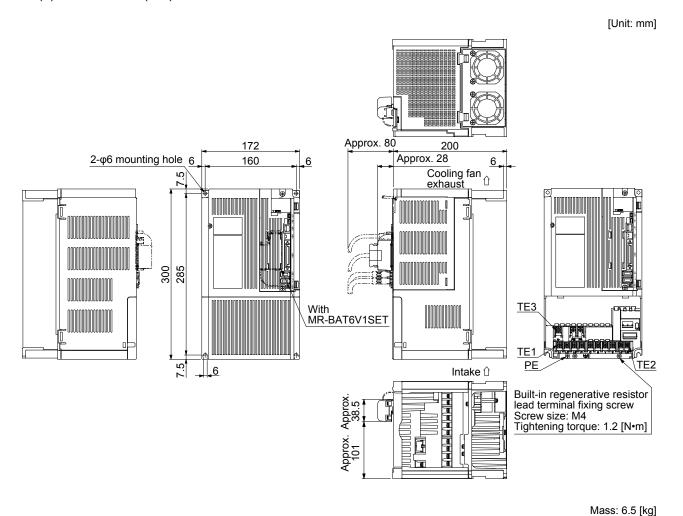


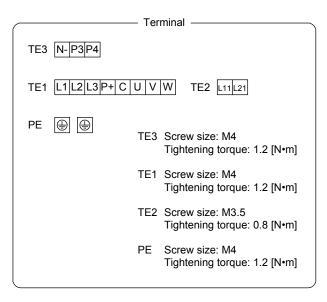


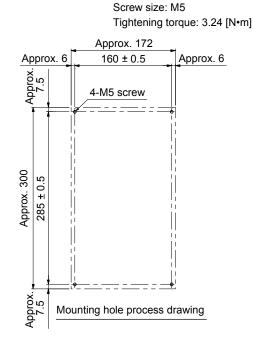
Mounting screw

9 - 14

(e) MR-J4-700A4(-RJ)

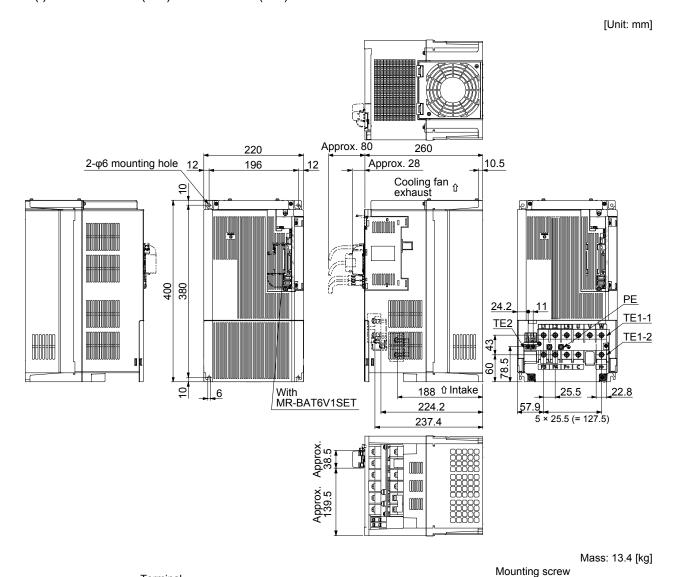


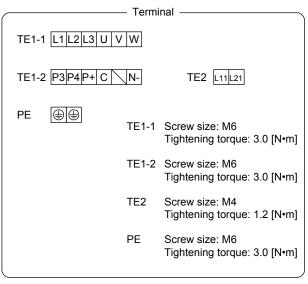


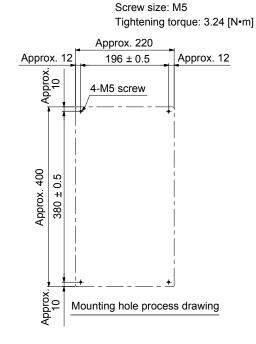


Mounting screw

(f) MR-J4-11KA4(-RJ)/MR-J4-15KA4(-RJ)

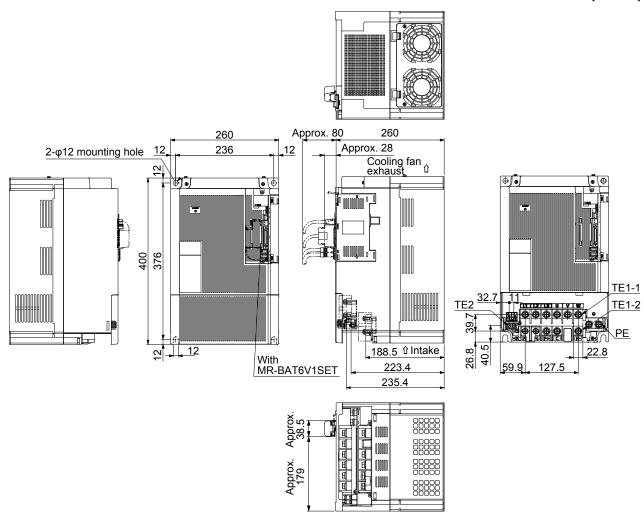






(g) MR-J4-22KA4(-RJ)

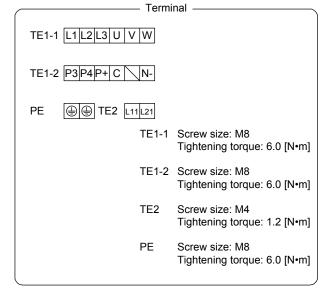
[Unit: mm]

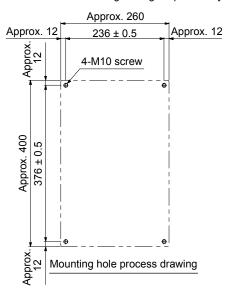


Mass: 18.2 [kg]

Mounting screw Screw size: M10

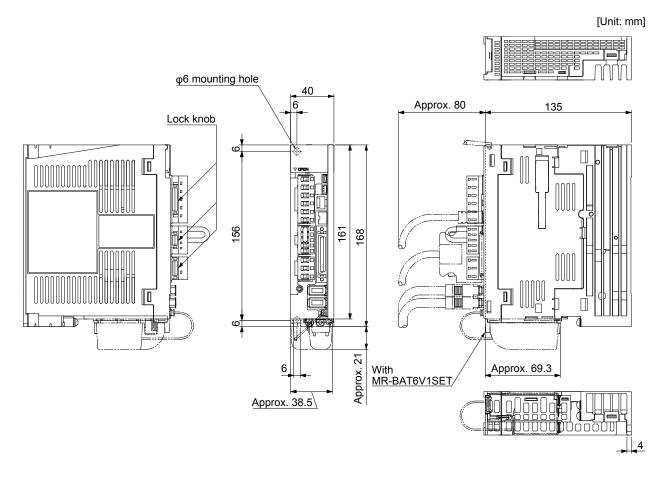
Tightening torque: 3.24 [N•m]





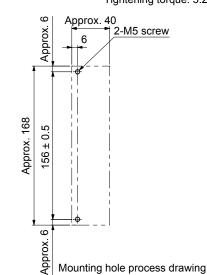
(3) 100 V class

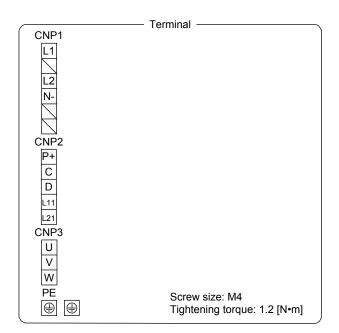
(a) MR-J4-10A1(-RJ)/MR-J4-20A1(-RJ)



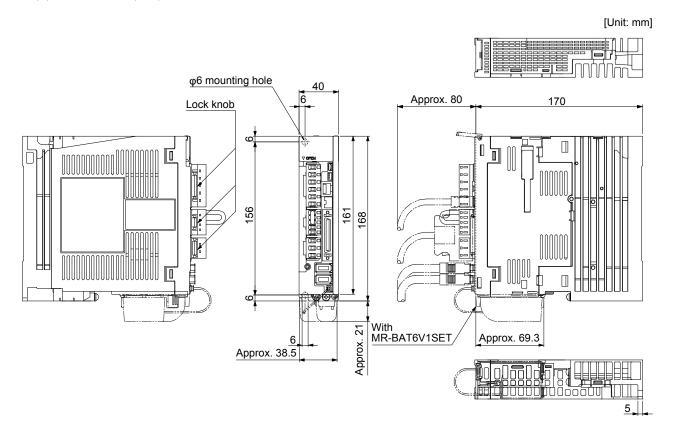
Mass: 0.8 [kg]

Mounting screw Screw size: M5 Tightening torque: 3.24 [N•m]





(b) MR-J4-40A1(-RJ)



Terminal CNP1 L1 L2 N-CNP2 С D L11 L21 CNP3 U V W PE Screw size: M4 Tightening torque: 1.2 [N•m]

Screw size: M5 Tightening torque: 3.24 [N•m] Approx. 40 Approx. 6 2-M5 screw Approx. 168 156 ± 0.5 Approx. 6

Mounting hole process drawing

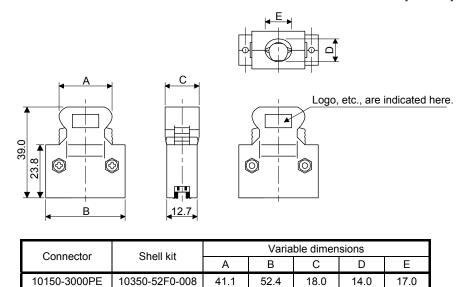
Mounting screw

Mass: 1.0 [kg]

9.2 Connector

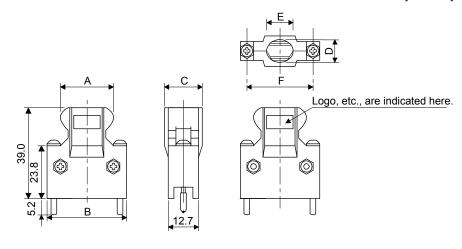
- (1) Miniature delta ribbon (MDR) system (3M)
 - (2) One-touch lock type

[Unit: mm]



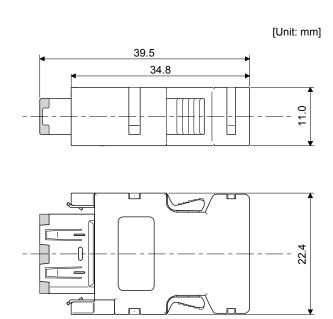
(b) Jack screw M2.6 type
This is not available as option.

[Unit: mm]



Connector	Shell kit	Variable dimensions						
Connector	SHEII KIL	Α	В	С	D	Е	F	
10150-3000PE	10350-52A0-008	41.1	52.4	18.0	14.0	17.0	46.5	

(2) SCR connector system (3M) Receptacle: 36210-0100PL Shell kit: 36310-3200-008



MEMO		

10. CHARACTERISTICS

POINT

● For the characteristics of the linear servo motor and the direct drive motor, refer to sections 15.4 and 16.5.

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-hand side area of the continuous or broken line in the graph.

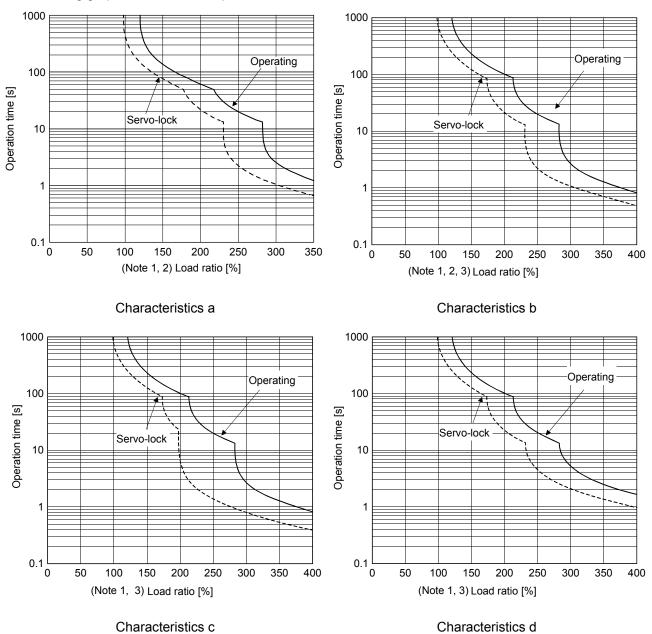
For the system where the unbalanced torque occurs, such as a vertical axis system, the unbalanced torque of the machine should be kept at 70% or less of the rated torque.

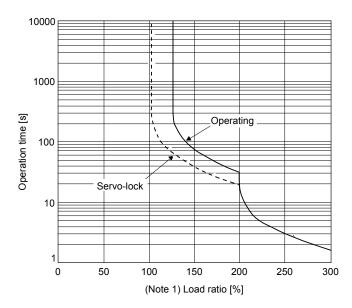
This servo amplifier has solid-state servo motor overload protection. (The servo motor overload current (full load current) is set on the basis of 120% rated current of the servo amplifier.)

The following table shows combinations of each servo motor and graph of overload protection characteristics.

			Rotary ser	vo motor			Graph of overload
HG-KR	HG-MR	HG-SR	HG-UR	HG-RR	HG-JR	HG-JR (When the maximum torque is 400%)	protection characteristics
053 13	053 13		72				Characteristics a
23 43 73	23 43 73	51 81 52 102			53 73 103	53	Characteristics b
		121 201 152 202 301 352	152 202	103 153 203	153 203 353	73 103 153 203	Characteristics c
		421 502 702	352 502	353 503	601 701M 503 703	353 503	Characteristics d
					801 12K1 15K1 20K1 25K1 11K1M 15K1M 22K1M 903		Characteristics e
		524 1024			534 734 1034	534	Characteristics b
		1524 2024 3524			1534 2034 3534	734 1034 1534 2034	Characteristics c
		5024 7024			6014 701M4 5034 7034	3534 5034	Characteristics d
					8014 12K14 15K14 20K14 25K14 11K1M4 15K1M4 22K1M4 9034		Characteristics e

The following graphs show overload protection characteristics.





Characteristics e

Note 1. 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 30 r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal protection.

- 2. The load ratio ranging from 300% to 350% applies to the HG-KR servo motor.
- 3. The operation time at the load ratio of 300% to 400% applies when the maximum torque of HG-JR servo motor is increased to 400% of rated torque.

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

			(Note 2) Ser	vo amplifier-genera	ited heat [W]	
Servo amplifier	Servo motor	(Note 1) Power supply capacity [kVA]	At rated output	At rated output [Generated heat in the cabinet when cooled outside the cabinet] (Note 3)	With servo-off	Area required for heat dissipation [m²]
	HG-MR053	0.3	25		15	0.5
MR-J4-10A(-RJ)	HG-MR13	0.3	25	1\	15	0.5
WIX-34-10A(-K3)	HG-KR053	0.3	25	1\	15	0.5
	HG-KR13	0.3	25] \	15	0.5
MR-J4-20A(-RJ)	HG-MR23	0.5	25] \	15	0.5
WR-J4-20A(-RJ)	HG-KR23	0.5	25	1 \	15	0.5
MR-J4-40A(-RJ)	HG-MR43	0.9	35	1 \	15	0.7
WR-J4-40A(-RJ)	HG-KR43	0.9	35	1 \	15	0.7
	HG-SR52	1.0	40] \	15	0.8
MR-J4-60A(-RJ)	HG-SR51	1.0	40] \	15	0.8
	HG-JR53	1.0	40] \	15	0.8
	HG-MR73	1.3	50] \	15	1.0
MR-J4-70A(-RJ)	HG-KR73	1.3	50] \	15	1.0
MR-J4-70A(-RJ)	HG-UR72	1.3	50] \	15	1.0
	HG-JR73	1.3	50] \	15	1.0
MR-J4-100A(-RJ)	HG-SR102	1.7	50] \	15	1.0
	HG-SR81	1.5	50] \	15	1.0
	HG-JR103	1.7	50	\	15	1.0
	HG-SR152	2.5	90	\	20	1.8
	HG-SR202	3.5	90	\	20	1.8
	HG-SR121	2.1	90	\	20	1.8
	HG-SR201	3.5	90	\	20	1.8
MR-J4-200A(-RJ)	HG-RR103	1.7	50	\	15	1.0
	HG-RR153	2.5	90]	20	1.8
	HG-UR152	2.5	90	\	20	1.8
	HG-JR153	2.5	90	\	20	1.8
	HG-JR203	3.5	90	\ \	20	1.8
	HG-SR352	5.5	130	\	20	2.6
	HG-SR301	4.8	120	<u> </u>	20	2.4
MR-J4-350A(-RJ)	HG-RR203	3.5	90	<u> </u> \	20	1.8
	HG-UR202	3.5	90] \	20	1.8
	HG-JR353	5.5	160]	20	2.7
	HG-SR502	7.5	195] \	25	3.9
	HG-SR421	6.3	160] \	25	3.2
	HG-RR353	5.5	135] \	25	2.7
MR-J4-500A(-RJ)	HG-RR503	7.5	195] \	25	3.9
	HG-UR352	5.5	195] \	25	3.9
	HG-UR502	7.5	195] \	25	3.9
	HG-JR503	7.5	195] \	25	3.9
	HG-SR702	10	300] \	25	6.0
MR-J4-700A(-RJ)	HG-JR703	10	300] \	25	6.0
1(04 100A(-100)	HG-JR701M	10	300] \	25	6.0
	HG-JR601	8.6	250		25	5.0

			(Note 2) Ser	vo amplifier-genera	ited heat [W]	
			(14010 2) 001	At rated output	ited fieat [vv]	
Servo amplifier		(Note 1)		[Generated heat		Area required for
	Servo motor	Power supply	At material acctions	in the cabinet	\A('A)	heat dissipation
·		capacity	At rated output	when cooled	With servo-off	[m ²]
		[kVA]		outside the		
				cabinet] (Note 3)		
	HG-JR903	13	435	130	45	8.7
MR-J4-11KA(-RJ)	HG-JR11K1M	16	530	160	45	11.0
WII (-04-11104(-110)	HG-JR801	12	370	110	45	7.0
	HG-JR12K1	18	570	170	45	11.5
MR-J4-15KA(-RJ)	HG-JR15K1M	22	640	195	45	13.0
WIIX-04-131XA(-1X0)	HG-JR15K1	22	640	195	45	12.8
	HG-JR22K1M	33	850	260	55	17.0
MR-J4-22KA(-RJ)	HG-JR20K1	30	800	240	55	16.0
	HG-JR25K1	38	900	270	55	19.0
MR-J4-60A4(-RJ)	HG-SR524	1.0	40	$V_{\overline{}}$	18	0.8
IVIIX-J4-0UA4(-KJ)	HG-JR534	1.0	40] \	18	0.8
	HG-SR1024	1.7	60		18	1.2
MR-J4-100A4(-RJ)	HG-JR734	1.3	60] \	18	1.2
	HG-JR1034	1.7	60] \	18	1.2
	HG-SR1524	2.5	90] \	20	1.8
MD 14 20044/ D I)	HG-SR2024	3.5	90] \	20	1.8
MR-J4-200A4(-RJ)	HG-JR1534	2.5	90	1 \	20	1.8
	HG-JR2034	3.5	90] \	20	1.8
MR-J4-350A4(-RJ)	HG-SR3524	5.5	130] \	20	2.6
	HG-JR3534	5.5	160	1	20	2.7
	HG-SR5024	7.5	195	1	25	3.9
MR-J4-500A4(-RJ)	HG-JR5034	7.5	195	\	25	3.9
	HG-SR7024	10	300] \	25	6.0
MD 14 70044/ D I)	HG-JR7034	10	300] \	25	6.0
MR-J4-700A4(-RJ)	HG-JR701M4	10	300]	25	6.0
	HG-JR6014	8.6	250] \	25	5.0
	HG-JR9034	13	435	130	45	8.7
MR-J4-11KA4(-RJ)	HG-JR11K1M4	16	530	160	45	11.0
WR-J4-11KA4(-RJ)	HG-JR8014	12	370	110	45	7.0
	HG-JR12K14	18	570	170	45	11.5
MR-J4-15KA4(-RJ)	HG-JR15K1M4	22	640	195	45	13.0
MK-J4-15KA4(-KJ)	HG-JR15K14	22	640	195	45	12.8
	HG-JR22K1M4	33	850	260	55	17.0
MR-J4-22KA4(-RJ)	HG-JR20K14	30	800	240	55	16.0
	HG-JR25K14	38	900	270	55	19.0
	HG-MR053	0.3	25		15	0.5
MD 14 1041/ D IV	HG-MR13	0.3	25		15	0.5
MR-J4-10A1(-RJ)	HG-KR053	0.3	25		15	0.5
	HG-KR13	0.3	25] \	15	0.5
MD 14 2044/ D IV	HG-MR23	0.5	25] \	15	0.5
MR-J4-20A1(-RJ)	HG-KR23	0.5	25] \	15	0.5
MD 14 4044/ D 1)	HG-MR43	0.9	35		15	0.7
MR-J4-40A1(-RJ)	HG-KR43	0.9	35	\	15	0.7

Note 1. The power supply equipment capacity changes with the power supply impedance. This value is applicable when the power factor improving AC reactor or power factor improving DC reactor are 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.

^{3.} This value is applicable when the servo amplifier is cooled by using the panel through attachment.

(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. (With an approximately 5 °C safety margin, the system should operate within a maximum 55 °C limit.) The necessary cabinet heat dissipation area can be calculated by equation 10.1.

$$A = \frac{P}{K \cdot \Delta T}$$
 (10.1)

A : Heat dissipation area [m²]

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.

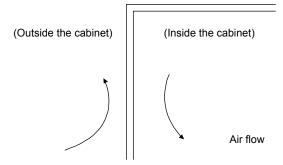


Fig. 10.2 Temperature distribution in an enclosed type cabinet

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

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.
- Servo motors for MR-J4 may have the different coasting distance from that of the previous model.
- ●The electronic dynamic brake operates in the initial state for the HG series servo motors of 600 W or smaller capacity. The time constant "т" for the electronic dynamic brake will be shorter than that of normal dynamic brake. Therefore, coasting distance will be longer than that of normal dynamic brake. For how to set the electronic dynamic brake, refer to [Pr. PF06] and [Pr. PF12].

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) (a), (b) of 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.

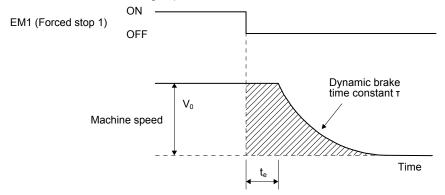


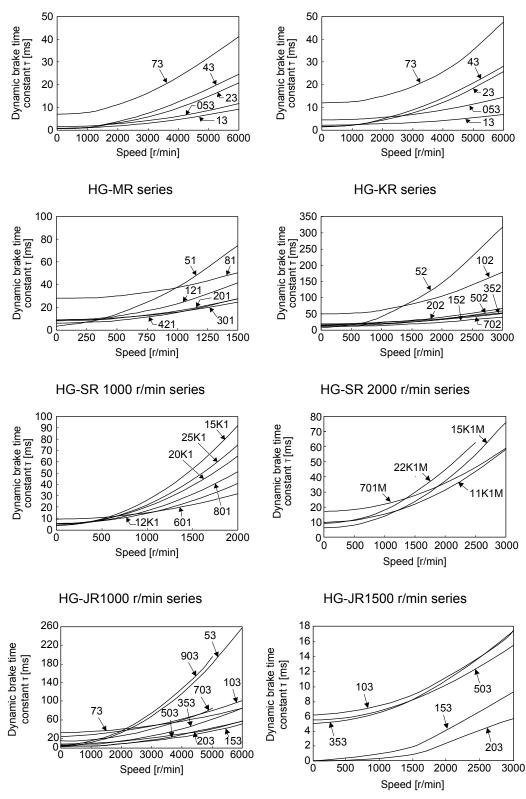
Fig. 10.3 Dynamic brake operation diagram

$L_{\text{max}} = \frac{V_0}{60} \cdot \left\{$	$\left\{ t_{e} + T \left(1 + \frac{J_{L}}{J_{M}} \right) \right\} \cdots $	(10.2
-------------------------------------------------	-----------------------------------------------------------------------------	-------

(2) Dynamic brake time constant

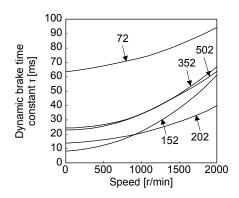
The following shows necessary dynamic brake time constant τ for equation 10.2.

(a) 200 V class



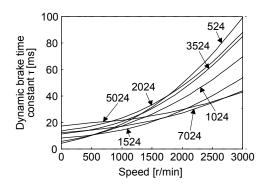
HG-JR3000 r/min series

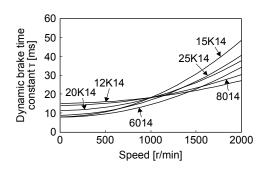
HG-RR series



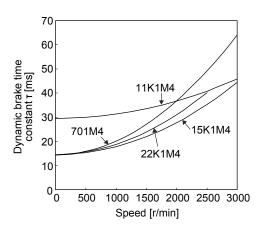
HG-UR series

(b) 400 V class

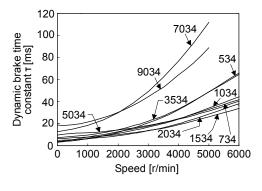








HG-JR1000 r/min series



HG-JR1500 r/min series

HG-JR3000 r/min 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 load inertia moment is higher than this value, the dynamic brake may burn. If the load to motor inertia ratio exceeds the indicated 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. The value in the parenthesis shows the value at the rated speed.

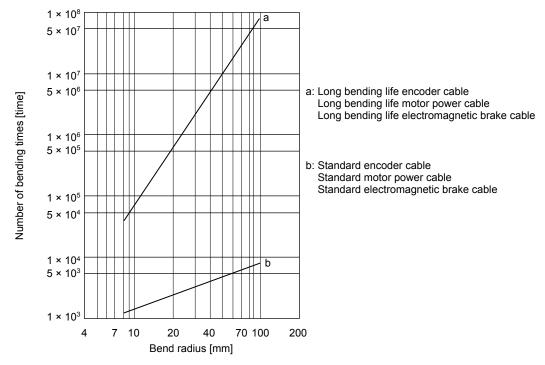
Servo motor	Permissible load to motor inertia ratio [multiplier]	
HG-KR053	ratio [matapher]	
HG-KR13		
HG-KR23	30	
HG-KR43		
HG-KR73		
HG-MR053	35	
HG-MR13		
HG-MR23		
HG-MR43	32	
HG-MR73		
HG-SR51		
HG-SR81		
HG-SR121	30	
HG-SR201		
HG-SR301	16	
HG-SR421	15	
HG-SR52		
HG-SR102	30	
HG-SR152	21	
HG-SR202	21	
HG-SR352	40 (45)	
HG-SR502	13 (15)	
HG-SR702	5 (15)	
HG-SR524	5 (15)	
HG-SR1024	F (17)	
HG-SR1524	5 (17)	
HG-SR2024		
HG-SR3524	5 (15)	
HG-SR5024	3 (13)	
HG-SR7024		
HG-UR72	30	
HG-UR152	50	
HG-UR202	16	
HG-UR352	10	
HG-UR502	15	
HG-RR103	30	
HG-RR153		
HG-RR203	16	
HG-RR353	15	
HG-RR503	13	

_	Permissible load to motor inertia	
Servo motor	ratio [multiplier]	
HG-JR53		
HG-JR73		
HG-JR103	30	
HG-JR153	7	
HG-JR203	7	
HG-JR353	16 (30)	
HG-JR503	15 (30)	
HG-JR703	11 (30)	
HG-JR903	18 (30)	
HG-JR701M	5	
HG-JR11K1M	40 (00)	
HG-JR15K1M	10 (30)	
HG-JR22K1M	20 (30)	
HG-JR601	5	
HG-JR801	30	
HG-JR12K1	20 (30)	
HG-JR15K1	17 (30)	
HG-JR20K1	26 (30)	
HG-JR25K1	21 (30)	
HG-JR534		
HG-JR734	7	
HG-JR1034	30 (30)	
HG-JR1534	1	
HG-JR2034	7	
HG-JR3534	20 (30) (Note)	
HG-JR5034	15 (30)	
HG-JR7034	11 (30)	
HG-JR9034	18 (30)	
HG-JR701M4	7 (10)	
HG-JR11K1M4		
HG-JR15K1M4	10 (30)	
HG-JR22K1M4	20 (30)	
HG-JR6014	10	
HG-JR8014	30	
HG-JR12K14	20 (30)	
HG-JR15K14	30 (30)	
HG-JR20K14	26 (30)	
HG-JR25K14	21 (30)	

Note. When the maximum torque is increased to 400%, the permissible load to motor inertia ratio at the maximum speed of the servo motor is 25 times.

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 currents at power-on of main circuit and control circuit

POINT

● For a servo amplifier of 600 W or less, the inrush current values can change depending on frequency of turning on/off the power and ambient temperature.

Since large inrush currents flow in the power supplies, always use molded-case circuit breakers and magnetic contactors. (Refer to section 11.10.)

When circuit protectors are used, it is recommended that the inertia delay type, which is not tripped by an inrush current, be used.

(1) 200 V class

The following shows the inrush currents (reference data) that will flow when 240 V AC is applied at the power supply capacity of 2500 kVA and the wiring length of 1 m. When you use a 1-phase 200 V AC power supply with MR-J4-10A(-RJ) to MR-J4-200A(-RJ), the inrush currents of the main circuit power supply are the same.

	Inrush cur	rents (A _{0-P})
Servo amplifier	Main circuit power supply (L1, L2 and L3)	Control circuit power supply (L11 and L21)
MR-J4-10A(-RJ) MR-J4-20A(-RJ) MR-J4-40A(-RJ) MR-J4-60A(-RJ)	30 A (attenuated to approx. 3 A in 20 ms)	20 A to 30 A
MR-J4-70A(-RJ) MR-J4-100A(-RJ)	34 A (attenuated to approx. 7 A in 20 ms)	(attenuated to approx. 1 A in 20 ms)
MR-J4-200A(-RJ) MR-J4-350A(-RJ)	113 A (attenuated to approx. 12 A in 20 ms)	
MR-J4-500A(-RJ)	42 A (attenuated to approx. 20 A in 20 ms)	34 A
MR-J4-700A(-RJ)	85 A (attenuated to approx. 20 A in 30 ms)	(attenuated to approx. 2 A in 20 ms)
MR-J4-11KA(-RJ)	226 A (attenuated to approx. 30 A in 30 ms)	
MR-J4-15KA(-RJ)	226 A (attenuated to approx. 50 A in 30 ms)	42 A (attenuated to approx. 2 A in 30 ms)
MR-J4-22KA(-RJ)	226 A (attenuated to approx. 70 A in 30 ms)	

(2) 400 V class

The following shows the inrush currents (reference data) that will flow when 480 V AC is applied at the power supply capacity of 2500 kVA and the wiring length of 1 m.

	Inrush cur	rents (A _{0-P})
Servo amplifier	Main circuit power supply (L1, L2 and L3)	Control circuit power supply (L11 and L21)
MR-J4-60A4(-RJ)	65 A	
MR-J4-100A4(-RJ)	(attenuated to approx. 5 A in 10 ms)	
MR-J4-200A4(-RJ)	80 A (attenuated to approx. 5 A in 10 ms)	40 A to 50 A (attenuated to approx. 0 A in 2 ms)
MR-J4-350A4(-RJ)	100 A (attenuated to approx. 20 A in 10 ms)	
MR-J4-500A4(-RJ)	65 A (attenuated to approx. 9 A in 20 ms)	41 A
MR-J4-700A4(-RJ)	68 A (attenuated to approx. 34 A in 20 ms)	(attenuated to approx. 0 A in 3 ms)
MR-J4-11KA4(-RJ)	339 A (attenuated to approx. 10 A in 30 ms)	
MR-J4-15KA4(-RJ)	339 A (attenuated to approx. 15 A in 30 ms)	38 A (attenuated to approx. 1 A in 30 ms)
MR-J4-22KA4(-RJ)	339 A (attenuated to approx. 20 A in 30 ms)	

(3) 100 V class

The following shows the inrush currents (reference data) that will flow when 120 V AC is applied at the power supply capacity of 2500 kVA and the wiring length of 1 m.

	Inrush currents (A _{0-P})				
Servo amplifier	Main circuit power supply (L1 and L2)	Control circuit power supply (L11 and L21)			
MR-J4-10A1(-RJ) MR-J4-20A1(-RJ) MR-J4-40A1(-RJ)	38 A (attenuated to approx. 14 A in 10 ms)	20 A to 30 A (attenuated to approx. 0 A in 1 ms to 2 ms)			

↑WARNING

■Before connecting any option or peripheral equipment, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. 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 auxiliary 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

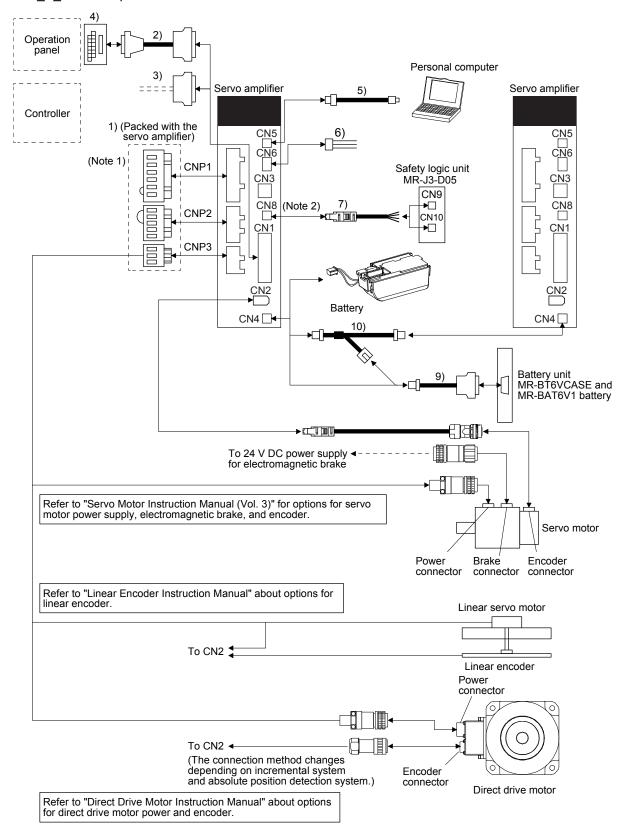
POINT

●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.

Purchase the cable and connector options indicated in this section.

11.1.1 Combinations of cable/connector sets

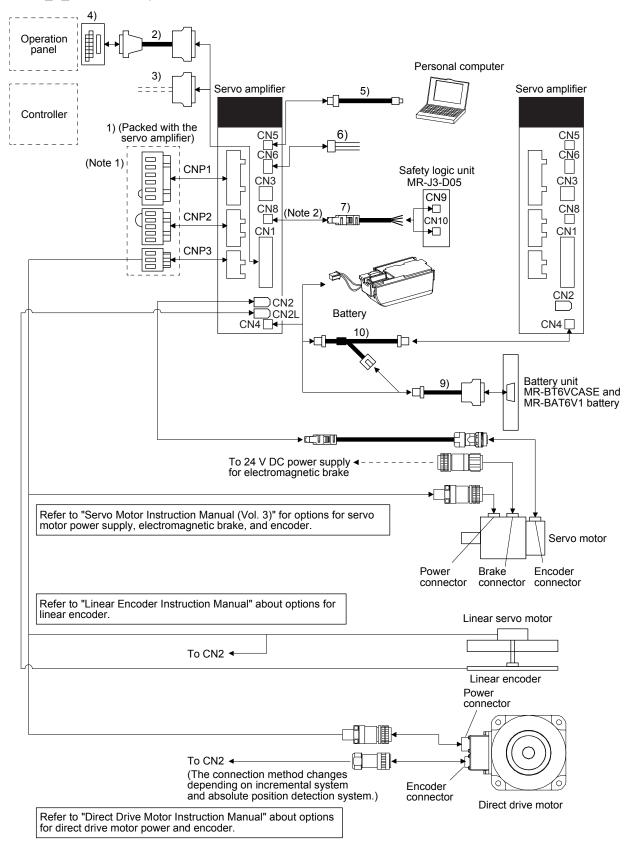
For MR-J4-_A_ servo amplifier



Note 1. Connectors for 3.5 kW or less. For 5 kW or more, it is a terminal block.

2. When not using the STO function, attach a short-circuit connector (8)) supplied with a servo amplifier.

For MR-J4-_A_-RJ servo amplifier



Note 1. Connectors for 3.5 kW or less. For 5 kW or more, it is a terminal block.

2. When not using the STO function, attach a short-circuit connector (8)) supplied with a servo amplifier.

No.	Name	Model	Description	Remark
1)	Servo amplifier power connector set			Supplied with 200 V class and 100 V class servo
			CNP1 Connector: CNP2 Connector: CNP3 Connector: 06JFAT-SAXGDK-H7.5 05JFAT-SAXGDK-H5.0 03JFAT-SAXGDK (JST) (JST) Applicable wire size: 0.8 mm² to 2.1 mm² (AWG 18 to 14) Insulator OD: to 3.9 mm Open tool J-FAT-OT (N) or J-FAT-OT (JST)	amplifiers
				Supplied with 200 V class servo amplifiers of 2 kW
			CNP1 Connector: 06JFAT-SAXGFK-XL (JST) CNP3 Applicable wire size: 1.25 mm² to 5.5 mm² (AWG 16 to 10) Insulator OD: to 4.7 mm CNP2 Connector: 05JFAT-SAXGDK-H5.0 03JFAT-SAXGFK- (JST) (JST) (JST) (JST) Open tool J-FAT-OT-EXL (JST)	<u> </u>
				Supplied with 400 V class servo amplifiers of 3.5 kW
			CNP1 connector: CNP2 connector: CNP3 connector: 06JFAT-SAXGDK- 05JFAT-SAXGDK- 03JFAT-SAXGDK HT10.5 HT7.5 HT10.5 (JST) (JST) (JST) (JST) Applicable wire size: 1.25 mm² to 2.1 mm² (AWG 16 to 14) Insulator OD: to 3.9 mm Open tool J-FAT-OT-XL	or less.
2)	Junction terminal	MR-J2M-	(JST) Junction terminal block connector CN1 connector	For
_,	block cable	CN1TBL_M Cable length: 0.5 m, 1 m (Refer to section 11.6.)	Connector: D7950-B500FL Connector: 10150-6000EL (3M) Shell kit: 10350-3210-000 (3M or equivalent)	junction terminal block connection
3)	CN1 connector set	MR-J3CN1	Connector: 10150-3000PE Shell kit: 10350-52F0-008 (3M or equivalent)	
4)	Junction terminal block	MR-TB50	Refer to section 11.6.	
5)	USB cable	MR-J3USBCBL3M Cable length: 3 m	CN5 connector Personal computer connector mini-B connector (5 pins) A connector	For connection with PC-AT compatible personal computer

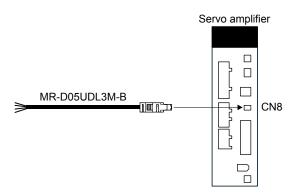
No.	Name	Model	Desc	ription	Remark
6)	Monitor cable	MR-J3CN6CBL1M Cable length: 1 m	3 (Red) 2 (White) 1 (Black)	CN6 connector Housing: 51004-0300 Terminal: 50011-8100 (Molex)	
7)	STO cable	MR-D05UDL3M-B	>	Connector set: 2069250-1 (TE Connectivity)	Connection cable for the CN8 connector
8)	Short-circuit connector		CC_T_mT		Supplied with servo amplifier
9)	Battery cable	MR-BT6V1CBL_M Cable length: 0.3/1 m (Refer to section 11.1.3.)	Housing: PAP-02V-0 Contact: SPHD-001G0-P0.5 (JST)	Connector: 10114-3000PE Shell kit: 10314-52F0-008 (3M or equivalent)	For connection with battery unit
10)	Junction battery cable	MR-BT6V2CBL_M Cable length: 0.3/1 m (Refer to section 11.1.3.)	Housing: PAP-02V-0 Contact: SPHD-001G0-P0.5 (JST)	Housing: PALR-02VF Contact: SPAL-001T-P0.5 (JST) Housing: PAP-02V-0 Contact: SPHD-001G0-P0.5 (JST)	For battery junction

11.1.2 MR-D05UDL3M-B STO cable

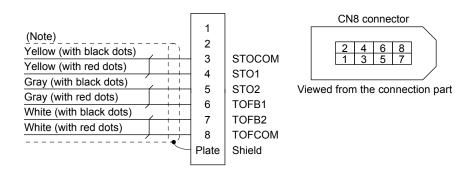
This cable is for connecting an external device to the CN8 connector.

Cable model	Cable length	Application
MR-D05UDL3M-B	3 m	Connection cable for the CN8 connector

(1) Configuration diagram



(2) Internal wiring diagram



Note. Do not use the two core wires with orange sheath (with red or black dots).

11.1.3 Battery cable/junction battery cable

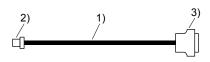
(1) Model explanations

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	
Cable Model	0.3 m	1 m	bending life	Аррисациитетнатк	
MR-BT6V1CBL_M	03	1	Standard	For connection with MR- BT6VCASE	
MR-BT6V2CBL_M	CBL_M 03 1		Standard	For junction	

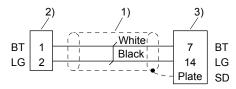
(2) MR-BT6V1CBL_M

(a) Appearance



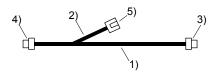
Components	Description					
1) Cable VSVC 7/0.18 × 2C						
Housing: PAP-02V-0						
2) Connector	Contact: SPHD-001G0-P0.5 (JST)					
Connector: 10114-3000PE						
3) Connector	Shell kit: 10314-52F0-008 (3M or equivalent)					

(b) Internal wiring diagram



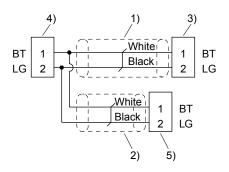
(3) MR-BT6V2CBL_M

(a) Appearance



Components	Description
1) Cable	VSVC 7/0.18 × 2C
2) Cable	V3VC 1/0.16 × 2C
3) Connector	Housing: PAP-02V-0
4) Connector	Contact: SPHD-001G0-P0.5 (JST)
E) Connector	Housing: PALR-02VF
5) Connector	Contact: SPAL-001T-P0.5 (JST)

(b) Internal wiring diagram



11.2 Regenerative options



● 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.

(1) 200 V class

					Regenerativ	e Power [W]			
Servo amplifier	Built-in regenerative resistor	MR-RB032 [40 Ω]	MR-RB12 [40 Ω]	MR-RB30 [13 Ω]	MR-RB3N [9 Ω]	MR-RB31 [6.7 Ω]	MR-RB32 [40 Ω]	(Note 1) MR-RB50 [13 Ω]	(Note 1) MR-RB5N [9 Ω]	(Note 1) MR-RB51 [6.7 Ω]
MR-J4-10A (-RJ)		30								
MR-J4-20A (-RJ)	10	30	100							
MR-J4-40A (-RJ)	10	30	100							
MR-J4-60A (-RJ)	10	30	100							
MR-J4-70A (-RJ)	20	30	100				300			
MR-J4-100A (-RJ)	20	30	100				300			
MR-J4-200A (-RJ)	100			300				500		
MR-J4-350A (-RJ)	100				300				500	
MR-J4-500A (-RJ)	130					300				500
MR-J4-700A (-RJ)	170					300				500

Sonyo	(Note 2) Regenerative power [W]							
Servo amplifier	External regenerative resistor (accessory)	MR-RB5R [3.2 Ω]	MR-RB9F [3 Ω]	MR-RB9T [2.5 Ω]				
MR-J4-11KA (-RJ)	500 (800)	500 (800)						
MR-J4-15KA (-RJ)	850 (1300)		850 (1300)					
MR-J4-22KA (-RJ)	850 (1300)			850 (1300)				

Note 1. Always install a cooling fan.

^{2.} Values in parentheses assume the installation of a cooling fan.

(2) 400 V class

	Regenerative power [W]								
Servo amplifier	Built-in regenerative resistor	MR- RB1H-4 [82 Ω]	(Note 1) MR- RB3M-4 [120 Ω]	(Note 1) MR- RB3G-4 [47 Ω]	(Note 1) MR- RB5G-4 [47 Ω]	(Note 1) MR- RB34-4 [26 Ω]	(Note 1) MR- RB54-4 [26 Ω]	(Note 1) MR- RB3U-4 [22 Ω]	(Note 1) MR- RB5U-4 [22 Ω]
MR-J4-60A4(-RJ)	15	100	300						
MR-J4-100A4(-RJ)	15	100	300						
MR-J4-200A4(-RJ)	100	/		300	500				
MR-J4-350A4(-RJ)	100			300	500				
MR-J4-500A4(-RJ)	130					300	500		
MR-J4-700A4(-RJ)	170	/						300	500

	(Note 2) Regenerative power [W]			
Servo amplifier	External regenerative resistor (accessory)	MR-RB5K-4 [10 Ω]	MR-RB6K-4 [10 Ω]	
MR-J4-11KA4(-RJ)	500 (800)	500 (800)		
MR-J4-15KA4(-RJ)	850 (1300)		850 (1300)	
MR-J4-22KA4(-RJ)	850 (1300)		850 (1300)	

Note 1. Always install a cooling fan.

2. Values in parentheses assume the installation of a cooling fan.

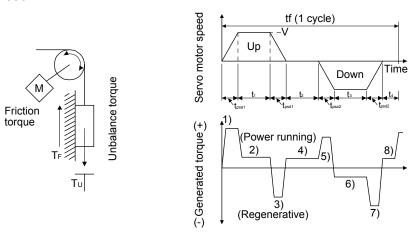
(3) 100 V class

	Regenerative power [W]			
Servo amplifier	Built-in regenerative resistor	MR-RB032 [40 Ω]	MR-RB12 [40 Ω]	
MR-J4-10A1(-RJ)		30		
MR-J4-20A1(-RJ)	10	30	100	
MR-J4-40A1(-RJ)	10	30	100	

11.2.2 Selection of regenerative option

(1) Rotary servo motor and direct drive motor Use the following method when regeneration occurs continuously in vertical motion applications or when it is desired to make an in-depth selection of the regenerative option.

(a) Regenerative energy calculation



Formulas for calculating torque and energy in operation

Regenerative power	Torque applied to servo motor [N•m] (Note)	Energy E [J]
1)	$T_1 = \frac{(J_L/\eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psa1}} + T_U + T_F$	$E_1 = \frac{0.1047}{2} \bullet V \bullet T_1 \bullet t_{psa1}$
2)	$T_2 = T_U + T_F$	$E_2 = 0.1047 \cdot V \cdot T_2 \cdot t_1$
3)	$T_{3} = \frac{-(J_{L} \cdot \eta + J_{M}) \cdot V}{9.55 \cdot 10^{4}} \cdot \frac{1}{t_{psd1}} + T_{U} + T_{F}$	$E_3 = \frac{0.1047}{2} \bullet V \bullet T_3 \bullet t_{psd1}$
4), 8)	T_4 , $T_8 = T_U$	E ₄ , E ₈ = 0 (No regeneration)
5)	$T_5 = \frac{(J_L/\eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psa2}} - T_U + T_F$	$E_5 = \frac{0.1047}{2} \bullet V \bullet T_5 \bullet t_{psa2}$
6)	$T_6 = -T_U + T_F$	$E_6 = 0.1047 \cdot V \cdot T_6 \cdot t_3$
7)	$T_7 = \frac{-(J_L \cdot \eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psd2}} - T_U + T_F$	$E_7 = \frac{0.1047}{2} \bullet V \bullet T_7 \bullet t_{psd2}$

Note. η : Drive system efficiency

From the calculation results in 1) to 8), find the absolute value (Es) of the sum total of negative energies.

(b) 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-J4-10A(-RJ)	55	9
MR-J4-20A(-RJ)	75	9
MR-J4-40A(-RJ)	85	11
MR-J4-60A(-RJ)	85	11
MR-J4-70A(-RJ)	85	18
MR-J4-100A(-RJ)	85	18
MR-J4-200A(-RJ)	85	36
MR-J4-350A(-RJ)	85	40
MR-J4-500A(-RJ)	90	45
MR-J4-700A(-RJ)	90	70
MR-J4-11KA(-RJ)	90	120
MR-J4-15KA(-RJ)	90	170
MR-J4-22KA(-RJ)	90	250

Servo amplifier	Inverse efficiency [%]	Capacitor charging [J]
MR-J4-60A4(-RJ)	85	12
MR-J4-100A4(-RJ)	85	12
MR-J4-200A4(-RJ)	85	25
MR-J4-350A4(-RJ)	85	43
MR-J4-500A4(-RJ)	90	45
MR-J4-700A4(-RJ)	90	70
MR-J4-11KA4(-RJ)	90	120
MR-J4-15KA4(-RJ)	90	170
MR-J4-22KA4(-RJ)	90	250
MR-J4-10A1(-RJ)	55	4
MR-J4-20A1(-RJ)	75	4
MR-J4-40A1(-RJ)	85	10

Inverse efficiency (η_m): Efficiency including some efficiencies of the servo motor and servo amplifier when rated (regenerative) torque is generated at rated speed. Since the efficiency varies with the speed and generated torque, allow for about 10%.

Capacitor charging (Ec): Energy charged into the electrolytic capacitor in the servo amplifier

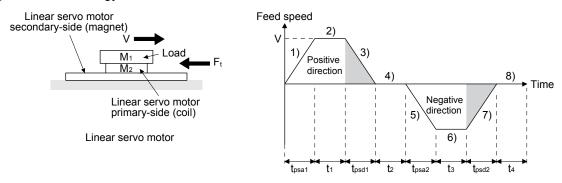
Subtract the capacitor charging from the result of multiplying the sum total of regenerative energies by the inverse efficiency to calculate the energy consumed by the regenerative option.

$$ER[J] = \eta_m \cdot Es - Ec$$

Calculate the power consumption of the regenerative option on the basis of single-cycle operation period tf [s] to select the necessary regenerative option.

(2) Linear servo motor

(a) Thrust and energy calculation



The following shows equations of the linear servo motor thrust and energy at the driving pattern above.

Section	Thrust F of linear servo motor [N]	Energy E [J]
1)	$F_1 = (M_1 + M_2) \cdot V/t_{psa1} + F_t$	$E_1 = V/2 \bullet F_1 \bullet t_{psa1}$
2)	$F_2 = F_1$	$E_2 = V \cdot F_2 \cdot t_1$
3)	$F_3 = -(M_1 + M_2) \cdot V/t_{psd1} + F_t$	$E_3 = V/2 \cdot F_3 \cdot t_{psd1}$
4), 8)	F ₄ , F ₈ = 0	E ₄ , E ₈ = 0 (No regeneration)
5)	$F_5 = (M_1 + M_2) \cdot V/t_{psa2} + F_t$	$E_5 = V/2 \cdot F_5 \cdot t_{psa2}$
6)	$F_6 = F_t$	$E_6 = V \cdot F_6 \cdot t_3$
7)	$F_7 = -(M_1 + M_2) \cdot V/t_{psd2} + F_t$	$E_7 = V/2 \cdot F_7 \cdot t_{psd2}$

From the calculation results in 1) to 8), find the absolute value (Es) of the sum total of negative energies.

- (b) Losses of servo motor and servo amplifier in regenerative mode For inverse efficiency and capacitor charging energy, refer to (1) (b) of this section.
- (c) Regenerative energy calculation

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 resistor.

$$ER[J] = \eta \cdot Es - Ec$$

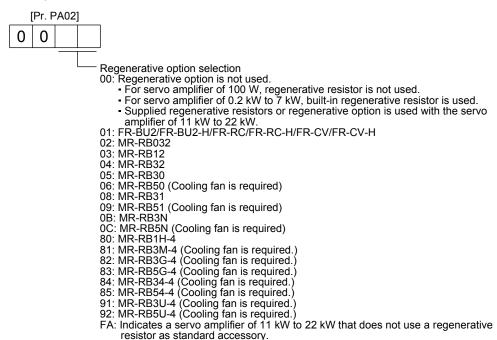
From the total of ER's whose subtraction results are positive and one-cycle period, the power consumption PR [W] of the regenerative option can be calculated with the following equation.

PR [W] = total of positive ER's/one-cycle operation period (tf)

Select a regenerative option from the PR value. Regenerative option is not required when the energy consumption is equal to or less than the built-in regenerative energy.

11.2.3 Parameter setting

Set [Pr. PA02] according to the option to be used.



11.2.4 Connection of regenerative option

POINT

- •When the MR-RB50, MR-RB51, MR-RB5N, MR-RB3M-4, MR-RB3G-4, MR-RB5G-4, MR-RB54-4, MR-RB5K-4, or MR-RB6K-4 is used, a cooling fan is required to cool it. The cooling fan should be prepared by the customer.
- ●For the sizes of wires used for wiring, refer to section 11.9.

The regenerative option generates heat of 100 °C higher than the ambient temperature. Fully consider heat dissipation, installation position, used wires, etc. to place 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-J4-500A(-RJ) or less/MR-J4-350A4(-RJ) or less Always remove the wiring from across P+ to D and fit the regenerative option across P+ to C. G3 and G4 are thermal sensor's terminals. Between G3 and G4 is opened when the regenerative option overheats abnormally.

Always remove the lead from across P+ to D.

Servo amplifier

Regenerative option

P

C

C

Note 3)

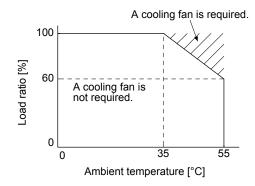
G3

(Note 3)

G4

(Note 1, 2)

- Note 1. When using the MR-RB50, MR-RB5N, MR-RB51, MR-RB3M-4, MR-RB3G-4, or MR-RB5G-4, forcibly cool it with a cooling fan (92 mm × 92 mm, minimum air flow: 1.0 m³).
 - 2. When the ambient temperature is more than 55 °C and the regenerative load ratio is more than 60% in MR-RB30, MR-RB-31, MR-RB32 and MR-RB3N, forcefully cool the air with a cooling fan (1.0 m³/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.)

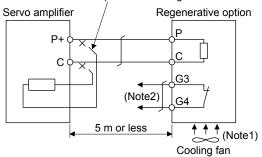


- 3. Make up a sequence which will switch off the magnetic contactor when abnormal heating occurs.
 - G3-G4 contact specifications

Maximum voltage: 120 V AC/DC Maximum current: 0.5 A/4.8 V DC Maximum capacity: 2.4 VA (2) MR-J4-500A4(-RJ)/MR-J4-700A(-RJ)/MR-J4-700A4(-RJ)

Always remove the wiring (across P+ to C) of the servo amplifier built-in regenerative resistor and fit the regenerative option across P+ to C. G3 and G4 are thermal sensor's terminals. Between G3 and G4 is opened when the regenerative option overheats abnormally.

Always remove the wiring (across P+ to C) of the servo amplifier built-in regenerative resistor.



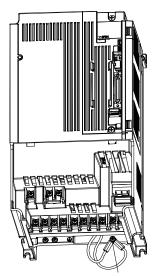
- Note 1. When using the MR-RB51, MR-RB34-4, MR-RB54-4, MR-RB3U-4, or MR-RB5U-4, forcibly cool it with a cooling fan (92 mm × 92 mm, minimum air flow: 1.0 m³).
 - 2. Make up a sequence which will switch off the magnetic contactor when abnormal heating occurs.

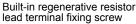
G3-G4 contact specifications

Maximum voltage: 120 V AC/DC Maximum current: 0.5 A/4.8 V DC

Maximum capacity: 2.4 VA

When using the regenerative option, remove the servo amplifier's built-in regenerative resistor wires (across P+ to C), fit them back to back, and secure them to the frame with the accessory screw as shown below.



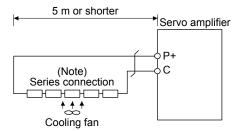


(3) MR-J4-11KA(-RJ) to MR-J4-22KA(-RJ)/MR-J4-11KA4(-RJ) to MR-J4-22KA4(-RJ) (when using the supplied regenerative resistor)



- ■The regenerative resistor supplied with 11 kW to 22 kW servo amplifiers does not have a protective cover. Touching the resistor (including wiring/screw hole area) may cause a burn injury and electric shock. Even if the power was shut-off, be careful until the bus voltage discharged and the temperature decreased because of the following reasons.
 - It may cause a burn injury due to very high temperature without cooling.
 - It may cause an electric shock due to charged capacitor of the servo amplifier.

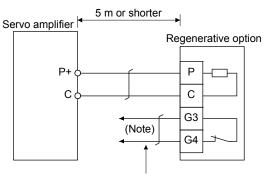
When using the regenerative resistors supplied to the servo amplifier, the specified number of resistors (4 or 5 resistors) must be connected in series. If they are connected in parallel or in less than the specified number, the servo amplifier may become faulty and/or the regenerative resistors burn. Install the resistors at intervals of about 70 mm. Cooling the resistors with two cooling fans (1.0 m³/min or more, 92 mm × 92 mm) improves the regeneration capability. In this case, set "_ _ F A" in [Pr. PA02].



Note. The number of resistors connected in series depends on the resistor type. The thermal sensor is not mounted on the attached regenerative resistor. An abnormal heating of resistor may be generated at a regenerative circuit failure. Install a thermal sensor near the resistor and establish a protective circuit to shut off the main circuit power supply when abnormal heating occurs. The detection level of the thermal sensor varies according to the settings of the resistor. Set the thermal sensor in the most appropriate position on your design basis, or use the thermal sensor built-in regenerative option. (MR-RB5R, MR-RB9F, MR-RB9T, MR-RB5K-4, or MR-RB6K-4)

0	Demonstration	Regenerative power [W]		Resultant	Number of	
Servo amplifier	Regenerative resistor	Normal	Cooling	resistance $[\Omega]$	resistors	
MR-J4-11KA(-RJ)	GRZG400-0.8Ω	500	800	3.2	4	
MR-J4-15KA(-RJ)	GRZG400-0.6Ω	850	1300	3	5	
MR-J4-22KA(-RJ)	GRZG400-0.5Ω	650	850 1300		5	
MR-J4-11KA4(-RJ)	GRZG400-2.5Ω	500	800	10	4	
MR-J4-15KA4(-RJ) MR-J4-22KA4(-RJ)	GRZG400-2Ω	850	1300	10	5	

(4) MR-J4-11KA-PX to MR-J4-22KA-PX/MR-J4-11KA-RZ to MR-J4-22KA-RZ/MR-J4-11KA4-PX to MR-J4-22KA4-PX/MR-J4-11KA4-RZ to MR-J4-22KA4-RZ (when using the regenerative option) The MR-J4-11KA-PX to MR-J4-22KA-PX, MR-J4-11KA-PX to MR-J4-22KA-RZ, MR-J4-11KA4-PX to MR-J4-22KA4-PX, and MR-J4-11KA4-RZ to MR-J4-22KA4-RZ servo amplifiers are not supplied with regenerative resistors. When using any of these servo amplifiers, always use the regenerative option MR-RB5R, MR-RB9F, MR-RB9T, MR-RB5K-4, and MR-RB6K-4. Cooling the regenerative option with cooling fans improves regenerative capability. G3 and G4 are thermal sensor's terminals. Between G3 and G4 is opened when the regenerative option overheats abnormally.



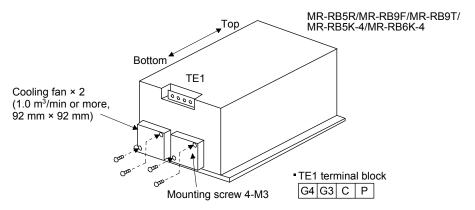
Configure up a circuit which shuts off main circuit power when thermal protector operates.

Note. G3-G4 contact specifications

Maximum voltage: 120 V AC/DC Maximum current: 0.5 A/4.8 V DC Maximum capacity: 2.4 VA

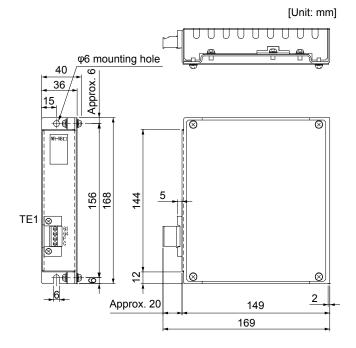
Canto amplifiar	Regenerative	Resistance	Regenerative power [W]		
Servo amplifier	option	[Ω]	Without cooling fans	With cooling fans	
MR-J4-11KA-PX	MR-RB5R	3.2	500	800	
MR-J4-11KA-RZ	WII C T COTT	0.2	000	000	
MR-J4-15KA-PX	MR-RB9F	3	850	1300	
MR-J4-15KA-RZ	WIIX-IXD9I	3	030	1300	
MR-J4-22KA-PX	MR-RB9T	2.5	850	1300	
MR-J4-22KA-RZ	MIK-KD9 I	2.5	050	1300	
MR-J4-11KA4-PX	MR-RB5K-4	10	500	800	
MR-J4-11KA4-RZ	WIK-KDJK-4	10	500	800	
MR-J4-15KA4-PX					
MR-J4-15KA4-RZ	MR-RB6K-4	10	850	1300	
MR-J4-22KA4-PX	WIN-NOON-4	10	030	1300	
MR-J4-22KA4-RZ					

When using cooling fans, install them using the mounting holes provided in the bottom of the regenerative option.



11.2.5 Dimensions

(1) MR-RB12



- TE1 terminal



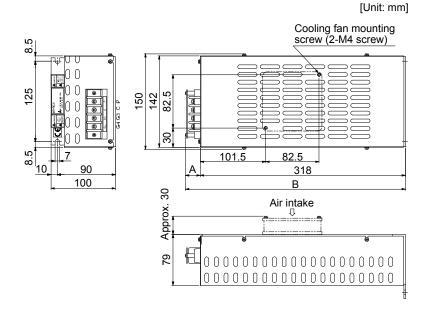
Applicable wire size: 0.2 mm² to 2.5 mm² (AWG 14 to 12) Tightening torque: 0.5 to 0.6 [N•m]

Mounting screw
 Screw size: M5

Tightening torque: 3.24 [N•m]

Mass: 1.1 [kg]

(2) MR-RB30/MR-RB31/MR-RB32/MR-RB3N/MR-RB34-4/MR-RB3M-4/MR-RB3G-4/MR-RB3U-4



Terminal block

Р	
С	
G3	
G4	

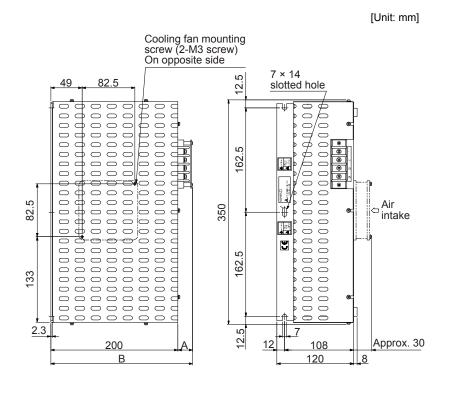
Terminal screw size: M4
Tightening torque: 1.2 [N•m]

Mounting screw
 Screw size: M5

Tightening torque: 5.4 [N•m]

Regenerative option	Variable dimensions		Mass [kg]	
MR-RB30	Α	ь		
MR-RB31	17			
MR-RB32		335		
MR-RB3N			1	29
MR-RB34-4			2.9	
MR-RB3M-4	22	341		
MR-RB3G-4	23	341		
MR-RB3U-4				

(3) MR-RB50/MR-RB51/MR-RB5N/MR-RB54-4/MR-RB5G-4/MR-RB5U-4



Terminal block

Р	
С	
G3	
G4	

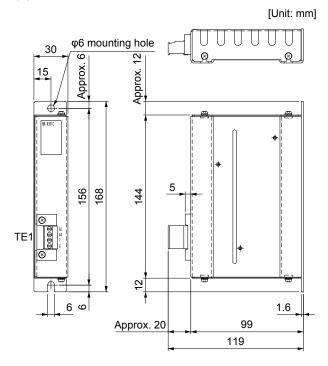
Terminal screw size: M4 Tightening torque: 1.2 [N•m]

Mounting screw
 Screw size: M5

Tightening torque: 5.4 [N•m]

Regenerative	Variable dimensions		Mass	
option	Α	В	[kg]	
MR-RB50				
MR-RB51	17	217		
MR-RB5N			5.6	
MR-RB54-4			5.0	
MR-RB5G-4	23	223		
MR-RB5U-4				

(4) MR-RB032



- TE1 terminal



Applicable wire size: 0.2 mm² to 2.5 mm²

(AWG 24 to 12)

Tightening torque: 0.5 to 0.6 [N•m]

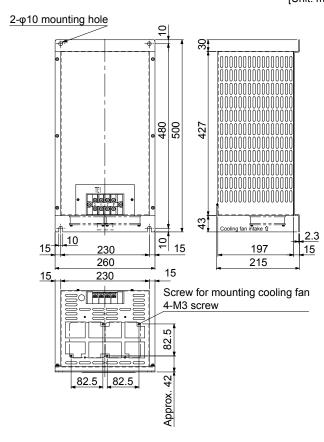
Mounting screw
 Screw size: M5

Tightening torque: 3.24 [N•m]

Mass: 0.5 [kg]

(5) MR-RB5R/MR-RB9F/MR-RB9T/MR-RB5K-4/MR-RB6K-4

[Unit: mm]



TE1 terminal block

G4 G3	С	Р
-------	---	---

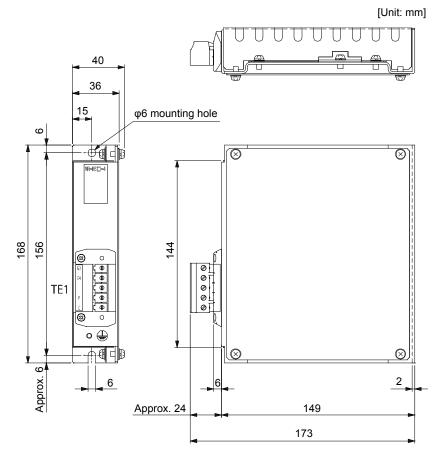
Terminal screw size: M5
Tightening torque: 2.0 [N•m]

 Mounting screw Screw size: M8

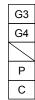
Tightening torque: 13.2 [N•m]

Regenerative	Mass	
option	[kg]	
MR-RB5R	10	
MR-RB9F	11	
MR-RB9T	'''	
MR-RB5K-4	10	
MR-RB6K-4	11	

(6) MR-RB1H-4



TE1 terminal



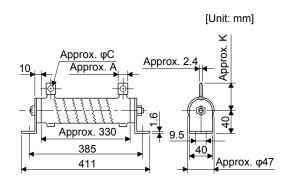
Applicable wire size: AWG 24 to 10 Tightening torque: 0.5 to 0.6 [N•m]

Mounting screw Screw size: M5

Tightening torque: 3.24 [N•m]

Mass: 1.1 [kg]

(7) GRZG400-0.8 Ω /GRZG400-0.6 Ω /GRZG400-0.5 Ω /GRZG400-2.5 Ω /GRZG400-2.0 Ω (standard accessories)



Regenerative	Variab	ole dime	nsions	Mounting	Tightening	Mass [kg]
resistor	Α	С	K	screw size	torque [N•m]	
GRZG400-0.8Ω	10	5.5	39		13.2	0.8
GRZG400-0.6Ω	16	8.2	46			
GRZG400-0.5Ω	10	0.2	40	M8		
GRZG400-2.5Ω	10	5.5	39	20		
GRZG400-2.0Ω	10	5.5	39			

11.3 FR-BU2-(H) Brake unit

POINT

- ■Use a 200 V class brake unit and a resistor unit with a 200 V class servo amplifier, and a 400 V class brake unit and a resistor unit with a 400 V class servo amplifier. Combination of different voltage class units cannot be used.
- ●When a brake unit and a resistor unit are installed horizontally or diagonally, the heat dissipation effect diminishes. Install them on a flat surface vertically.
- Temperature of the resistor unit case rises to higher than +100 °C. Keep cables and flammable materials away from the case.
- Ambient temperature condition of the brake unit is between -10 °C to 50 °C. Note that the condition is different from the ambient temperature condition of the servo amplifier (between 0 °C and 55 °C).
- Configure the circuit to shut down the power-supply with the alarm output of the brake unit and the resistor unit under abnormal condition.
- ●Use the brake unit with a combination indicated in section 11.3.1.
- For executing a continuous regenerative operation, use FR-RC-(H) power regeneration converter or FR-CV-(H) power regeneration common converter.
- Brake unit and regenerative options (Regenerative resistor) cannot be used simultaneously.

Connect the brake unit to the bus of the servo amplifier. As compared to the MR-RB regenerative option, the brake unit can return larger power. Use the brake unit when the regenerative option cannot provide sufficient regenerative capability.

When using the brake unit, set [Pr. PA02] of the servo amplifier to "__ 0 1".

When using the brake unit, always refer to the FR-BU2 Instruction Manual.

11.3.1 Selection

Use a combination of servo amplifier, brake unit and resistor unit listed below.

	Brake unit	Resistor unit	Number of connected units	Permissible continuous power [kW]	Resultant resistance [Ω]	Applicable servo amplifier (Note 3)
200 V class	FR-BU2-15K	FR-BR-15K	1	0.99	8	MR-J4-500A(-RJ) (Note 1)
			2 (parallel)	1.98	4	MR-J4-500A(-RJ) MR-J4-700A(-RJ) MR-J4-11KA(-RJ) MR-J4-15KA(-RJ)
	FR-BU2-30K	FR-BR-30K	1	1.99	4	MR-J4-500A(-RJ) MR-J4-700A(-RJ) MR-J4-11KA(-RJ) MR-J4-15KA(-RJ)
	FR-BU2-55K	FR-BR-55K	1	3.91	2	MR-J4-11KA(-RJ) MR-J4-15KA(-RJ) MR-J4-22KA(-RJ)
		MT-BR5-55K	1	5.5	2	MR-J4-22KA(-RJ)
400 V class	FR-BU2-H30K	FR-BR-H30K	1	1.99	16	MR-J4-500A4(-RJ) MR-J4-700A4(-RJ) MR-J4-11KA4(-RJ) (Note 2)
	FR-BU2-H55K	FR-BR-H55K	1	3.91	8	MR-J4-11KA4(-RJ) MR-J4-15KA4(-RJ) MR-J4-22KA4(-RJ)
	FR-BU2-H75K	MT-BR5-H75K	1	7.5	6.5	MR-J4-22KA4(-RJ)

Note 1. Only when using servo motor HG-RR353/HG-UR352

- 2. When HG-JR11K1M4 servo motor is used, limit the torque during power running to 180% or less, or the servo motor speed to 1800 r/min or less.
- 3. When the brake unit is selected by using the capacity selection software, a brake unit other than the combinations listed may be shown. Refer to the combinations displayed on the capacity selection software for detailed combinations.

11.3.2 Brake unit parameter setting

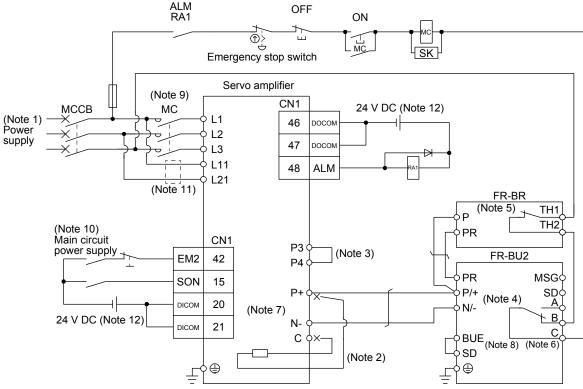
Whether a parameter can be changed or not is listed below.

Parameter		Change possible/ Remark	
No.	Name	impossible	Neillaik
0	Brake mode switchover	Impossible	Do not change the parameter
1	Monitor display data selection	Possible	Refer to the FR-BU2 Instruction Manual.
2	Input terminal function selection 1	Impossible	Do not change the parameter
3	Input terminal function selection 2		
77	Parameter write selection		
78	Cumulative energization time carrying-over times		
CLr	Parameter clear		
ECL	Alarm history clear		
C1	For manufacturer setting		

11.3.3 Connection example

POINT

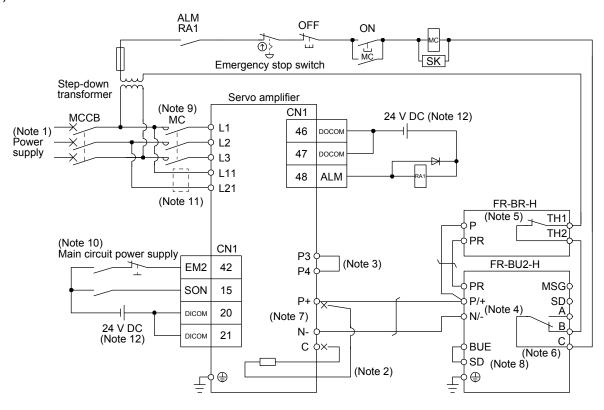
- ●EM2 has the same function as EM1 in the torque control mode.
- Connecting PR terminal of the brake unit to P+ terminal of the servo amplifier results in brake unit malfunction. Always connect the PR terminal of the brake unit to the PR terminal of the resistor unit.
- (1) Combination with FR-BR-(H) resistor unit
 - (a) When connecting a brake unit to a servo amplifier
 - 1) 200 V class



Note 1. For power supply specifications, refer to section 1.3.

- 2. When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: P+ and D, 7 kW: P+ and C). For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
- 3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
- 4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in servo amplifier and brake unit malfunction.
- Contact rating: 1b contact, 110 V AC_5 A/220 V AC_3 A
 Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
- 6. Contact rating: 230 V AC_0.3 A/30 V DC_0.3 A
 - Normal condition: B-C is conducting/A-C is not conducting. Abnormal condition: B-C is not conducting/A-C is conducting.
- 7. Do not connect more than one cable to each P+ and N- terminals of the servo amplifier.
- 8. Always connect BUE and SD terminals. (factory-wired)
- 9. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 10. Configure up a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 11. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
- 12. 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.

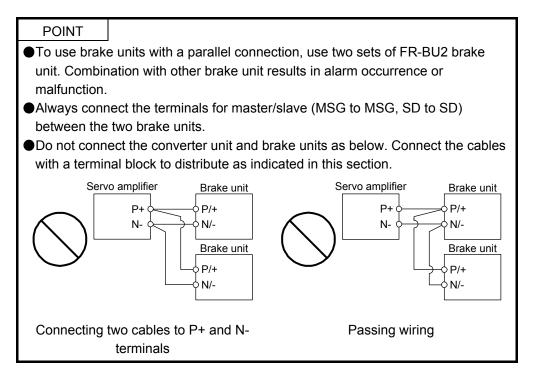
2) 400 V class

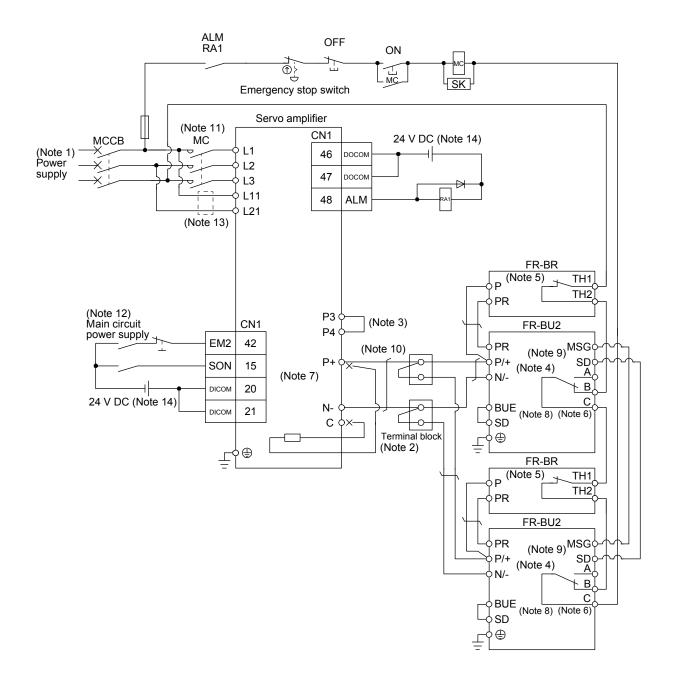


Note 1. For the power supply specifications, refer to section 1.3.

- 2. For the servo amplifier of 5 kW and 7 kW, always disconnect the lead wire of built-in regenerative resistor, which is connected to P+ and C terminals. For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
- 3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
- 4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in servo amplifier and brake unit malfunction.
- Contact rating: 1b contact, 110 V AC, 5 A/220 V AC, 3 A
 Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
- 6. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting.
- 7. Do not connect more than one cable to each P+ and N- terminals of the servo amplifier.
- 8. Always connect BUE and SD terminals. (factory-wired)
- 9. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 10. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 11. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
- 12. 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.

(b) When connecting two brake units to a servo amplifier

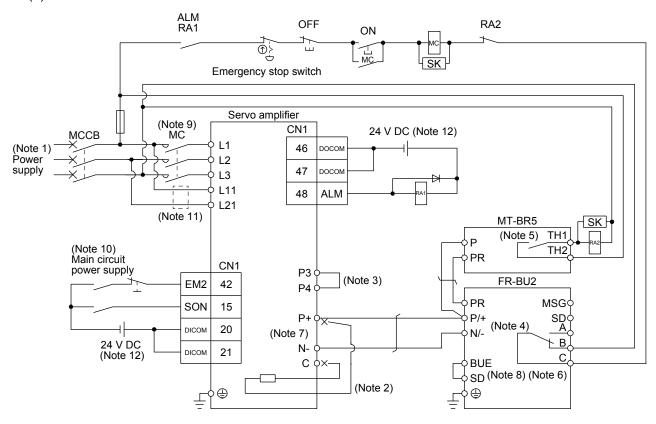




- Note 1. For power supply specifications, refer to section 1.3.
 - 2. When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: P+ and D, 7 kW: P+ and C). For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
 - 3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
 - Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in servo amplifier and brake unit malfunction.
 - Contact rating: 1b contact, 110 V AC_5 A/220 V AC_3 A
 Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
 - Contact rating: 230 V AC_0.3 A/30 V DC_0.3 A
 Normal condition: B-C is conducting/A-C is not conducting. Abnormal condition: B-C is not conducting/A-C is conducting.
 - 7. Do not connect more than one cable to each P+ and N- terminals of the servo amplifier.
 - 8. Always connect BUE and SD terminals. (factory-wired)
 - 9. Connect MSG and SD terminals of the brake unit to a correct destination. Incorrect connection destination results in servo amplifier and brake unit malfunction.
 - 10. For the cable to connect the terminal block and the P+ and N- terminals of the servo amplifier, use the cable indicated in (4) (b) of this section.
 - 11. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
 - 12. Configure up a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
 - 13. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
 - 14. 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) Combination with MT-BR5-(H) resistor unit

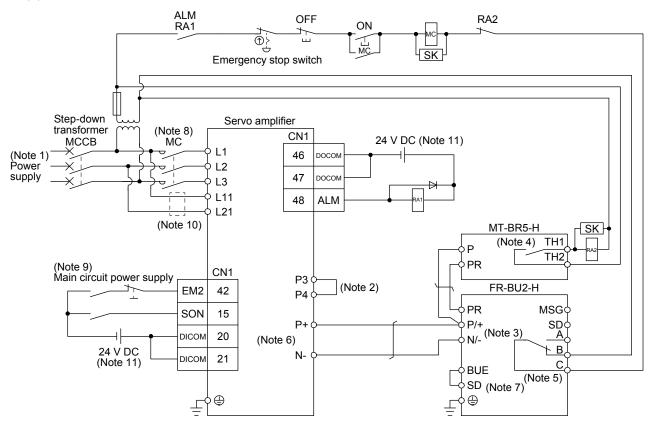
(a) 200 V class



Note 1. For the power supply specifications, refer to section 1.3.

- 2. Do not connect a supplied regenerative resistor to the P+ and C terminals.
- 3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
- 4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in servo amplifier and brake unit malfunction.
- Contact rating: 1a contact, 110 V AC, 5 A/220 V AC, 3 A
 Normal condition: TH1-TH2 is not conducting. Abnormal condition: TH1-TH2 is conducting.
- Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
 Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting.
- 7. Do not connect more than one cable to each P+ and N- terminals of the servo amplifier.
- 8. Always connect BUE and SD terminals. (factory-wired)
- 9. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 10. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 11. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
- 12. 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.

(b) 400 V class



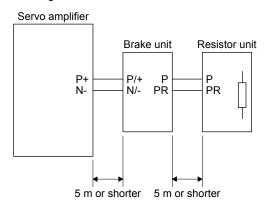
Note 1. For power supply specifications, refer to section 1.3.

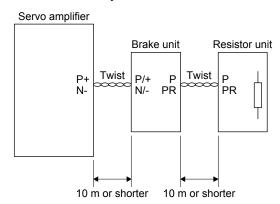
- 2. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
- 3. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in servo amplifier and brake unit malfunction.
- Contact rating: 1a contact, 110 V AC, 5 A/220 V AC, 3 A
 Normal condition: TH1-TH2 is not conducting. Abnormal condition: TH1-TH2 is conducting.
- 5. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A

 Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
- 6. Do not connect more than one cable to each P+ and N- terminals of the servo amplifier.
- 7. Always connect BUE and SD terminals. (factory-wired)
- 8. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 9. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
- 11. 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) Connection instructions

Keep the wires between the servo amplifier and the brake unit, and between the resistor unit and the brake unit as short as possible. For wires longer than 5 m, twist the wires five times or more per meter. The wires should not exceed 10 m even when the wires are twisted. If wires exceeding 5 m without twisted or exceeding 10 m with or without twisted are used, the brake unit may malfunction.



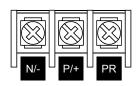


(4) Cables

(a) Cables for the brake unit

For the brake unit, HIV cable (600 V grade heat-resistant PVC insulated wire) is recommended.

1) Main circuit terminal



Terminal block

Brake unit		Main Crimp circuit terminal T		Tightening torque	Wire size	
		terminal	N/-, P/+, PR,⊕			
		screw size	N/-, P/+, PR,⊕	N/-, P/+,		AWG
200 V	FR-BU2-15K	M4	5.5-4	1.5	3.5	12
class	FR-BU2-30K	M5	5.5-5	2.5	5.5	10
	FR-BU2-55K	M6	14-6	4.4	14	6
400 V	FR-BU2-H30K	M4	5.5-4	1.5	3.5	12
class	FR-BU2-H55K	M5	5.5-5	2.5	5.5	10
	FR-BU2-H75K	M6	14-6	4.4	14	6

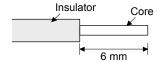
2) Control circuit terminal

POINT

• Under tightening can cause a cable disconnection or malfunction. Over tightening can cause a short circuit or malfunction due to damage to the screw or the brake unit.







Wire the stripped cable after twisting to prevent the cable from becoming loose. In addition, do not solder it.

Screw size: M3

Tightening torque: 0.5 N•m to 0.6 N•m

Wire size: 0.3 mm² to 0.75 mm²

Screw driver: Small flat-blade screw driver

(Tip thickness: 0.4 mm/Tip width 2.5 mm)

(b) Cables for connecting the servo amplifier and a distribution terminal block when connecting two sets of the brake unit

Brake unit	Wire size		
Diake unit	HIV wire [mm ²]	AWG	
FR-BU2-15K	8	8	

- (5) Crimp terminals for P+ and N- terminals of servo amplifier
 - (a) Recommended crimp terminals

POINT

Always use recommended crimp terminals or equivalent since some crimp terminals cannot be installed depending on the size.

	Servo amplifier	Brake unit	Number of connected units		(Note 1) Applicable tool
200 V	MR-J4-500A(-RJ)	FR-BU2-15K	1	FVD5.5-S4 (JST)	а
class			2	8-4NS (JST) (Note 2)	b
		FR-BU2-30K	1	FVD5.5-S4 (JST)	а
	MR-J4-700A(-RJ)	FR-BU2-15K	2	8-4NS (JST) (Note 2)	b
		FR-BU2-30K	1	FVD5.5-S4 (JST)	а
	MR-J4-11KA(-RJ)	FR-BU2-15K	2	FVD8-6 (JST)	С
		FR-BU2-30K	1	FVD5.5-6 (JST)	а
		FR-BU2-55K	1	FVD14-6 (JST)	d
	MR-J4-15KA(-RJ)	FR-BU2-15K	2	FVD8-6 (JST)	С
		FR-BU2-30K	1	FVD5.5-6 (JST)	а
		FR-BU2-55K	1	FVD14-6 (JST)	d
	MR-J4-22KA(-RJ)	FR-BU2-55K	1	FVD14-8 (JST)	d
400 V	MR-J4-500A4(-RJ)	FR-BU2-H30K	1	FVD5.5-S4 (JST)	а
class	MR-J4-700A4(-RJ)	FR-BU2-H30K	1	FVD5.5-S4 (JST)	а
	MR-J4-11KA4(-RJ)	FR-BU2-H30K	1	FVD5.5-6 (JST)	а
		FR-BU2-H55K	1	FVD5.5-6 (JST)	а
	MR-J4-15KA4(-RJ)	FR-BU2-H55K	1	FVD5.5-6 (JST)	а
	MR-J4-22KA4(-RJ)	FR-BU2-H55K	1	FVD5.5-8 (JST)	а
		FR-BU2-H75K	1	FVD14-8 (JST)	d

Note 1. Symbols in the applicable tool field indicate applicable tools in (4) (b) of this section.

(b) Applicable tool

	Servo amplifier-side crimp terminals					
Symbol	mbol Applicable tool				Manufacturer	
	Crimp terminal	Body	Head	Dice	Manuacturei	
а	FDV5.5-S4	YNT-1210S				
a	FDV5.5-6					
b	8-4NS	YHT-8S				
	FVD8-6	YF-1	YNE-38	DH-111	JST	
С		E-4		DH-121		
d	FVD14-6	YF-1	YNE-38	DH-112		
u	FVD14-8	E-4		DH-122		

^{2.} Coat the crimping part with an insulation tube.

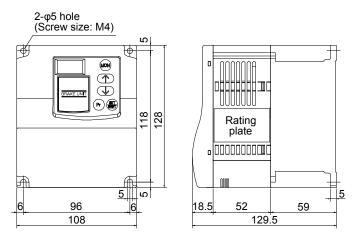
11.3.4 Dimensions

(1) FR-BU2-(H) Brake unit

[Unit: mm] FR-BU2-15K φ5 hole5 hole (Screw size: M4) Θ **P** 28 Rating plate ____4 56 6 18.5 62 132.5 68

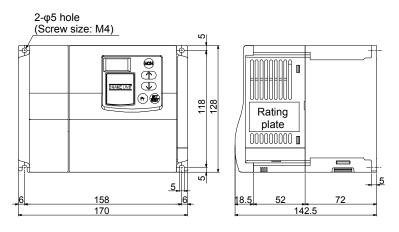
[Unit: mm]

FR-BU2-30K/FR-BU2-H30K

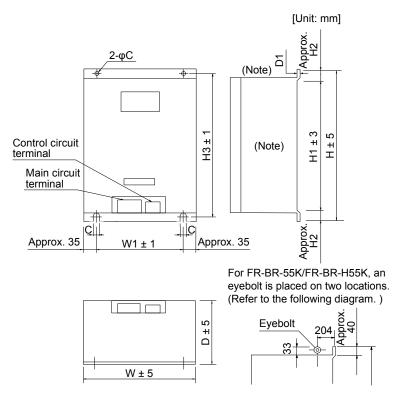


[Unit: mm]

FR-BU2-55K/FR-BU2-H55K/FR-BU2-H75K



(2) FR-BR-(H) Resistor unit



Note. Ventilation ports are provided on both sides and the top. The bottom is open.

Re	esistor unit	W	W1	Н	H1	H2	Н3	D	D1	С	Approximate mass [kg]
200.17	FR-BR-15K	170	100	450	410	20	432	220	3.2	6	15
200 V class	FR-BR-30K	340	270	600	560	20	582	220	4	10	30
Class	FR-BR-55K	480	410	700	620	40	670	450	3.2	12	70
400 V	FR-BR-H30K	340	270	600	560	20	582	220	4	10	30
class	FR-BR-H55K	480	410	700	620	40	670	450	3.2	12	70

(3) MT-BR5-(H) resistor unit

			[Unit: mm]
Re	esistor unit	Resistance	Approximate mass [kg]
200 V class	MT-BR5-55K	2.0 Ω	50
400 V class	MT-BR5-H75K	6.5 Ω	70

11.4 FR-RC-(H) power regeneration converter

POINT

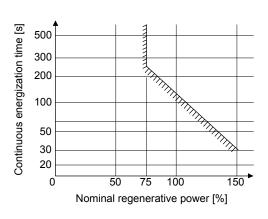
- ●When using the FR-RC-(H), power regeneration converter, set [Pr. PA04] to "0 0 _ _" to enable EM1 (Forced stop 1).
- ●When using the FR-RC-(H) power regeneration converter, refer to "Power Regeneration Converter FR-RC Instruction Manual (IB(NA)66330)".

When using the FR-RC-(H) power regeneration converter, set [Pr. PA02] to " $_$ 0 1" and set [Pr. PC27] to " $_$ 1".

(1) Selection example

The converters can continuously return 75% of the nominal regenerative power. They are applied to the servo amplifiers of the 5 kW to 22 kW.

Power regeneration converter	Nominal regenerative power [kW]	Servo amplifier
FR-RC-15K	15	MR-J4-500A(-RJ) MR-J4-700A(-RJ)
FR-RC-30K	30	MR-J4-11KA(-RJ) MR-J4-15KA(-RJ)
FR-RC-55K	55	MR-J4-22KA(-RJ)
FR-RC-H15K	15	MR-J4-500A4(-RJ) MR-J4-700A4(-RJ)
FR-RC-H30K	30	MR-J4-11KA4(-RJ) MR-J4-15KA4(-RJ)
FR-RC-H55K	55	MR-J4-22KA4(-RJ)

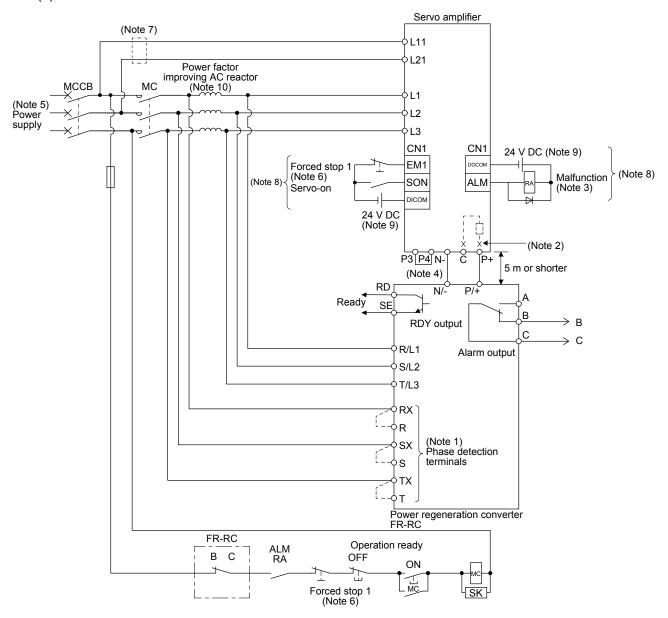


(2) Connection example

POINT

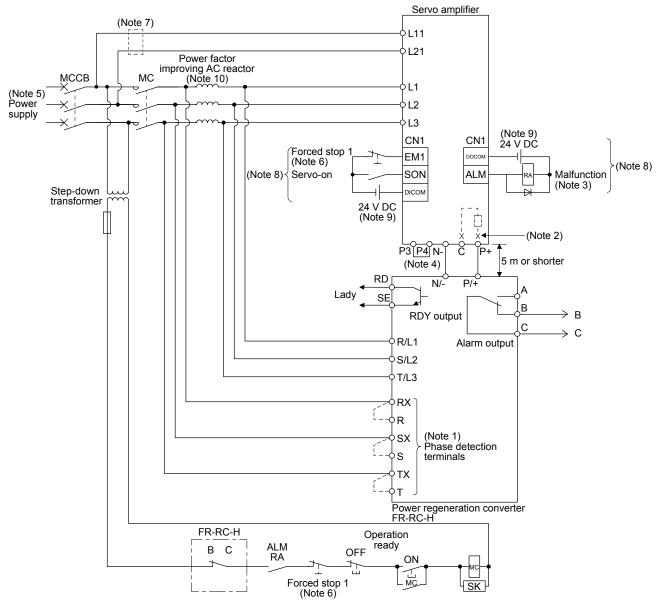
●In this configuration, only the STO function is supported. The forced stop deceleration function is not available.

(a) 200 V class



- Note 1. When not using the phase detection terminals, fit the jumpers across RX-R, SX-S and TX-T. If the jumpers remain removed, the FR-RC will not operate.
 - 2. When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: P+ and D, 7 kW: P+ and C). For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
 - 3. If disabling ALM (Malfunction) output with the parameter, configure up the power supply circuit which switches off the magnetic contactor after detection of alarm occurrence on the controller side.
 - 4. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
 - 5. For power supply specifications, refer to section 1.3.
 - 6. Set [Pr. PA04] to "0 0 _ _" to enable EM1 (Forced stop 1). Configure up the circuit which shuts off main circuit power with external circuit at EM1 (Forced stop 1) off.
 - 7. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
 - 8. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
 - 9. 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.
 - 10. For selection of power factor improving AC reactors, refer to "Power Regeneration Converter FR-RC Instruction Manual (IB(NA)66330)".

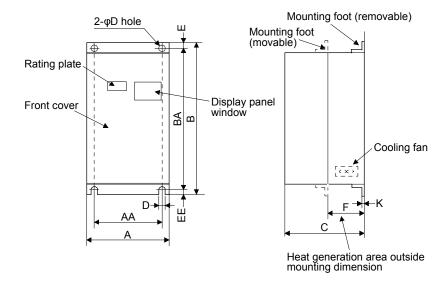
(b) 400 V class



Note 1. When not using the phase detection terminals, fit the jumpers across RX-R, SX-S and TX-T. If the jumpers remain removed, the FR-RC-H will not operate.

- 2. For the servo amplifier of 5 kW and 7 kW, always disconnect the lead wire of built-in regenerative resistor, which is connected to P+ and C terminals. For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
- 3. If disabling ALM (Malfunction) output with the parameter, configure up the power supply circuit which switches off the magnetic contactor after detection of alarm occurrence on the controller side.
- 4. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
- 5. For the power supply specifications, refer to section 1.3.
- 6. Set [Pr. PA04] to "0 0 _ _" to enable EM1 (Forced stop 1). Configure up the circuit which shuts off main circuit power with external circuit at EM1 (Forced stop 1) off.
- 7. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
- 8. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 9. 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.
- 10. For selection of power factor improving AC reactors, refer to "Power Regeneration Converter FR-RC Instruction Manual (IB(NA)66330)".

(3) Dimensions

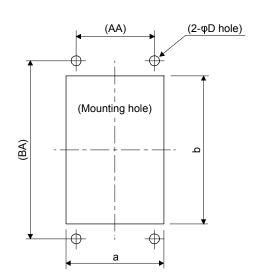


[Unit: mm]

Power regeneration converter	Α	AA	В	ВА	С	D	E	EE	K	F	Approximate mass [kg]
FR-RC-15K	270	200	450	432	195	10	10	8	3.2	87	19
FR-RC-30K	340	270	600	582	195	10	10	8	3.2	90	31
FR-RC-55K	480	410	700	670	250	12	15	15	3.2	135	55
FR-RC-H15K	340	270	600	582	195	10	10	8	3.2	90	31
FR-RC-H30K	340	270	600	362	195	10	ט	0	3.2	90	31
FR-RC-H55K	480	410	700	670	250	12	15	15	3.2	135	55

(4) Mounting hole machining dimensions

The following shows mounting hole dimensions for mounting the heat generation area of the power regeneration converter outside a cabinet as measures against heat generation when the converter is mounted in an enclosed type cabinet.



				[Uni	it: mm]
Power regeneration converter	а	b	D	AA	ВА
FR-RC-15K	260	412	10	200	432
FR-RC-30K	330	562	10	270	582
FR-RC-55K	470	642	12	410	670
FR-RC-H15K	330	562	10	270	582
FR-RC-H30K	330	302	Ü	210	362
FR-RC-H55K	470	642	12	410	670

11.5 FR-CV-(H) power regeneration common converter

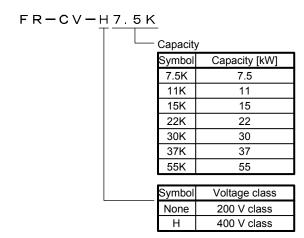
POINT

- For details of the power regeneration common converter FR-CV-(H), refer to the FR-CV Installation Guide (IB(NA)0600075).
- Do not supply power to the main circuit power supply terminals (L1, L2, and L3) of the servo amplifier. Doing so will fail the servo amplifier and FR-CV-(H).
- ■Connect the DC power supply between the FR-CV-(H) and servo amplifier with correct polarity. Connection with incorrect polarity will fail the FR-CV-(H) and servo amplifier.
- ■Two or more FR-CV-(H)'s cannot be installed to improve regeneration capability. Two or more FR-CV-(H)'s cannot be connected to the same DC power supply line
- ●When using FR-CV-(H), set [Pr. PA04] to "0 0 _ _" to enable EM1 (Forced stop 1).

When using the FR-CV-(H) power regeneration common converter, set [Pr. PA02] to "_ _ 0 1" and set [Pr. PC27] to "_ _ 1".

11.5.1 Model designation

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.



11.5.2 Selection example

(1) 200 V class

FR-CV power regeneration common converter can be used for the 200 V class servo amplifier of 100 W to 22 kW. The following shows the restrictions on using the FR-CV.

- (a) Up to six servo amplifiers can be connected to one FR-CV.
- (b) FR-CV capacity [W] ≥ Total of rated capacities [W] × 2 of servo amplifiers connected to FR-CV.
- (c) The total of used servo motor rated currents should be equal to or less than the applicable current [A] of the FR-CV.
- (d) Among the servo amplifiers connected to the FR-CV, the servo amplifier of the maximum capacity should be equal to or less than the maximum connectable capacity [W].

The following table lists the restrictions.

Item	FR-CV							
iteiii	7.5K	11K	15K	22K	30K	37K	55K	
Maximum number of connected servo amplifiers				6				
Total of connectable servo amplifier capacities [kW]	3.75	5.5	7.5	11	15	18.5	27.5	
Total of connectable servo motor rated currents [A]	33	46	61	90	115	145	215	
Maximum servo amplifier capacity [kW]	3.5	5	7	11	15	15	22	

When using the FR-CV, always install the dedicated stand-alone reactor (FR-CVL).

Power regeneration common	Dedicated stand-alone
converter	reactor
FR-CV-7.5K(-AT)	FR-CVL-7.5K
FR-CV-11K(-AT)	FR-CVL-11K
FR-CV-15K(-AT)	FR-CVL-15K
FR-CV-22K(-AT)	FR-CVL-22K
FR-CV-30K(-AT)	FR-CVL-30K
FR-CV-37K	FR-CVL-37K
FR-CV-55K	FR-CVL-55K

(2) 400 V class

FR-CV-H power regeneration common converter can be used for the servo amplifier of 11 kW to 22 kW. The following shows the restrictions on using the FR-CV-H.

- (a) Up to two servo amplifiers can be connected to one FR-CV-H.
- (b) FR-CV-H capacity [W] ≥ Total of rated capacities [W] × 2 of servo amplifiers connected to FR-CV-H.
- (c) The total of used servo motor rated currents should be equal to or less than the applicable current [A] of the FR-CV-H.
- (d) Among the servo amplifiers connected to the FR-CV-H, the servo amplifier of the maximum capacity should be equal to or less than the maximum connectable capacity [W].

The following table lists the restrictions.

Item	FR-CV-H_					
item	22K	30K	37K	55K		
Maximum number of connected servo amplifiers		1		2		
Total of connectable servo amplifier capacities [kW]	11	15	18.5	27.5		
Total of connectable servo motor rated currents [A]	43	57	71	110		
Maximum servo amplifier capacity [kW]	11	15	15	22		

When using the FR-CV-H, always install the dedicated stand-alone reactor (FR-CVL-H).

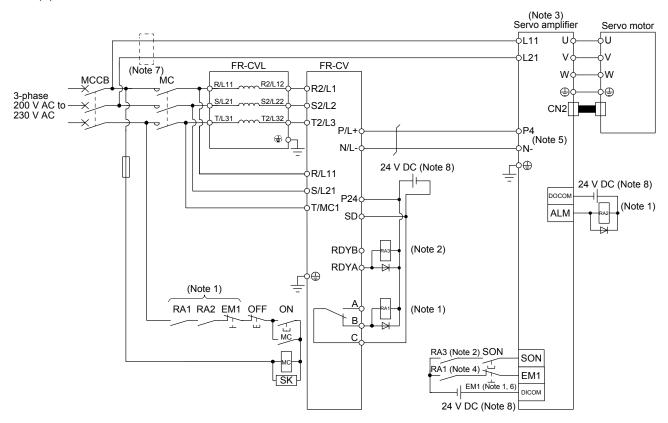
Power regeneration common converter	Dedicated stand-alone reactor
FR-CV-H22K(-AT)	FR-CVL-H22K
FR-CV-H30K(-AT)	FR-CVL-H30K
FR-CV-H37K	FR-CVL-H37K
FR-CV-H55K	FR-CVL-H55K

(3) Connection diagram

POINT

●In this configuration, only the STO function is supported. The forced stop deceleration function is not available.

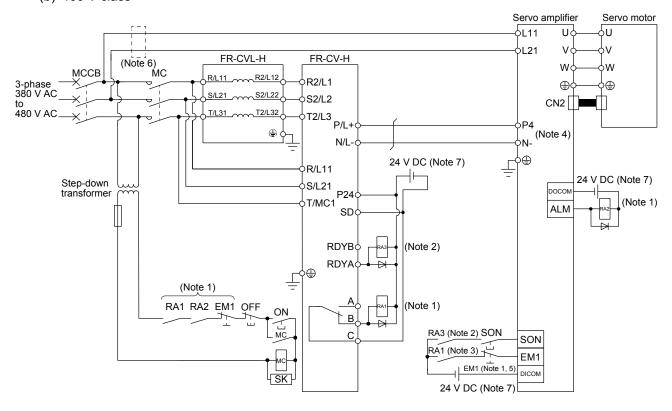
(a) 200 V class



Note 1. Configure a sequence that will shut off main circuit power at the follow cases.

- FR-CV or servo amplifier alarm occurs.
- EM1 (forced stop 1) turns off.
- 2. For the servo amplifier, configure a sequence that will switch the servo-on after the FR-CV is ready.
- 3. When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: P+ and D, 7 kW: P+ and C).
- 4. Configure a sequence that will make a stop with the emergency stop input of the servo system controller if an alarm occurs in the FR-CV.
- 5. When using FR-CV, always disconnect wiring between P3 and P4 terminals.
- 6. Set [Pr. PA04] to "0 0 " to enable EM1 (Forced stop 1).
- 7. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
- 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.

(b) 400 V class



Note 1. Configure a sequence that will shut off main circuit power in the following.

- An alarm occurred at FR-CV-H or servo amplifier.
- EM1 (Forced stop 1) is enabled.
- 2. For the servo amplifier, configure a sequence that will switch the servo-on after the FR-CV-H is ready.
- 3. Configure a sequence that will make a stop with the forced stop input of the servo amplifier if an alarm occurs in the FR-CV-H.
- 4. When using FR-CV-H, always disconnect wiring between P3 and P4 terminals.
- 5. Set [Pr. PA04] to "0 0 $_$ " to enable EM1 (Forced stop 1).
- 6. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
- 7. 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) Selection example of wires used for wiring

POINT

Selection conditions of wire size are as follows.

Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire) Construction condition: Single wire set in midair

(a) Wire sizes

1) Across P to P4, N to N

The following table indicates the connection wire sizes of the DC power supply (P4, N- terminals) between the FR-CV and servo amplifier.

Total of servo amplifier capacities [kW]	Wire [mm ²]
1 or less	2 (AWG 14)
2	3.5 (AWG 12)
5	5.5 (AWG 10)
7	8 (AWG 8)
11	14 (AWG 6)
15	22 (AWG 4)
22	50 (AWG 1/0)
27.5	50 (AWG 1/0)

The following table indicates the connection wire sizes of the DC power supply (P4, N- terminals) between the FR-CV-H and servo amplifier.

Total of servo amplifier capacities [kW]	Wire [mm²]
11	8 (AWG 8)
15	8 (AWG 8)
22	14 (AWG 6)
27.5	14 (AWG 6)

2) Grounding

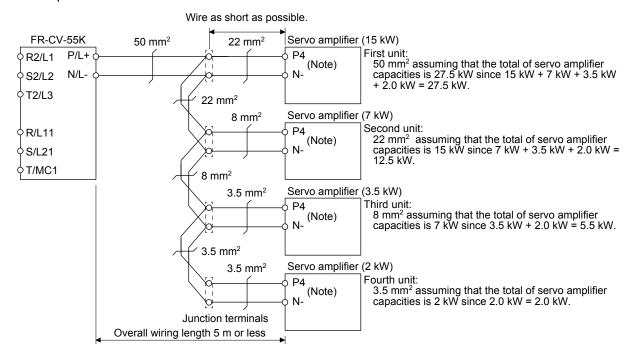
For grounding, use the wire of the size equal to or greater than that indicated in the following table, and make it as short as possible.

Power regeneration common converter	Grounding wire size [mm²]
FR-CV-7.5K to FR-CV-15K	8 (AWG 8)
FR-CV-22K/FR-CV-30K	22 (AWG 4)
FR-CV-37K/FR-CV-55K	38 (AWG 2)
FR-CV-H22K/FR-CV-H30K	8 (AWG 8)
FR-CV-H37K/FR-CV-H55K	14 (AWG 6)

(b) Example of selecting the wire sizes

1) 200 V class

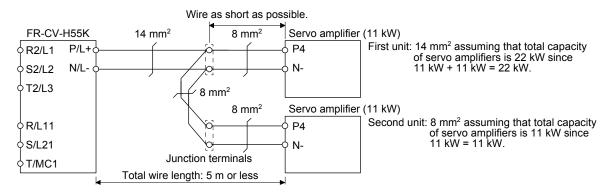
When connecting multiple servo amplifiers, always use junction terminals for wiring the servo amplifier terminals P4, N-. Also, connect the servo amplifiers in the order of larger to smaller capacities.



Note. When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: P+ and D, 7 kW: P+ and C).

2) 400 V class

When connecting two servo amplifiers of 11 kW, always use junction terminals for wiring the servo amplifier terminals P4, N-.



(5) Other precautions

- (a) When using the FR-CV-(H), always install the dedicated stand-alone reactor (FR-CVL-(H)). Do not use the power factor improving AC reactor (FR-HAL-(H)) or Power factor improving DC reactor (FR-HEL-(H)).
- (b) The inputs/outputs (main circuits) of the FR-CV-(H) and servo amplifiers include high-frequency components and may provide electromagnetic wave interference to communication equipment (such as AM radios) used near them. In this case, interference can be reduced by installing the radio noise filter (FR-BIF(-H)) or line noise filter (FR-BSF01, FR-BLF).
- (c) The overall wiring length for connection of the DC power supply between the FR-CV-(H) and servo amplifiers should be 5 m or less, and the wiring must be twisted.

(6) Specifications

	_	Power regenera	ation								
	common converter FR-CV-			7.5K	11K	15K	22K	30K	37K	55K	
Item											
	Total of connectable servo amplifier [kW]			3.75	5.5	7.5	11	15	18.5	27.5	
Maxir	num servo amplifie	r capacity	[kW]	3.5	5	7	11	15	15	22	
Output	Total of connectate motor rated current		[A]	33	46	61	90	115	145	215	
Out	Regenerative	Short-time rat	ing	To	tal capacity	of applicable	servo motors	, 300% torqu	e, 60s (Note	1)	
	braking torque	Continuous ra	ating	100% torque							
	Rated input AC vo	oltage/frequency	'	3-phase 200 V AC to 220 V AC, 50 Hz, 200 V AC to 230 V AC, 60 Hz							
Power supply	Permissible AC vo	oltage fluctuation	ı	3-phase 170 V AC to 242 V AC, 50 Hz, 170 V AC to 253 V AC, 60 Hz							
Pol	Permissible freque	ency fluctuation		±5%							
	Power supply cap	acity (Note 2) [l	kVA]	17	20	28	41	52	66	100	
IP rat	ing (JEM 1030), co	oling method		Open type (IP00), forced cooling							
ent	Ambient temperat	ure		-10 °C to 50 °C (non-freezing)							
йц	Ambient humidity			90 %RH or less (non-condensing)							
Environment	Ambience			Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt							
Altitude, vibration resistance				1000 m or less above sea level, 5.9 m/s ²							
Molde	Molded-case circuit breaker or earth-			30 AF	50 AF	100 AF	100 AF	125AF	125AF	225 AF	
leaka	ge current breaker			30 A	50 A	75 A	100 A	125 A	125 A	175 A	
Magr	etic contactor			S-N20 S-T21	S-N35 S-T35	S-N50 S-T50	S-N65 S-T65	S-N80 S-T80	S-N95 S-T100	S-N125	

Item		Power regeneration common converter FR-CV-H_	22K	30K	37K	55K	
Total of connectable servo amplifier [kW]			11	15	185	27.5	
Maxir	mum servo amplifie	r capacity [kW]	11	15	15	22	
Ħ	Total of connectab motor rated curren	[Δ]	43	57	71	110	
Output			Total capacity	of applicable se (Not		% torque, 60 s	
	braking torque	Continuous rating	100% torque				
oly	Rated input AC vo	Itage/frequency	3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz				
Power supply	Permissible AC vo	Itage fluctuation	3-phase 323 V AC to 528 V AC, 50 Hz/60 Hz				
wer	Permissible freque	ency fluctuation	±5%				
Po	Power supply capa	acity (Note 2) [kVA]	41	52	66	100	
IP rat	ing (JEM 1030), co	oling method	Open type (IP00), forced cooling				
ent	Ambient temperate	ure	-10 °C to 50 °C (non-freezing)				
Ambient humidity			90 %RH or less (non-condensing)				
Ambient temperature Ambient humidity Ambience			Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt				
Altitude, vibration resistance			1000 m or less above sea level, 5.9 m/s ²				
Molded-case circuit breaker or earth-			50AF	60AF	100AF	100AF	
leakage current breaker			50A	60A	75A	100A	
Magn	netic contactor		S-N25	S-N35	S-N50	S-N65	
magi	.55 5011140101		S-T25	S-T35	S-T50	S-T65	

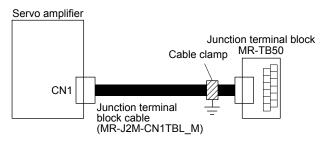
Note 1. This is the time when the protective function of the FR-CV-(H) is activated. The protective function of the servo amplifier is activated in the time indicated in section 10.1.

^{2.} The specified value is the power supply capacity of FR-CV-(H). The total power supply capacities of the connected servo amplifiers are actually required.

11.6 Junction terminal block MR-TB50

(1) Usage

Always use the junction terminal block (MR-TB50) with the option cable (MR-J2M-CN1TBL_M) as a set.



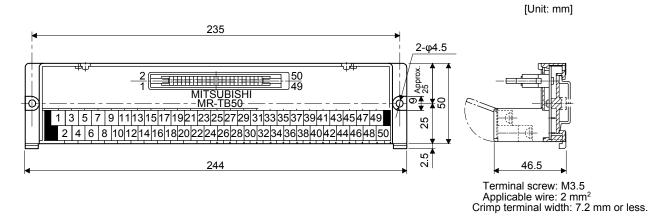
Ground the option cable on the junction terminal block side with the cable clamp fitting (AERSBAN-ESET). For the use of the cable clamp fitting, refer to section 11.14, (2) (c).

(2) Terminal labels

Use the following junction terminal block labels. This label is supplied with the junction terminal block MR-TB50.

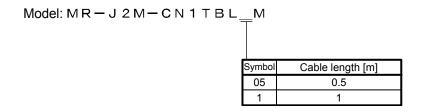
Position control mode
P15R LG LAR LBR LZR PG SON PC RES DICOM ZSP TLC TLA OP NP CR LSP LOP 0000M RD 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
LA LB LZ PP OPC TL DICOM INP INP LG LG NG EMG LSN 0000M ALM SD 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Speed control mode
P15R LG LAR LBR LZR
VC LA LB LZ SP2 ST2 DICOM SA SA LG LG LG LG EMG LSN DICOM ALM SD N 4 ∞ ∞ 2 2 2 2 2 3 8 8 3 8 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 8 3 3 <t< td=""></t<>
Torque control mode
P15R LG LAR LBR LZR
VLA LA LB LZ SP2 RS1 DICOM LG LG LG EMG DOCOM ALM SD

(3) Dimensions



(4) Junction terminal block cable MR-J2M-CN1TBL_M

(a) Model explanations



(b) Connection diagram

1) MR-J4-_A_(-RJ) 100 W or more

10150-6000EL (Servo ampli Signal symbol			iller side)	I	D7930-I	55001	L (Junction	terminal si
Position		Torque	Pin No.				Pin No.	
P15R	Speed P15R	P15R	1	ζ		~	1	
FISK	V/C	VLA				- 1 1	$\vdash \frac{1}{2}$	
10	VC		3	ii		i i	2	
LG_	LG	LG				11		
LA	LA	LA	4				4	
<u>LAR</u>	LAR	LAR	5			1.1	5	
LB	LB	LB	6				6	
LBR	LBR	LBR	7	1.1		- ! !	7	
LZ	LZ	LZ	8				8	
LZR	LZR	LZR	9			1.1	9	
PP			10				10	
PG			11			1.1	11	
OPC			12				12	
$\overline{}$			13		ſ	1.1	13	
			14				14	
SON	SON	SON	15	ii		- i i	15	
LOP	SP2	SP2	16				16	
PC	ST1	RS2	17	ii		- i i	17	
TL	ST2	RS1	18				18	
RES	RES	RES	19	- 		- i i -	19	
DICOM	DICOM	DICOM	20	11			20	
DICOM	DICOM	DICOM	21	11		- 11	21	
INP	SA		22				- 22	
ZSP	ZSP	ZSP	23			11	23	
INP	SA		24				24	
TLC	TLC	TLC	25	1.1		1 1	25	
			26				26	
TLA	TLA	TC	27	1 1		11	27	
LG	LG	LG	28				28	
			29	1.1		- 1 1	29	
LG	LG	LG	30				30	
			31	1 1		11	31	
			32				32	
OP	OP	OP	33	1.1		11	33	
LG	LG	LG	34				34	
NP			35	11		11	35	
NG			36				36	
PP2			37	11		- 11	37	
NP2			38				38	
<u> </u>			39	1.1		11	39	
$\overline{}$			40			- 11	40	
CR	SP1	SP1	41	1.1		1.1	41	
EMG	EMG	EMG	42			11	42	
LSP	LSP		43	1.1		1.1	43	
LSN	LSN		44				44	
LOP	LOP	LOP	45	11		i i	45	
DOCOM	DOCOM	DOCOM	46				46	
DOCOM	DOCOM		47	1.1		ii	47	
ALM	ALM		48				47	
RD	RD	ALM RD	49	-		ii		
	KD.	KD.	50)		U	49 50	
_		_	เวบ	-			า วบ โ	

2) MR-J4-03A6(-RJ)

10150-60	000EL (Se	ervo ampli	fier side)	D7950-B500FL (Junction terminal side)
Si	gnal symb	ool	Dia Na	Pin No.
Position	Speed	Torque	Pin No.	
P15R	P15R	P15R	1	1
	VC	VLA	2] 2
LG	LG	LG	3	3
LA	LA	LA	4	4
LAR	LAR	LAR	5	5
LB	LB	LB	6	6
LBR	LBR	LBR	7	7
LZ	LZ	LZ	8	8
LZR	LZR	LZR	9	1 9
PP			10	10
PG			11	11
OPC			12	12
SDP	SDP	SDP	13	13
SDN	SDN	SDN	14	14
SON	SON	SON	15	15
LOP	SP2	SP2	16	16
PC	ST1	RS2	17	17
TL	ST2	RS1	18	18
RES	RES	RES	19	10
DICOM	DICOM	DICOM	20	20
DICOM	DICOM	DICOM	21	1 21
INP	SA	DICON	22	21 22
ZSP	ZSP	ZSP	23	1
INP	SA	ZSF	24	23
TLC	TLC	TLC	25	1 25
MO1	MO1		26	25 26
TLA	TLA	MO1 TC	27	27
		LG	28	28
LG	LG MO2			
MO2		MO2	29	29
LG	LG	LG	30	30
TRE	TRE	TRE	31	31
0.0	0.0	0.0	32	32
OP	OP	OP	33	33
LG	LG	LG	34	34
NP			35	1 35
NG			36	36
PP2			37	3/
NP2			38	38
RDP	RDP	RDP	39	1 1 39
RDN	RDN	RDN	40	40
CR	SP1	SP1	41	41
EMG	EMG	EMG	42	42
LSP	LSP		43	43
LSN	LSN		44	44
LOP	LOP	LOP	45	45
DOCOM	DOCOM	DOCOM	46	46
DOCOM	DOCOM	DOCOM	47	47
ALM	ALM	ALM	48	48
RD	RD	RD	49	49
			50	50
SD	SD	SD	Plate	1-/

11.7 MR Configurator2

POINT

■MR-J4-_A_-RJ servo amplifier is supported with software version 1.19V or later.

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.

11.7.1 Specifications

Item	Description				
Project	Create/read/save/delete project, system setting, and print				
Parameter	Parameter setting, axis name setting, parameter converter (Note 1)				
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, machine diagnosis, fully closed loop diagnosis (Note 2), and linear diagnosis (Note 3)				
Test operation	Jog operation (Note 4), positioning operation, motor-less operation (Note 5), DO forced output, and program operation, test mode information				
Adjustment	One-touch tuning, tuning, and machine analyzer				
Others	Servo assistant, parameter setting range update, help display				

Note 1. This is available only in the standard control mode for a rotary servo motor.

- 2. This is available only in the fully closed loop control mode.
- 3. This is available only in the linear servo motor control mode.
- 4. This is available in the standard control mode, fully closed loop control mode, and DD motor control mode.
- 5. This is available only in the standard control mode. This will be available in the fully closed loop control mode, linear servo motor control mode, and DD motor control mode in the future.

11.7.2 System configuration

(1) Components

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	CPU (recommended) Memory (recommended) Hard Disk Communication interface	Microsoft® Windows® 8.1 Enterprise Operating System/Pro Operating System //Operating System Microsoft® Windows® 8 Enterprise Operating System/Pro Operating System //Operating System Microsoft® Windows® 7 Enterprise Operating System/Ultimate Operating System //Professional Operating System/Home Premium Operating System //Starter Operating System Microsoft® Windows Vista® Enterprise Operating System/Ultimate Operating System //Business Operating System/Home Premium Operating System //Home Basic Operating System Microsoft® Windows® XP Professional Operating System, Service Pack3 //Home Edition Operating System, Service Pack3 Desktop personal computer: Intel® Celeron® processor 2.8GHz or more Laptop personal computer: Intel® Pentium® M processor 1.7GHz or more 512 MB or more (for 32-bit OS) and 1GB or more (for 64-bit OS) 1GB or more USB port				
Browser	Windows® Interne	et 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-J3USBCBL3	M				

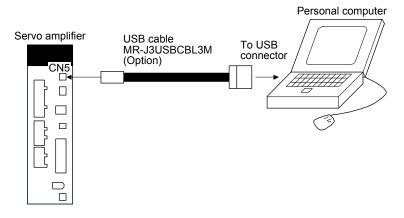
Note 1. On some personal computers, MR Configurator2 may not run properly.

- 2. When Windows® XP or later is used, the following functions cannot be used.
 - Windows Program Compatibility mode
 - Fast User Switching
 - Remote Desktop
 - Large Fonts Mode (Display property)
 - DPI settings other than 96DPI (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



11.7.3 Precautions for using USB communication function

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.

11.8 Battery

POINT

■Refer to app. 2 and 3 for battery transportation and the new EU Battery Directive.

This battery is used to construct an absolute position detection system. Refer to chapter 12 for construction of the absolute position detection system.

11.8.1 Selection of battery

The available batteries vary depending on servo amplifiers. Select a required battery.

(1) Applications of the batteries

Model	Name	Application	Built-in battery
MR-BAT6V1SET	Battery	For absolute position data backup	MR-BAT6V1
MR-BAT6V1BJ	Battery for junction battery cable	For transporting a servo motor and machine apart	
MR-BAT6V1SET-A	Battery	For absolute position data backup	MR-BAT6V1
MR-BT6VCASE	Battery case	For absolute position data backup of multi-axis servo motor	MR-BAT6V1

(2) Combinations of batteries and the servo amplifier

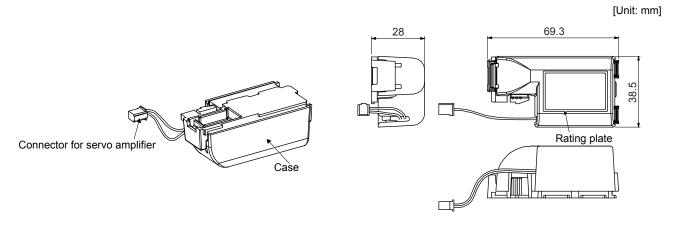
Model	MR-J4A_(-RJ) 100 W or more	MR-J4-03A6(-RJ)
MR-BAT6V1SET	0	
MR-BAT6V1BJ	0	
MR-BAT6V1SET-A		0
MR-BT6VCASE	0	

11.8.2 MR-BAT6V1SET battery

POINT

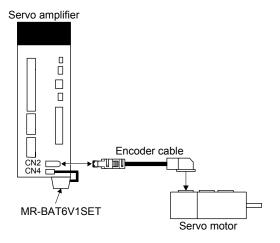
● For the specifications and year and month of manufacture of the built-in MR-BAT6V1 battery, refer to section 11.8.6.

(1) Parts identification and dimensions



Mass: 34 [g] (including MR-BAT6V1 battery)

(2) Battery mounting Connect as follows.



(3) Battery replacement procedure



• Before replacing a battery, turn off the main circuit power and wait for 15 minutes or longer until the charge lamp turns off. Then, check the voltage between P+ and N- with a voltage tester or others. 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.



- ■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

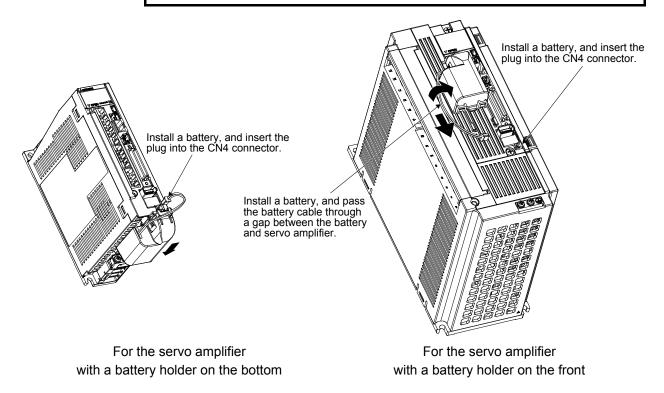
- Replacing battery with the control circuit power off will erase the absolute position data.
- ●Before replacing batteries, check that the new battery is within battery life.

Replace the battery while only control circuit power is on. Replacing battery with the control circuit power on triggers [AL.9F.1 Low battery]. However, the absolute position data will not be erased.

- (a) Battery installation and removal procedure
 - 1) Installation procedure

POINT

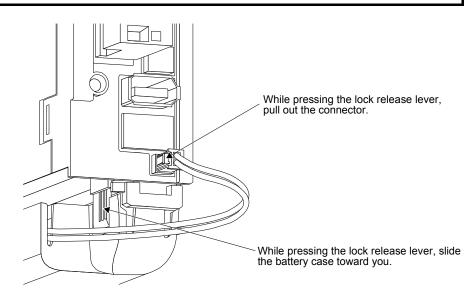
●For the servo amplifier with a battery holder on the bottom, it is not possible to wire for the earth with the battery installed. Insert the battery after executing the earth wiring of the servo amplifier.



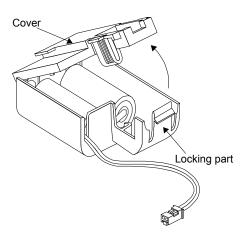
2) Removal procedure



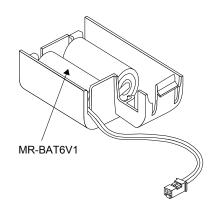
Pulling out the connector of the battery without the lock release lever pressed may damage the CN4 connector of the servo amplifier or the connector of the battery.



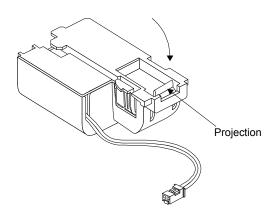
(4) Replacement procedure of the built-in battery When the MR-BAT6V1SET reaches the end of its life, replace the MR-BAT6V1 battery in the MR-BAT6V1SET.



1) While pressing the locking part, open the cover.



2) Replace the battery with a new MR-BAT6V1.



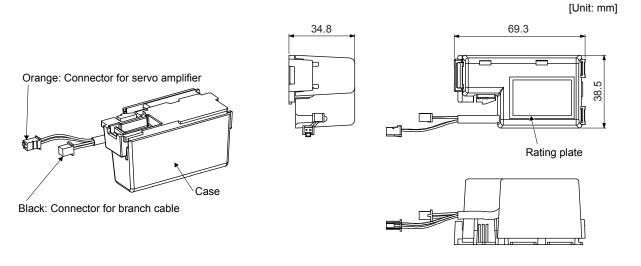
3) Press the cover until it is fixed with the projection of the locking part to close the cover.

11.8.3 MR-BAT6V1BJ battery for junction battery cable

POINT

- •MR-BAT6V1BJ is compatible only with HG series servo motors. It cannot be used with direct drive motors.
- ●MR-BAT6V1BJ cannot be used for fully closed loop system.

(1) Parts identification and dimensions



Mass: 66 [g]

(2) Year and month of manufacture of battery

Production year and month are indicated in a serial number (SERIAL) on the rating plate. The second digit from left in the number indicates the first digit of the dominical year, the third digit from left indicates a month (Oct: X, Nov: Y, Dec.: Z). For November 2013, the serial is like, "SERIAL: _3Y _ _ _ _ _ ".

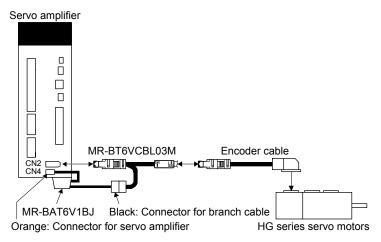
(3) Specification list

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	3	Not subject to the dangerous goods (Class 9) Refer to app. 2 for details.
Operating humidity and storage humidity		90 %RH or less (non-condensing)
(Note) Battery life		5 years from date of manufacture
Mass	[g]	66

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.

(4) Battery mounting

Connect the MR-BAT6V1BJ using the MR-BT6VCBL03M junction battery cable as follows.

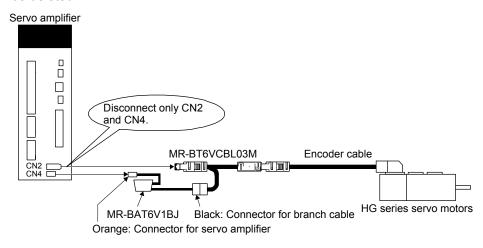


(5) Transporting a servo motor and machine apart

POINT

■Be sure to connect the connector for branch cable connection (black) when transporting a servo motor and machine apart. When the connector for branch cable connection (black) is not connected to the MR-BT6VCBL03M junction battery cable, no alarm will occur. However, the absolute position data will be erased when you transport a servo motor and machine apart.

When you transport a servo motor and machine apart, disconnect only CN2 and CN4 of the servo amplifier. When other connectors or cables are disconnected between the servo motor and battery, the absolute position data will be deleted.



(6) Battery replacement procedure

∱WARNING

• Before replacing a battery, turn off the main circuit power and wait for 15 minutes or longer until the charge lamp turns off. Then, check the voltage between P+ and N- with a voltage tester or others. 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.

●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.
- The battery built in MR-BAT6V1BJ cannot be replaced. Do not disassemble the MR-BAT6V1BJ. Otherwise, it may cause a malfunction.

POINT

- ■To replace the MR-BAT6V1BJ, follow the procedures given in this section to avoid erasing absolute position data.
- •Before replacing batteries, check that the new battery is within battery life.

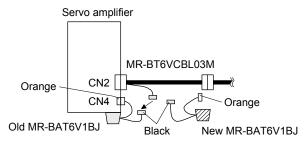
For MR-BAT6V1BJ, the battery can be replaced with the control circuit power supply off.

- (a) Battery installation and removal procedure The battery installation and removal procedure to the servo amplifier are the same as for the MR-BAT6V1SET battery. Refer to (3) of section 11.8.3.
- (b) Preparation for replacing MR-BAT6V1BJ Prepare a new MR-BAT6V1BJ as follows.

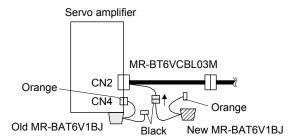
Model	Number and use	Remark
MR-BAT6V1BJ	1 for replacement	Battery within two years from the production date.

(c) Procedures of replacing MR-BAT6V1BJ Replace the product as follows regardless of on/off of the control circuit power supply. When it is replaced with other procedures, the absolute position data will be erased.

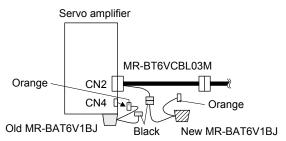
1) Remove the connector for branch cable connection (black) of the old MR-BAT6V1BJ.



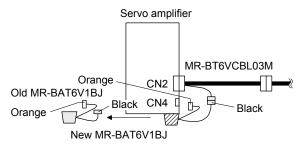
2) Connect the connector for branch cable connection (black) of the new MR-BAT6V1BJ.



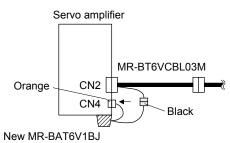
3) Remove the connector for servo amplifier (orange) of the old MR-BAT6V1BJ. When the control circuit power supply is on, performing 3) without [AL. 9F.1 Low battery] will trigger [AL. 9F.1].



4) Remove the old MR-BAT6V1BJ from servo amplifier and mount the new MR-BAT6V1BJ. When the control circuit power supply is on, [AL. 9F.1] will occur after 3).



5) Mount the connector for servo amplifier (orange) of the new MR-BAT6V1BJ. When the control circuit power supply is on, [AL. 9F.1] will be canceled.

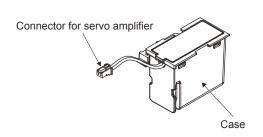


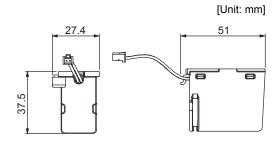
11.8.4 MR-BAT6V1SET-A battery

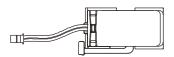
POINT

- ■Use MR-BAT6V1SET-A for MR-J4-03A6(-RJ) servo amplifier. The MR-BAT6V1SET-A cannot be used for MR-J4-_A_(-RJ) 100 W or more servo amplifiers.
- For the specifications and year and month of manufacture of the built-in MR-BAT6V1 battery, refer to section 11.8.6.

(1) Parts identification and dimensions

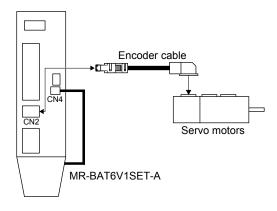






Mass: 55 [g] (including MR-BAT6V1 battery)

(2) Battery mounting Connect as follows.



(3) Battery replacement procedure

_WARNING

• Before replacing a battery, turn off the main circuit power supply and wait 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.



■The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions.

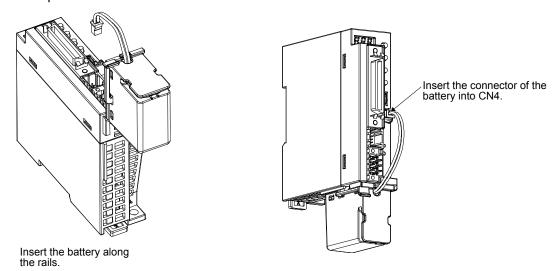
- Ground human body and work bench.
- Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

POINT

- Replacing battery with the control circuit power off will erase the absolute position data.
- •Before replacing batteries, check that the new battery is within battery life.

Replace the battery while only control circuit power is on. Replacing battery with the control circuit power on triggers [AL.9F.1 Low battery]. However, the absolute position data will not be erased.

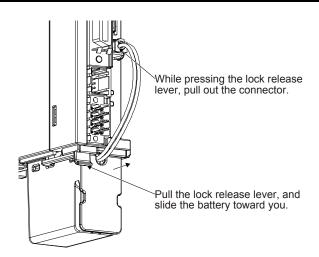
(a) Installation procedure



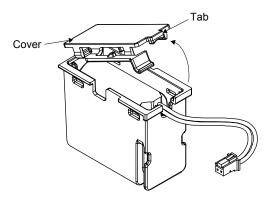
(b) Removal procedure



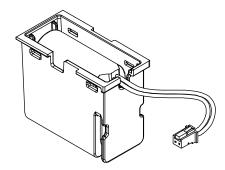
Pulling out the connector of the battery without the lock release lever pressed may damage the CN4 connector of the servo amplifier or the connector of the battery.



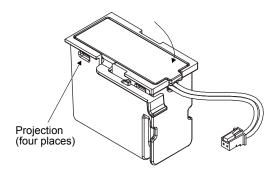
(4) Replacement procedure of the built-in battery
When the MR-BAT6V1SET-A reaches the end of its life, replace the MR-BAT6V1 battery in the MR-BAT6V1SET-A.



1) While pressing the locking part, 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.

11.8.5 MR-BT6VCASE battery case

POINT

- ■MR-BT6VCASE cannot be used for MR-J4-03A6(-RJ) servo amplifiers.
- ●The battery unit consists of an MR-BT6VCASE battery case and five MR-BAT6V1 batteries.
- ●For the specifications and year and month of manufacture of MR-BAT6V1 battery, refer to section 11.8.6.

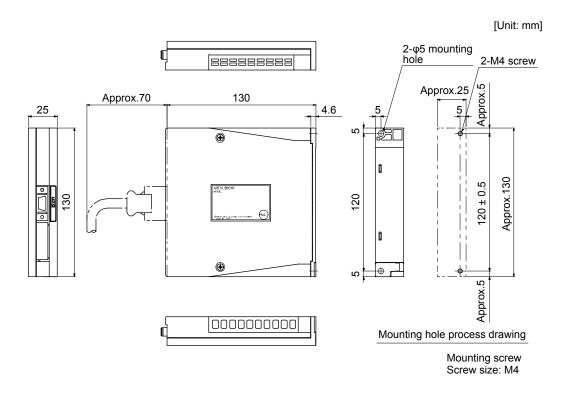
MR-BT6VCASE is a case used for connecting and mounting five MR-BAT6V1 batteries. A battery case does not have any batteries. Please prepare MR-BAT6V1 batteries separately.

(1) The number of connected servo motors

One MR-BT6VCASE holds absolute position data up to eight axes servo motors. For direct drive motors, up to four axes can be connected. Servo motors and direct drive motors in the incremental system are included as the axis Nos. Linear servo motors are not counted as the axis Nos. Refer to the following table for the number of connectable axes of each servo motor.

Servo motor		Number of axes							
Rotary servo motor	0	1	2	3	4	5	6	7	8
Direct drive motor	4	4	4	4	4	3	2	1	0

(2) Dimensions

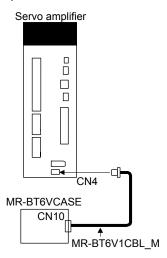


[Mass: 0.18 kg]

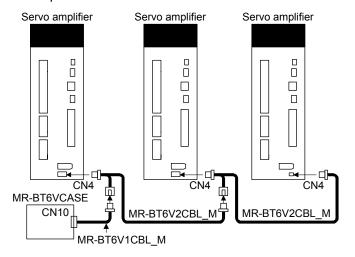
(3) Battery mounting

POINT

- ●One battery unit can be connected to up to 8-axis servo motors. However, when using direct drive motors, the number of axes of the direct drive motors should be up to 4 axes. Servo motors and direct drive motors in the incremental system are included as the axis Nos. Linear servo motors are not counted as the axis Nos.
- (a) When using 1-axis servo amplifier



(b) When using up to 8-axis servo amplifiers



(4) Battery replacement procedure



• Before replacing a battery, turn off the main circuit power and wait for 15 minutes or longer until the charge lamp turns off. Then, check the voltage between P+ and N- with a voltage tester or others. 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.



■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 battery with the control circuit power off will erase the absolute position data.
- Before replacing batteries, check that the new battery is within battery life.

Replace the battery while only control circuit power is on. Replacing battery with the control circuit power on triggers [AL. 9F.1 Low battery]. However, the absolute position data will not be erased.

(a) Assembling a battery unit



- Do not mount new and old batteries together.
- ●When you replace a battery, replace all batteries at the same time.

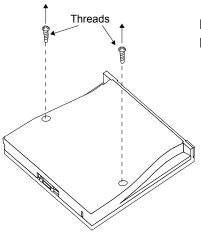
POINT

●Always install five MR-BAT6V1 batteries to an MR-BT6VCASE battery case.

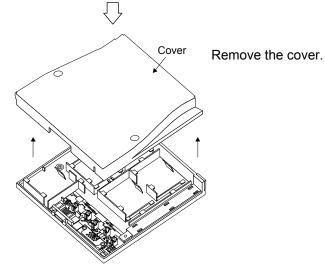
1) Required items

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 screwdriver.



CON2

CON3

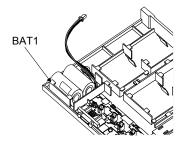
CON1

CON4

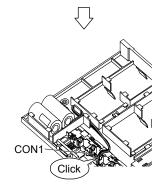
CON5

Parts identification

b) Mounting MR-BAT6V1



Securely mount an MR-BAT6V1 to the BAT1 holder.



Insert the MR-BAT6V1 connector mounted on BAT1 holder to CON1.

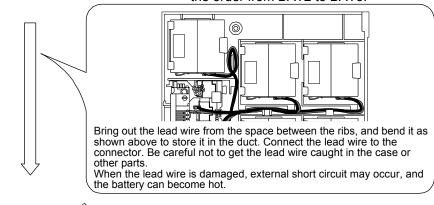
Confirm the click sound at this point.

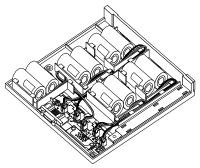
The connector has to be connected in the right direction.

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.



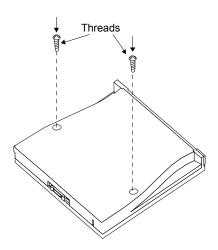


c) Assembly of the case

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

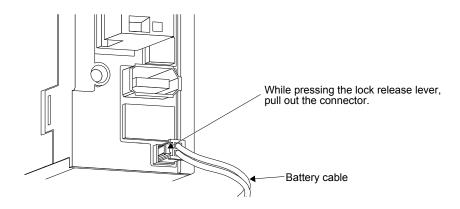
•When assembling the case, be careful not to get the lead wires caught in the fitting parts or the screwing parts.



- 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

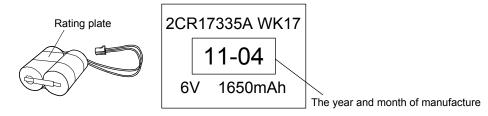


● Pulling out the connector of the MR-BT6V1CBL and the MR-BT6V2CBL without the lock release lever pressed may damage the CN4 connector of the servo amplifier or the connector of the MR-BT6V1CBL or MR-BT6V2CBL.



11.8.6 MR-BAT6V1 battery

The MR-BAT6V1 battery is a primary lithium battery for replacing MR-BAT6V1SET-A and MR-BAT6V1SET and a primary lithium battery built-in MR-BT6VCASE. Store the MR-BAT6V1 in the case to use. The year and month of manufacture of MR-BAT6V1 battery have been described to 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. 2 for details.
Operating humidity and storage humidity		90 %RH or less (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.

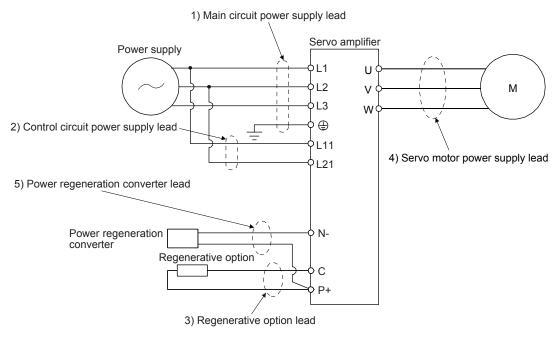
11.9 Selection example of wires

POINT

- ■To comply with the IEC/EN/UL/CSA standard, use the wires shown in app. 4 for wiring. To comply with other standards, use a wire that is complied with each standard.
- For the selection example when the MR-J4-_A-RJ servo amplifier is used with the DC power supply input, refer to app. 13.3.
- Selection conditions of wire size are as follows.
 Construction condition: Single wire set in midair

Wire length: 30 m or less

The following diagram shows the wires used for wiring. Use the wires given in this section or equivalent.



(1) Example of selecting the wire sizes

Use the 600 V Grade heat-resistant polyvinyl chloride insulated wire (HIV wire) for wiring. The following shows the wire size selection example.

(a) 200 V class

Table 11.1 Wire size selection example 1 (HIV wire)

		Wire [mm	²] (Note 1)	
Servo amplifier	1) L1/L2/L3/⊕	2) L11/L21	3) P+/C	4) U/V/W/⊕ (Note 3)
MR-J4-10A(-RJ)				
MR-J4-20A(-RJ)				
MR-J4-40A(-RJ)		4.054.0		AWG 18 to 14
MR-J4-60A(-RJ)	2 (AWG 14)	1.25 to 2 (AWG 16 to 14)	2 (AWG 14)	(Note 4)
MR-J4-70A(-RJ)		(Note 4)	2 (AVVG 14)	
MR-J4-100A(-RJ)		(11010 4)		
MR-J4-200A(-RJ) (3-phase power supply input)				
MR-J4-200A(-RJ) (1-phase power supply input) MR-J4-350A(-RJ)	3.5 (AWG 12)			AWG 16 to 10
MR-J4-500A(-RJ) (Note 2)	5.5 (AWG 10): a	1.25 (AWG 16): a		2 (AWG 14): c 3.5 (AWG 12): a 5.5 (AWG 10): a
MR-J4-700A(-RJ) (Note 2)	8 (AWG 8): b	2 (AWG 14): d (Note 4)	2 (AWG 14): c	2 (AWG 14): c 3.5 (AWG 12): a 5.5 (AWG 10): a 8 (AWG 8): b
MR-J4-11KA(-RJ) (Note 2)	14 (AWG 6): f	1.25 (AWG 16): c	3.5 (AWG 12): g	14 (AWG 6): f 55 (AWG 10): g (Note 5) 8 (AWG 8): k
MR-J4-15KA(-RJ) (Note 2)	22 (AWG 4): h	2 (AWG 14): c (Note 4)	5.5 (AWG 10): g	22 (AWG 4): h 8 (AWG 8): k (Note 5)
MR-J4-22KA(-RJ) (Note 2)	38 (AWG 2): i		5.5 (AWG 10): j	38 (AWG 2): i

Note 1. Alphabets in the table indicate crimping tools. For crimp terminals and applicable tools, refer to (2) in this section.

- To connect these models to a terminal block, be sure to use the screws that come with the terminal block.
- 3. The wire size shows applicable size of the servo amplifier connector and terminal block. For wires connecting to the servo motor, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 4. Be sure to use the size of 2 mm² when corresponding to IEC/EN/UL/CSA standard.
- 5. This is for connecting to the linear servo motor with natural cooling method.

Use wires 5) of the following sizes with the power regeneration converter (FR-RC).

Model	Wires [mm ²]
FR-RC-15K	14 (AWG 6)
FR-RC-30K	14 (AWG 6)
FR-RC-55K	22 (AWG 4)

(b) 400 V class

Table 11.2 Wire size selection example (HIV wire)

	Wires [mm²] (Note 1)					
Servo amplifier	1) L1/L2/L3/🖶	2) L11/L21	3) P+/C	4) U/V/W/⊕ (Note 3)		
MR-J4-60A4(-RJ) MR-J4-100A4(-RJ) MR-J4-200A4(-RJ) MR-J4-350A4(-RJ)	2 (AWG 14)	1.25 to 2 (AWG 16 to 14) (Note 4)	2 (AWG14)	AWG 16 to 14		
MR-J4-500A4(-RJ) (Note 2)	2 (AWG 14): b	1.25 (AWG 16): a	2 (Δ)Δ(C14): h	3.5 (AWG 12): a		
MR-J4-700A4(-RJ) (Note 2)	3.5 (AWG 12): a	2 (AWG 14): c (Note 4)	2 (AWG14): b	5.5 (AWG 10): a		
MR-J4-11KA4(-RJ) (Note 2)	5.5 (AWG 10): d		2 (AWG14): f	8 (AWG 8): g		
MR-J4-15KA4(-RJ) (Note 2)	8 (AWG 8): g	1.25 (AWG 16): b	3.5 (AWG 12): d	6 (AWG 6). g		
MR-J4-22KA4(-RJ) (Note 2)	2 (AWG 14): b (Note 4)		3.5 (AWG 12): e	5.5 (AWG 10): e (Note 5) 8 (AWG 8):h (Note 6) 14 (AWG 6): i		

Note 1. Alphabets in the table indicate crimping tools. For crimp terminals and applicable tools, refer to (2) in this section.

- 2. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.
- 3. The wire size shows applicable size of the servo amplifier connector and terminal block. For wires connecting to the servo motor, refer to each servo amplifier instruction manual.
- 4. Be sure to use the size of 2 mm² when corresponding to IEC/EN/UL/CSA standard.
- 5. This is for connecting to the linear servo motor with natural cooling method.
- 6. This is for connecting to the linear servo motor with liquid cooling method.

Use wires (5)) of the following sizes with the power regeneration converter (FR-RC-H).

Model	Wire [mm²]
FR-RC-H15K	
FR-RC-H30K	14 (AWG 6)
FR-RC-H55K	

(c) 100 V class

Table 11.3 Wire size selection example (HIV wire)

	Wires [mm ²]					
Servo amplifier	1) L1/L2/⊕	2) L11/L21	3) P+/C	4) U/V/W/⊕ (Note 1)		
MR-J4-10A1(-RJ)		1.25 to 2		AVA/C 40 to 44		
MR-J4-20A1(-RJ)	2 (AWG 14)	(AWG 16 to 14)	2 (AWG 14)	AWG 18 to 14 (Note 2)		
MR-J4-40A1(-RJ)		(Note 2)		(14016-2)		

Note 1. The wire size shows applicable size of the servo amplifier connector and terminal block. For wires connecting to the servo motor, refer to each servo amplifier instruction manual.

2. Be sure to use the size of 2 mm² when corresponding to IEC/EN/UL/CSA standard.

(2) Selection example of crimp terminals

(a) 200 V class

		Servo amplifier-side crimp terminals						
Symbol (Note 2)			Applicable tool					
	Crimp terminal	Body	Head	Dice	Manufacturer			
а	FVD5.5-4	YNT-1210S						
b (Note 1)	8-4NS	YHT-8S						
С	FVD2-4	YNT-1614						
d	FVD2-M3	1111-1014						
е	FVD1.25-M3	YNT-2216						
f	FVD14-6	YF-1	YNE-38	DH-122 DH-112				
g	FVD5.5-6	YNT-1210S			JST			
h	FVD22-6	YF-1	YNE-38	DH-123 DH-113				
i	FVD38-8	YF-1	YNE-38	DH-124 DH-114				
j	FVD5.5-8	YNT-1210S						
k	FVD8-6	YF-1/E-4	YNE-38	DH-121 DH-111				

Note 1. Coat the crimping part with an insulation tube.

(b) 400 V class

		Servo amplifier-side crimp terminals				
Symbol	Crimp terminal		Applicable tool			
	(Note)	Body	Head	Dice		
а	FVD5.5-4	YNT-1210S				
b	FVD2-4	YNT-1614				
С	FVD2-M3	1111-1014				
d	FVD5.5-6	YNT-1210S				
е	FVD5.5-8	YNT-1210S			JST	
f	FVD2-6	YNT-1614				
g	FVD8-6			DH-121/DH-111		
h	FVD8-8	YF-1	YNE-38	DH-121/DH-111		
i	FVD14-8			DH-122/DH-112		

Note. Some crimp terminals may not be mounted depending on the size. Make sure to use the recommended ones or equivalent ones.

^{2.} Some crimp terminals may not be mounted depending on the size. Make sure to use the recommended ones or equivalent ones.

11.10 Molded-case circuit breakers, fuses, magnetic contactors



- 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.

POINT

● For the selection when the MR-J4-_A-RJ servo amplifier is used with the DC power supply input, refer to app. 13.4.

(1) For main circuit power supply When using a fuse instead of the molded-case circuit breaker, use the one having the specifications given in this section.

	Molded-case	circuit breaker (Note	1, 4)		Fuse	_	
Servo amplifier	Frame, ra Power factor improving reactor is not used	ted current Power factor improving reactor is used	Voltage AC [V]	Class	Current [A]	Voltage AC [V]	Magnetic contactor (Note 2)
MR-J4-10A(-RJ)	30 A frame 5 A	30 A frame 5 A			10		
MR-J4-20A(-RJ)	30 A frame 5 A	30 A frame 5 A			10		
MR-J4-40A(-RJ)	30 A frame 10 A	30 A frame 5 A			15		
MR-J4-60A(-RJ)	30 A frame 15 A	30 A frame 10 A					
MR-J4-70A(-RJ)	30 A frame 15 A	30 A frame 10 A					S-N10
MR-J4-100A(-RJ) (3-phase power supply input)	30 A frame 15 A	30 A frame 10 A			20		S-T10
MR-J4-100A(-RJ) (1-phase power supply input)	30 A frame 15 A	30 A frame 15 A			30		
MR-J4-200A(-RJ)	30 A frame 20 A	30 A frame 20 A	240 T	Т	40	300	S-N20 (Note 3) S-T21
MR-J4-350A(-RJ)	30 A frame 30 A	30 A frame 30 A			70		S-N20 S-T21
MR-J4-500A(-RJ)	50 A frame 50 A	50 A frame 50 A			125		S-N35 S-T35
MR-J4-700A(-RJ)	100 A frame 75 A	60 A frame 60 A			150		S-N50
MR-J4-11KA(-RJ)	100 A frame 100 A	100 A frame 100 A			200		S-T50
MR-J4-15KA(-RJ)	125 A frame 125 A	125 A frame 125 A			250		S-N65 S-T65
MR-J4-22KA(-RJ)	225 A frame 175 A	225 A frame 175 A			350		S-N95 S-T100
MR-J4-60A4(-RJ)	30 A frame 5 A	30 A frame 5 A			10		C N/40
MR-J4-100A4(-RJ)	30 A frame 10 A	30 A frame 5 A			15		S-N10 S-T10
MR-J4-200A4(-RJ)	30 A frame 15 A	30 A frame 10 A			25		0-110
MR-J4-350A4(-RJ)	30 A frame 20 A	30 A frame 15 A			35		S-N20
MR-J4-500A4(-RJ)	30 A frame 20 A	30 A frame 20 A			50		(Note 3) S-T21
MR-J4-700A4(-RJ)	30 A frame 30 A	30 A frame 30 A	480	Т	65	600	S-N20 S-T21
MR-J4-11KA4(-RJ)	50 A frame 50 A	50 A frame 50 A			100		S-N25 S-T35
MR-J4-15KA4(-RJ)	60 A frame 60 A	60 A frame 60 A			150		S-N35 S-T35
MR-J4-22KA4(-RJ)	100 A frame 100 A	100 A frame 100 A			175		S-N50 S-T50
MR-J4-10A1(-RJ)	30 A frame 5 A	30 A frame 5 A			10		0.1140
MR-J4-20A1(-RJ)	30 A frame 10 A	30 A frame 10 A	240	Т	15	300	S-N10
MR-J4-40A1(-RJ)	30 A frame 15 A	30 A frame 10 A]		20		S-T10

Note $\,$ 1. When having the servo amplifier comply with the IEC/EN/UL/CSA standard, refer to app. 4.

^{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 which has the same or more operation characteristics than our lineup.

(2) For control circuit power supply

When the wiring for the control circuit power supply (L11, L21) is thinner than that for the main circuit power supply (L1, L2, L3), install an overcurrent protection device (molded-case circuit breaker or fuse) to protect the branch circuit.

Servo amplifier	Molded-case circuit bi	reaker (Note)	Fuse (0	Class T)	Fuse (Class K5)		
Servo ampliller	Frame, rated current	Voltage AC [V]	Current [A]	Voltage AC [V]	Current [A]	Voltage AC [V]	
MR-J4-10A(-RJ)							
MR-J4-20A(-RJ)							
MR-J4-40A(-RJ)							
MR-J4-60A(-RJ)							
MR-J4-70A(-RJ)							
MR-J4-100A(-RJ)							
MR-J4-200A(-RJ)	30 A frame 5 A	240	1	300	1	250	
MR-J4-350A(-RJ)							
MR-J4-500A(-RJ)							
MR-J4-700A(-RJ)							
MR-J4-11KA(-RJ)							
MR-J4-15KA(-RJ)							
MR-J4-22KA(-RJ)							
MR-J4-60A4(-RJ)							
MR-J4-100A4(-RJ)							
MR-J4-200A4(-RJ)							
MR-J4-350A4(-RJ)							
MR-J4-500A4(-RJ)	30 A frame 5 A	480	1	600	1	600	
MR-J4-700A4(-RJ)							
MR-J4-11KA4(-RJ)							
MR-J4-15KA4(-RJ)							
MR-J4-22KA4(-RJ)							
MR-J4-10A1(-RJ)							
MR-J4-20A1(-RJ)	30 A frame 5 A	240	1	300	1	250	
MR-J4-40A1(-RJ)							

Note. When having the servo amplifier comply with the IEC/EN/UL/CSA standard, refer to app. 4.

11.11 Power factor improving DC reactors

The following shows the advantages of using power factor improving DC reactor.

- 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 be about 85%.
- As compared to the power factor improving AC reactor (FR-HAL-(H)), it decreases the loss.

When connecting the power factor improving DC reactor to the servo amplifier, always disconnect P3 and P4. If it remains connected, the effect of the power factor improving DC reactor is not produced.

When used, the power factor improving DC reactor generates heat. To release heat, therefore, leave a 10 cm or more clearance at each of the top and bottom, and a 5 cm or more clearance on each side.

(1) 200 V class

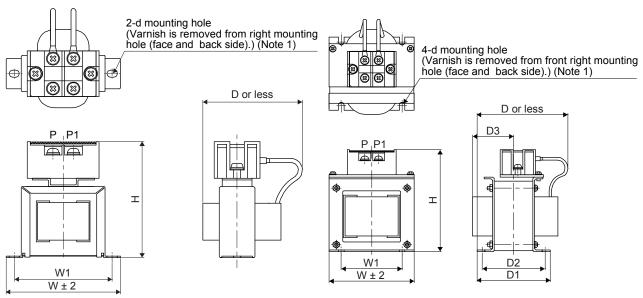


Fig. 11.1 Fig. 11.2

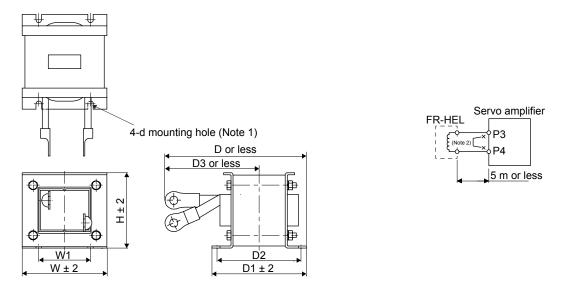


Fig. 11.3

- Note 1. Use this for grounding.
 - 2. When using the Power factor improving DC reactor, remove the short bar across P3-P4.

	Power factor					Dimension	ons [mn	n]			Terminal	Mass	Wire [mm²]
Servo amplifier	improving DC reactor	Dimensions	W	W1	Н	D (Note 1)	D1	D2	D3	d	size	[kg]	(Note 2)
MR-J4-10A(-RJ) MR-J4-20A(-RJ)	FR-HEL-0.4K		70	60	71	61		21		M4	M4	0.4	
MR-J4-40A(-RJ)	FR-HEL-0.75K	Fig. 11.1	85	74	81	61	\	21	\	M4	M4	0.5	
MR-J4-60A(-RJ) MR-J4-70A(-RJ)	FR-HEL-1.5K	rig. 11.1	85	74	81	70		30		M4	M4	0.8	2 (AWG 14)
MR-J4-100A(-RJ)	FR-HEL-2.2K		85	74	81	70	\	30	\	M4	M4	0.9	
MR-J4-200A(-RJ)	FR-HEL-3.7K		77	55	92	82	66	57	37	M4	M4	1.5	
MR-J4-350A(-RJ)	FR-HEL-7.5K		86	60	113	98	81	72	43	M4	M5	2.5	3.5 (AWG 12)
MR-J4-500A(-RJ)	FR-HEL-11K		105	64	133	112	92	79	47	M6	M6	3.3	5.5 (AWG 10)
MR-J4-700A(-RJ)	FR-HEL-15K	Fig. 11.2	105	64	133	115	97	84	48.5	M6	M6	4.1	8 (AWG 8)
MR-J4-11KA(-RJ)	FR-HEL-15K	119.11.2	105	64	133	115	97	84	48.5	M6	M6	4.1	14 (AWG 6)
MR-J4-15KA(-RJ)	FR-HEL-22K		105	64	93	175	117	104	115 (Note 1)	M6	M10	5.6	22 (AWG 4)
MR-J4-22KA(-RJ)	FR-HEL-30K	Fig. 11.3	114	72	100	200	125	101	135 (Note 1)	M6	M10	7.8	38 (AWG 2)

Note 1. Maximum dimensions. The dimension varies depending on the input/output lines.

2. Selection conditions of wire size are as follows.

Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)

Construction condition: Single wire set in midair

(2) 400 V class

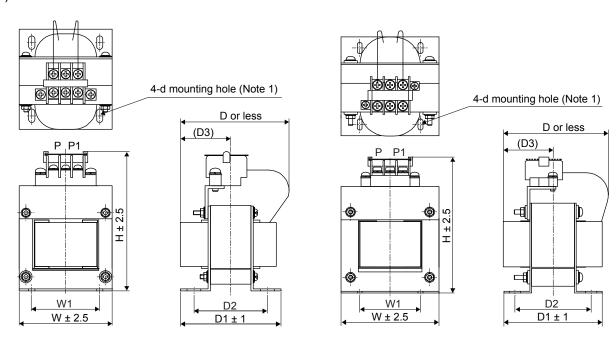


Fig. 11.4 Fig. 11.5

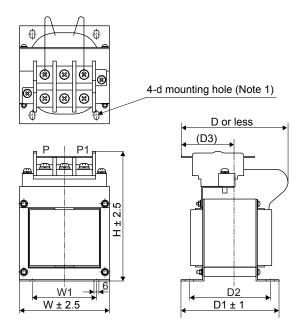
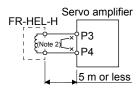


Fig. 11.6



Note 1. Use this for grounding.

2. When using the power factor improving DC reactor, remove the short bar across P3 and P4.

	Power factor				D	imens	ions [r		Terminal	Mass	Wire [mm ²]		
Servo amplifier	improving DC reactor	Dimensions	W	W1	Н	D	D1	D2	D3	d	size	[kg]	(Note)
MR-J4-60A4(-RJ)	FR-HEL-H1.5K	Eig. 11.4	66	50	100	80	74	54	37	M4	M3.5	1.0	2 (AWG 14)
MR-J4-100A4(-RJ)	FR-HEL-H2.2K	Fig. 11.4	76	50	110	80	74	54	37	M4	M3.5	1.3	2 (AWG 14)
MR-J4-200A4(-RJ)	FR-HEL-H3.7K		86	55	120	95	89	69	45	M4	M4	2.3	2 (AWG 14)
MR-J4-350A4(-RJ)	FR-HEL-H7.5K	Fig. 11.5	96	60	128	105	100	80	50	M5	M4	3.5	2 (AWG 14)
MR-J4-500A4(-RJ)	FR-HEL-H11K		105	75	137	110	105	85	53	M5	M5	4.5	3.5 (AWG 12)
MR-J4-700A4(-RJ)	FR-HEL-H15K		105	75	152	125	115	5 95	62	M5	M6	5.0	5.5 (AWG 10)
MR-J4-11KA4(-RJ)	FK-HEL-HISK	Fig. 11.6	105	75	152	123	115	90	02	IVIS	IVIO	5.0	8 (AWG 8)
MR-J4-15KA4(-RJ)	FR-HEL-H22K	Fig. 11.6	133	90	178	120	95	75	53	M5	M6	6.0	8 (AWG 8)
MR-J4-22KA4(-RJ)	FR-HEL-H30K		133	90	178	120	100	80	56	M5	M6	6.5	14 (AWG 6)

Note. Selection conditions of wire size are as follows.

Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)

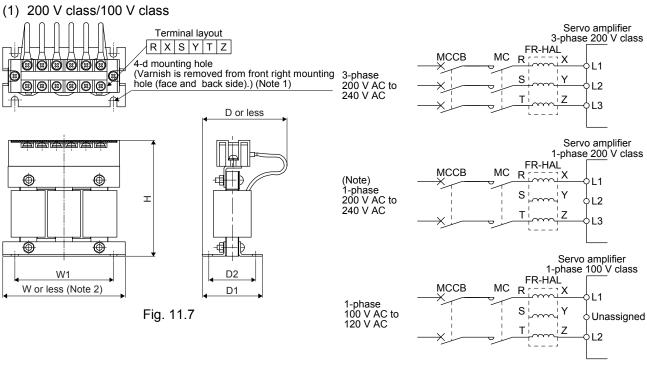
Construction condition: Single wire set in midair

11.12 Power factor improving AC reactors

The following shows the advantages of using power factor improving AC reactor.

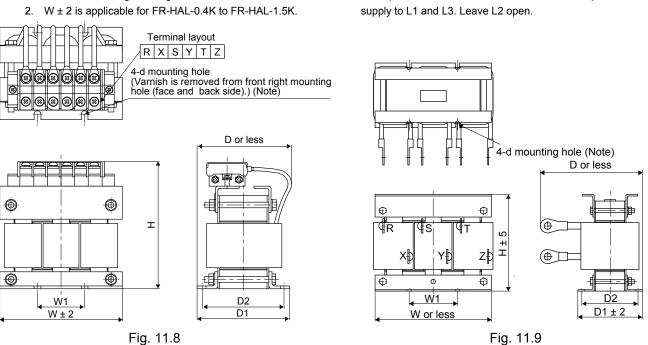
- It improves the power factor by increasing the form factor of the servo amplifier's input current.
- It decreases the power supply capacity.
- The input power factor is improved to be about 80%.

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.



Note 1. Use this hole for grounding.

Note. For 1-phase 200 V AC to 240 V AC, connect the power



Note. Use this hole for grounding.

Note. Use this for grounding.

	Power factor				Dime	ensions [mn	n]			Terminal	Mass
Servo amplifier	improving AC reactor	Dimensions	W	W1	Н	D (Note)	D1	D2	d	size	[kg]
MR-J4-10A(-RJ) MR-J4-20A(-RJ) MR-J4-10A1(-RJ)	FR-HAL-0.4K		104	84	99	72	51	40	M5	M4	0.6
MR-J4-40A(-RJ) MR-J4-20A1(-RJ)	FR-HAL-0.75K		104	84	99	74	56	44	M5	M4	0.8
MR-J4-60A(-RJ) MR-J4-70A(-RJ) MR-J4-40A1(-RJ)	FR-HAL-1.5K		104	84	99	77	61	50	M5	M4	1.1
MR-J4-100A(-RJ) (3-phase power supply input)	FR-HAL-2.2K	Fig. 11.7	115 (Note)	40	115	77	71	57	M6	M4	1.5
MR-J4-100A(-RJ) (1-phase power supply input) MR-J4-200A(-RJ) (3-phase power supply input)	FR-HAL-3.7K		115 (Note)	40	115	83	81	67	M6	M4	2.2
MR-J4-200A(-RJ) (1-phase power supply input)	FR-HAL-5.5K		115 (Note)	40	115	83	81	67	M6	M4	2.3
MR-J4-350A(-RJ)	FR-HAL-7.5K		130	50	135	100	98	86	M6	M5	4.2
MR-J4-500A(-RJ)	FR-HAL-11K		160	75	164	111	109	92	M6	M6	5.2
MR-J4-700A(-RJ)	FR-HAL-15K	Fig. 11.8	160	75	167	126	124	107	M6	M6	7.0
MR-J4-11KA(-RJ)	FR-HAL-15K	1 lg. 11.0	160	75	167	126	124	107	M6	M6	7.0
MR-J4-15KA(-RJ)	FR-HAL-22K		185 (Note)	75	150	158	100	87	M6	M8	9.0
MR-J4-22KA(-RJ)	FR-HAL-30K	Fig. 11.9	185 (Note)	75	150	168	100	87	M6	M10	9.7

Note. Maximum dimensions. The dimension varies depending on the input/output lines.

(2) 400 V class

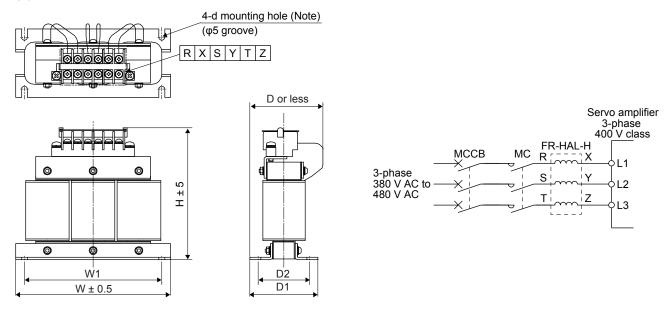


Fig. 11.10

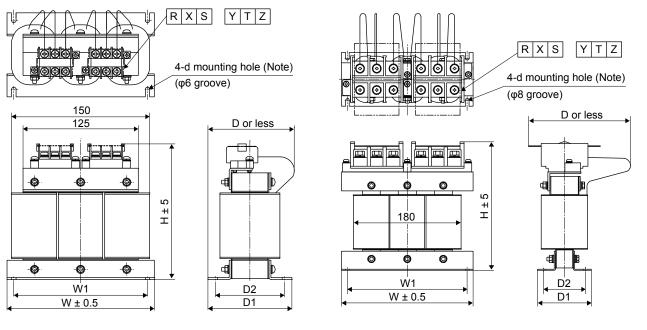


Fig. 11.11

Note. Use this for grounding.

	Power factor					Terminal	Mass				
Servo amplifier	improving AC reactor	Dimensions	W	W1	Н	D (Note)	D1	D2	d	size	[kg]
MR-J4-60A4(-RJ)	FR-HAL-H1.5K		135	120	115	59	59.6	45	M4	M3.5	1.5
MR-J4-100A4(-RJ)	FR-HAL-H2.2K	Fig. 11.10	135	120	115	59	59.6	45	M4	M3.5	1.5
MR-J4-200A4(-RJ)	FR-HAL-H3.7K		135	120	115	69	70.6	57	M4	M3.5	2.5
MR-J4-350A4(-RJ)	FR-HAL-H7.5K		160	145	142	91	91	75	M4	M4	5.0
MR-J4-500A4(-RJ)	FR-HAL-H11K	Fig. 11.11	160	145	146	91	91	75	M4	M5	6.0
MR-J4-700A4(-RJ) MR-J4-11KA4(-RJ)	FR-HAL-H15K	1 1g. 11.11	220	200	195	105	90	70	M5	M5	9.0
MR-J4-15KA4(-RJ)	FR-HAL-H22K	Fig. 11.12	220	200	215	170	90	70	M5	M8	9.5
MR-J4-22KA4(-RJ)	FR-HAL-H30K	Fig. 11.12	220	200	215	170	96	75	M5	M8	11

Note. Maximum dimensions. The dimension varies depending on the input/output lines.

11.13 Relays (recommended)

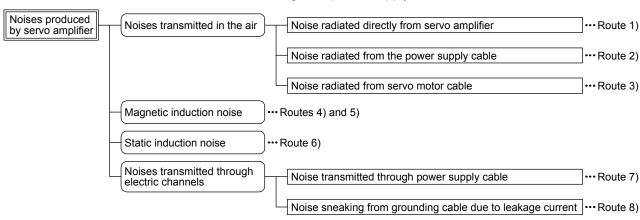
The following relays should be used with the interfaces

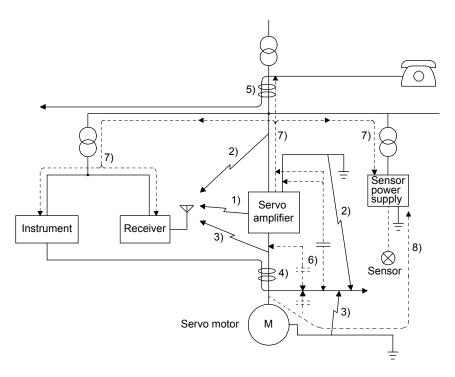
Interface	Selection example
Digital input (interface DI-1)	To prevent defective contacts , use a relay for
Relay used for digital input command signals	small signal (twin contacts).
	(Ex.) Omron : type G2A , MY
Digital output (interface DO-1)	Small relay with 12 V DC or 24 V DC of rated
Relay used for digital output signals	current 40 mA or less
	(Ex.) Omron : type MY

11.14 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 devices 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 devices malfunctions due to noises produced by the servo amplifier, noise suppression measures must be taken. 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 devices 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 devices located near the main circuit cables, and those transmitted through the power supply cables.



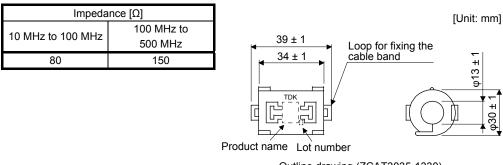


Noise transmission route	Suppression techniques
	When measuring instruments, receivers, sensors, etc. which handle weak signals and may malfunction due to noise and/or their signal cables are contained in a cabinet together with the servo amplifier or run near the servo amplifier, such devices may malfunction due to noises transmitted through the air. The following techniques are required.
1) 2) 3)	 Provide maximum clearance between easily affected devices and the servo amplifier. 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.
	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.
	Provide maximum clearance between easily affected devices and the servo amplifier.
4) 5) 6)	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.
	 Install the radio noise filter (FR-BIF(-H)) on the power lines (Input lines) of the servo amplifier. Install the line noise filter (FR-BSF01/FR-BLF) 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.

(2) Noise reduction techniques

(a) Data line filter (recommended)

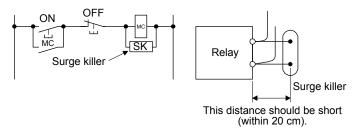
Noise can be prevented by installing a data line filter onto the encoder cable, etc. For example, ZCAT3035-1330 by TDK, ESD-SR-250 by NEC TOKIN, GRFC-13 by Kitagawa Industries, and E04SRM563218 by SEIWA ELECTRIC are available as data line filters. As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below. These impedances are reference values and not guaranteed values.



Outline drawing (ZCAT3035-1330)

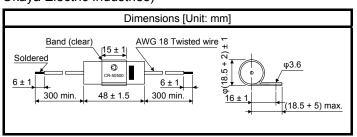
(b) Surge killer (recommended)

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



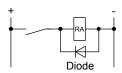
Note that a diode should be installed to a DC relay or the like.

Maximum voltage: Not less than 4 times the drive voltage of the relay or

the like

Maximum current: Not less than twice the drive current of the relay or the

like

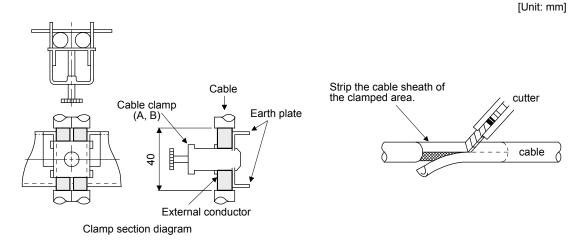


(c) Cable clamp fitting AERSBAN-_SET

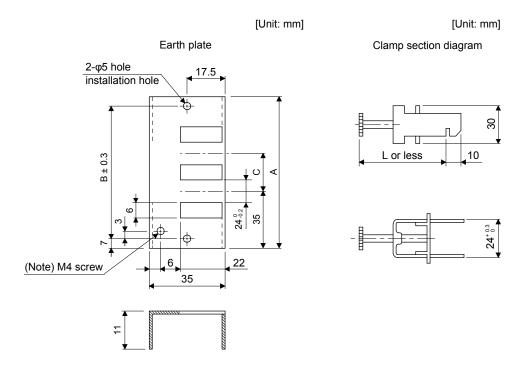
Generally, connecting the grounding of the shielded wire to the SD terminal of the connector provides a sufficient effect. However, the effect can be increased when the shielded wire is connected directly to the grounding plate as shown below.

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 clamp comes as a set with the grounding plate.



Dimensions



Note. Screw hole for grounding. Connect it to the grounding plate of the cabinet.

Model	Α	В	С	Accessory fittings
AERSBAN-DSET	100	86	30	Clamp A: 2 pcs.
AERSBAN-ESET	70	56		Clamp B: 1 pc.

Clamp fitting	L
Α	70
В	45

(d) Line noise filter (FR-BSF01/ FR-BLF)

Two filters are used

(Total number of passes: 4)

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 mounted on lines of the main power FR-BSF01 (for wire size 3.5 mm² (AWG 12) or less)) supply (L1, L2, and L3) and of the servo motor power (U, V, and Approx. 110 W). Pass each of the wires through the line noise filter an equal 95 ± 0.5 2-φ5 number of times in the same direction. For wires of the main 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. Approx. 65 Do not pass the grounding wire through the filte. Otherwise, the effect of the filter will drop. φ33 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 MCCB MC Servo amplifier Power L1 FR-BLF (for wire size 5.5 mm² (AWG 10) or more)) supply L2 L3 Line noise filter ∳ ⊕ (Number of passes: 4) 130 Example 2 MCCB MC O 85 Servo amplifier Power supply L1 L2 35 Line noise 80 filter L3 **(1)**

160

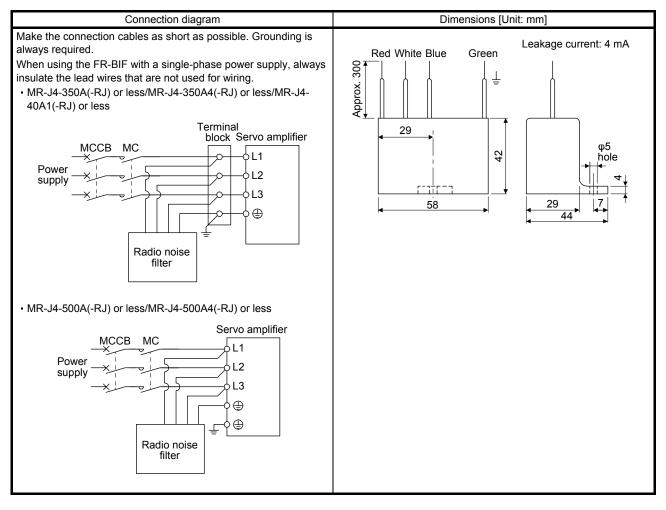
180

(e) Radio noise filter (FR-BIF(-H))

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.

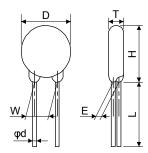
200 V class/100 V class: FR-BIF

400 V class: FR-BIF-H



(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, TND20V-471K and TND20V-102K, manufactured by NIPPON CHEMI-CON, are recommended. For detailed specification and usage of the varistors, refer to the manufacturer catalog.

Power				Maximum ra	ited		Maximum limit voltage		Static capacity	Varistor voltage rating (range)	
supply voltage	Varistor	Permissible circuit voltage		Surge current immunity	Energy immunity			[V]	(reference value)	V1 mA	
		AC [Vrms] DC [V]		8/20 µs [A]	2 ms [J]	[W]			[pF]	[V]	
200 V class/	TND20V-431K	275	350	10000/1 time	195	1.0	100	710	1300	430 (387 to 473)	
100 V class	TND20V-471K	300	385	7000/2 time	215	1.0	100	775	1200	470 (423 to 517)	
400 V class	TND20V-102K	625	825	7500/1 time 6500/2 times	400	1.0	100	1650	560	1000 (900 to 1100)	



							Unit: mm]	
Model	D Max.	H Max.	T Max.	E ± 1.0	(Note) L Min.	φ d ± 0.05 or less	W 1.0 or less	
TND20V-431K	24.5	24.5	6.4	3.3	20	0.8	10.0	
TND20V-471K	21.5	24.5	6.6	3.5	20	0.6	10.0	
TND20V-102K	22.5	25.5	9.5	6.4	20	8.0	10.0	

Note. For special purpose items for lead length (L), contact the manufacturer.

11.15 Earth-leakage current breaker

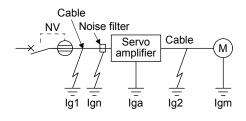
(1) Selection method

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 cables as short as possible, and make the grounding cable longer than 30 cm.

Rated sensitivity current ≥ 10 • {Ig1 + Ign + Iga + K • (Ig2 + Igm)} [mA]......(11.1)



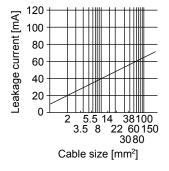
Earth-leakage curre	ent breaker	
Туре	Mitsubishi products	K
	NV-SP	
Models provided with	NV-SW	
harmonic and surge	NV-CP	1
reduction techniques	NV-CW	
	NV-HW	
	BV-C1	
General models	NFB	3
	NV-L	

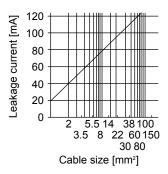
- Ig1: Leakage current on the electric channel from the earth-leakage current breaker to the input terminals of the servo amplifier (Found from Fig. 11.13.)
- Ig2: Leakage current on the electric channel from the output terminals of the servo amplifier to the servo motor (Found from Fig. 11.13.)

Ign: Leakage current when a filter is connected to the input side (4.4 mA per one FR-BIF(-H))

Iga: Leakage current of the servo amplifier (Found from table 11.5.)

Igm: Leakage current of the servo motor (Found from table 11.4.)





200 V class/100 V class (Note)

400 V class

Note. "Ig1" of 100 V class servo amplifiers will be 1/2 of 200 V class servo amplifiers.

Fig. 11.13 Leakage current example (lg1, lg2) for CV cable run in metal conduit

Table 11.4 Servo motor leakage current example (lgm)

Servo motor power [kW]	Leakage current [mA]		
0.05 to 1	0.1		
1.2 to 2	0.2		
3 to 3.5	0.3		
4.2 to 5	0.5		
6 to 7	0.7		
8 to 11	1.0		
12 to 15	1.3		
20 to 25	2.3		

Table 11.5 Servo amplifier leakage current example (Iga)

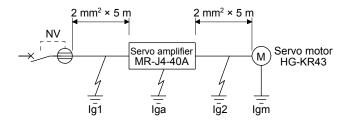
Servo amplifier capacity [kW]	Leakage current [mA]		
0.1 to 0.6	0.1		
0.75 to 3.5	0.15		
5/7	2		
11/15	5.5		
22	7		

Table 11.6 Earth-leakage current breaker selection example

Servo amplifier	Rated sensitivity current of earth- leakage current breaker [mA]		
MR-J4-10A(-RJ) to MR-J4-350A(-RJ) MR-J4-60A4(-RJ) to MR-J4-350A4(-RJ) MR-J4-10A1(-RJ) to MR-J4-40A1(-RJ)	15		
MR-J4-500A(-RJ) MR-J4-500A4(-RJ)	30		
MR-J4-700A(-RJ) MR-J4-700A4(-RJ)	50		
MR-J4-11KA(-RJ) to MR-J4-22KA(-RJ) MR-J4-11KA4(-RJ) to MR-J4-22KA4(-RJ)	100		

(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).

$$lg \ge 10 \cdot \{0.1 + 0 + 0.1 + 1 \cdot (0.1 + 0.1)\}$$

 $\ge 4 \text{ [mA]}$

According to the result of calculation, use an earth-leakage current breaker having the rated sensitivity current (Ig) of 4.0 [mA] or more.

An earth-leakage current breaker having Ig of 15 [mA] is used with the NV-SP/SW/CP/CW/HW series.

11.16 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

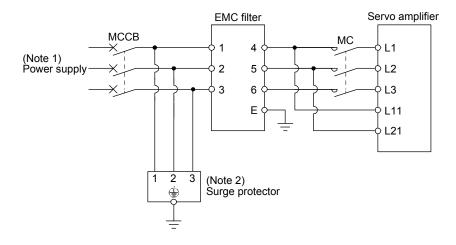
		Recommended filte	er (Soshin Electric)		
Servo amplifier	Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	Mass [kg]
MR-J4-10A(-RJ) to MR-J4-100A(-RJ)	HF3010A-UN (Note)	10		5	3.5
MR-J4-200A(-RJ) MR-J4-350A(-RJ)	HF3010A-UN (Note)	30			5.5
MR-J4-500A(-RJ) MR-J4-700A(-RJ)	HF3040A-UN (Note)	40	250	6.5	6
MR-J4-11KA(-RJ) MR-J4-15KA(-RJ) MR-J4-22KA(-RJ)	HF3100A-UN (Note)	100			12
MR-J4-60A4(-RJ) MR-J4-100A4(-RJ)	TF3005C-TX	5	500	5.5	6
MR-J4-200A4(-RJ) to MR-J4-700A4(-RJ)	TF3020C-TX	20			O
MR-J4-11KA4(-RJ)	TF3030C-TX	30			7.5
MR-J4-15KA4(-RJ)	TF3040C-TX	40			12.5
MR-J4-22KA4(-RJ)	TF3060C-TX	60			12.5
MR-J4-10A1(-RJ) to MR-J4-40A1(-RJ)	HF3010A-UN (Note)	10	250	5	3.5

Note. To use any of these EMC filters, the surge protector RSPD-500-U4 (Okaya Electric Industries) is required.

	Recommended filter (COSEL)				
Servo amplifier	Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	Mass [kg]
MR-J4-11KA(-RJ) to MR-J4-22KA(-RJ)	FTB-100-355-L (Note)	100	500	40	5.3
MR-J4-22KA4(-RJ)	FTB-80-355-L (Note)	80	500	80	5.3

 $Note.\ To\ use\ any\ of\ these\ EMC\ filters,\ the\ surge\ protector\ RSPD-500-U4\ (Okaya\ Electric\ Industries)\ is\ required.$

(2) Connection example



- Note 1. Refer to section 1.3 for the power supply specifications.
 - 2. The example is when a surge protector is connected.

(3) Dimensions

(a) EMC filter HF3010A-UN

3-M4

4-5.5 × 7

3-M4

M4

Approx. 41

258 ± 4

273 ± 2

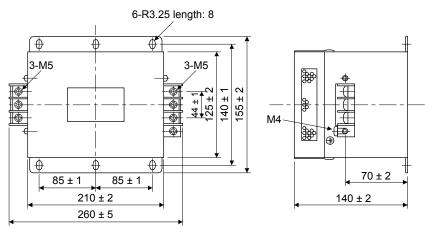
288 ± 4

300 ± 5

[Unit: mm]

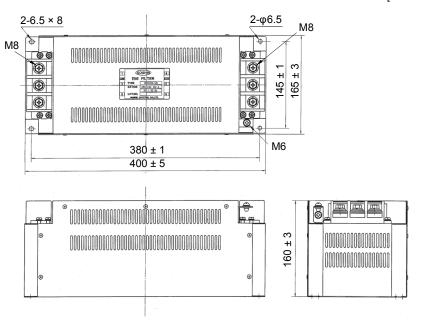
HF3030A-UN/HF-3040A-UN

[Unit: mm]

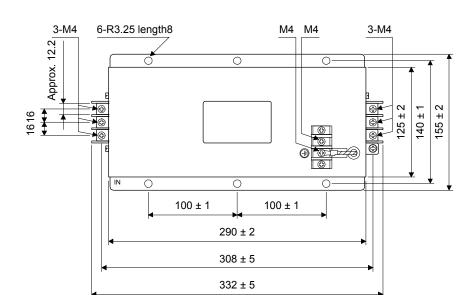


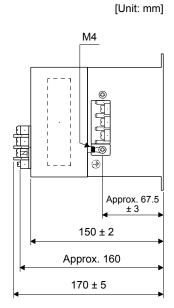
HF3100A-UN

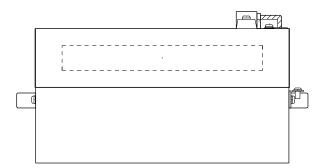
[Unit: mm]



TF3005C-TX/TX3020C-TX/TF3030C-TX

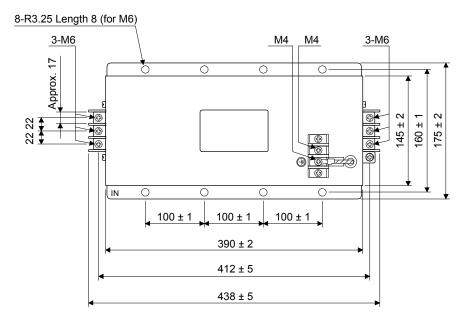


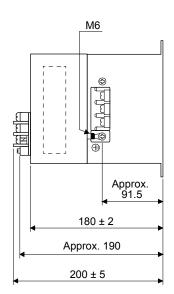


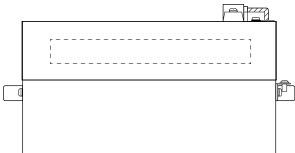


TF3040C-TX/TF3060C-TX

[Unit: mm]





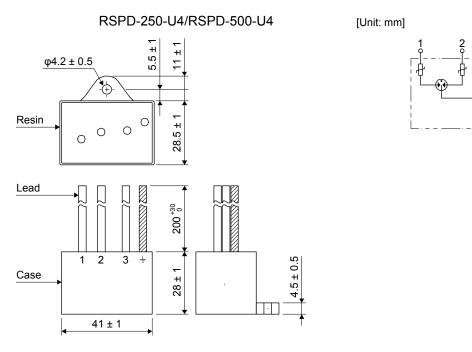


FTB-100-355-L/FTB-80-355-L

[Unit: mm] 3-M8 (option-S: hexagon socket head cap screw) 350 3-M8 (option-S: hexagon socket head cap screw) 309 Input Output 28 100 Model plate 26 M6 (option-S: hexagon socket head cap screw) M6 (option-S: hexagon socket head cap screw) Protective earth (PE) Terminal block cover Terminal block cover Protective earth (PE) 0 17 143 143 (Note) Mounting hole $2 - \phi 6.5$ 6.5 80 ± 0.5 Mounting plate 6.5 Mounting hole 335 ± 0.5

Note. No heat radiation holes on the opposite face.

(b) Surge protector



11.17 External dynamic brake



- ■Use an external dynamic brake for a servo amplifier of MR-J4-11KA(-RJ) to MR-J4-22KA(-RJ) and MR-J4-11KA4(-RJ) to MRJ4-22KA4(-RJ). Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at an alarm occurrence for which the servo motor does not decelerate to stop. Ensure the safety in the entire equipment. For alarms for which the servo motor does not decelerate to stop, refer to chapter 8.
- ●The external dynamic brake cannot be used for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs.

POINT

- ●EM2 has the same function as EM1 in the torque control mode.
- ■Configure up a sequence which switches off the magnetic contactor of the external dynamic brake after (or as soon as) SON (Servo-on) has been turned off at a power failure or a malfunction.
- For the braking time taken when the external dynamic brake is operated, refer to section 10.3.
- ●The external dynamic brake is rated for a short duration. Do not use it very frequently.
- ●When using the 400 V class external dynamic brake, the power supply voltage is restricted to 1-phase 380 V AC to 463 V AC (50 Hz/60 Hz).
- ●External dynamic brake operates at occurrence of alarm, [AL. E6 Servo forced stop warning], and when power is turned off. Do not use external 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 external 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.

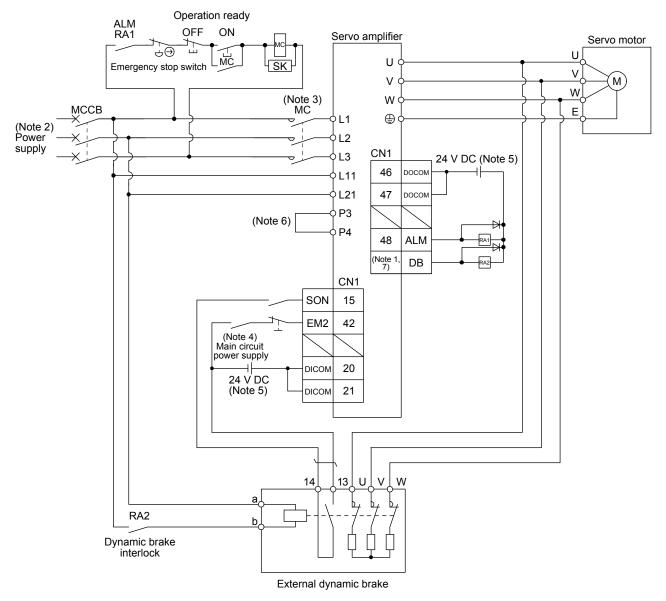
(1) Selection of external dynamic brake

The dynamic brake is designed to bring the servo motor to a sudden stop when a power failure occurs or the protective circuit is activated, and is built in the 7 kW or less servo amplifier. Since it is not built in the 11 kW or more servo amplifier, purchase it separately. Assign DB (Dynamic brake interlock) to any of CN1-22 to CN1-25, CN1-49, CN1-13, and CN1-14 pins in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47].

Servo amplifier	External dynamic brake
MR-J4-11KA(-RJ)	DBU-11K
MR-J4-15KA(-RJ)	DBU-15K
MR-J4-22KA(-RJ)	DBU-22K-R1
MR-J4-11KA4(-RJ)	DBU-11K-4
MR-J4-15KA4(-RJ)	DBU-22K-4
MR-J4-22KA4(-RJ)	DBU-22N-4

(2) Connection example

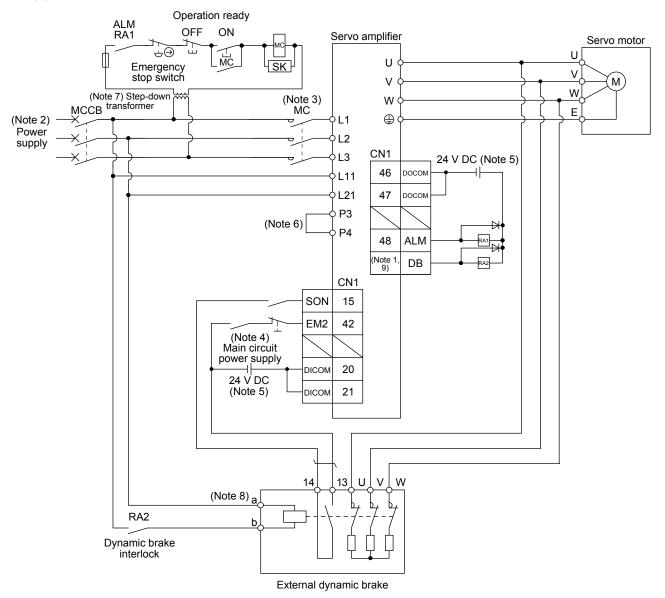
(a) 200 V class



Note 1. Assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47].

- 2. Refer to section 1.3 for the power supply specifications.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. Turn off EM2 when the main power circuit power supply is off.
- 5. 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.
- 6. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
- 7. The external dynamic brake cannot be used for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs.

(b) 400 V class



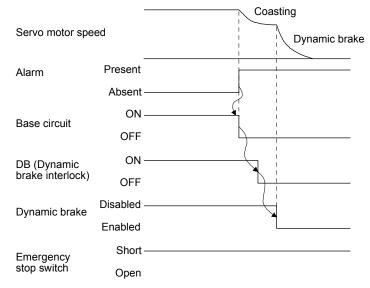
11. OPTIONS AND AUXILIARY EQUIPMENT

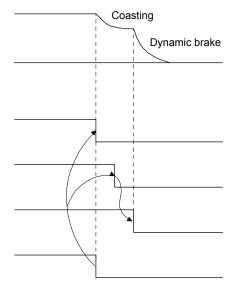
- Note 1. Assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47].
 - 2. For power supply specifications, refer to section 1.3.
 - 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
 - 4. Turn off EM2 when the main power circuit power supply is off.
 - 5. 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.
 - 6. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
 - 7. Stepdown transformer is required when the coil voltage of the magnetic contactor is 200 V class.
 - 8. The power supply voltage of the inside magnet contactor for 400 V class external dynamic brake DBU-11K-4 and DBU-22K-4 is restricted as follows. When using these external dynamic brakes, use them within the range of the power supply.

External dynamic brake	Power supply voltage
DBU-11K-4	1-phase 380 V AC to 463 V AC, 50
DBU-22K-4	Hz/60 Hz

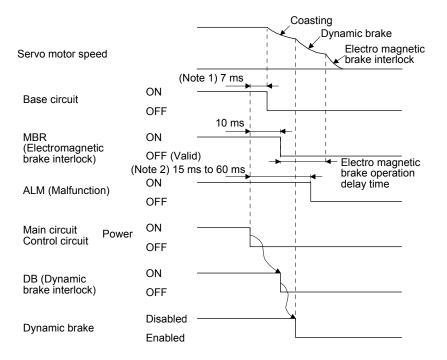
9. The external dynamic brake cannot be used for compliance with SEMI-F47 standard. Do not assign DB (Dynamic brake interlock) in [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47]. Failure to do so will cause the servo amplifier to become servo-off when an instantaneous power failure occurs.

(3) Timing chart





- a. Timing chart at alarm occurrence
- b. Timing chart at emergency stop switch enabled



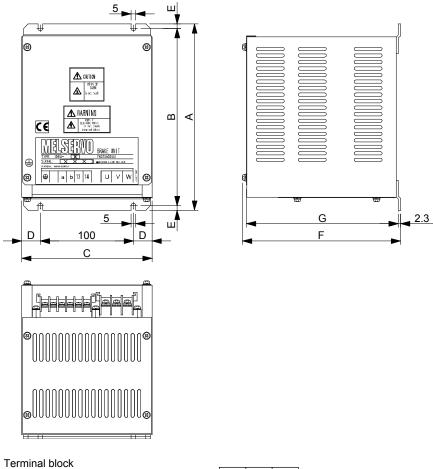
- Note 1. When powering off, DB (Dynamic brake interlock) will be turned off, and the base circuit is turned off earlier than usual before an output shortage occurs.

 (Only when assigning the DB as the output signal)
 - 2. Variable according to the operation status.
- c. Timing chart when both of the main and control circuit power are off

(4) Dimensions

(a) DBU-11K/DBU-15K/DBU-22K-R1

[Unit: mm]



Screw: M3.5

(

Tightening torque: 0.8 [N•m]

b

13 | 14

U V W

Screw: M4

Tightening torque: 1.2 [N•m]

External dynamic brake	۸	В	C	D	Е	F G	F G	_	Г	Mass	(Note) Connection wire [mm ²]	
External dynamic brake	Α	Ь)	D				г	Г	G	[kg]	U/V/W
DBU-11K	200	190	140	20	5	170	163.5	2	5.5 (AWG 10)	2 (AWG 14)		
DBU-15K/DBU-22K-R1	250	238	150	25	6	235	228	6	5.5 (AWG 10)	2 (AWG 14)		

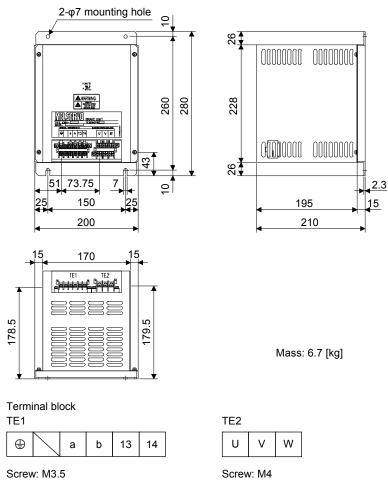
Note. Selection conditions of wire size are as follows.

Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)

Construction condition: Single wire set in midair

(b) DBU-11K-4/DBU-22K-4





	(Note) Connection wire [mm ²]			
External dynamic brake	U/V/W	Except U/V/W		
DBU-11K-4	5.5 (AWG 10)	2 (AWG 14)		
DBU-22K-4	5.5 (AWG 10)	2 (AWG 14)		

Note. Selection conditions of wire size are as follows.

Tightening torque: 0.8 [N•m]

Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)

Tightening torque: 1.2 [N•m]

Construction condition: Single wire set in midair

11.18 Panel through attachment (MR-J4ACN15K/MR-J3ACN)

Use the panel through attachment to mount the heat generation area of the servo amplifier in the outside of the cabinet to dissipate servo amplifier-generated heat to the outside of the cabinet and reduce the amount of heat generated in the cabinet. In addition, designing a compact cabinet is allowed.

In the cabinet, machine a hole having the panel cut dimensions, fit the panel through attachment to the servo amplifier with the fitting screws (4 screws supplied), and install the servo amplifier to the cabinet.

Please prepare screws for mounting. They do not come with.

The environment outside the cabinet when using the panel through attachment should be within the range of the servo amplifier operating environment.

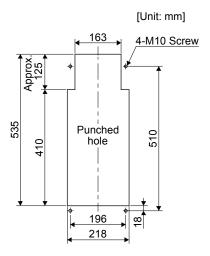
The panel through attachments are used for MR-J4-11KA(-RJ) to MR-J4-22KA(-RJ) and MR-J4-11KA4(-RJ) to MR-J4-22KA4(-RJ).

The following shows the combinations.

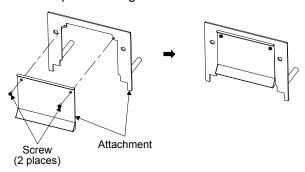
Servo amplifier	Panel through attachment
MR-J4-11KA(-RJ) MR-J4-15KA(-RJ)	MR-J4ACN15K
MR-J4-22KA(-RJ)	MR-J3ACN
MR-J4-11KA4(-RJ) MR-J4-15KA4(-RJ)	MR-J4ACN15K
MR-J4-22KA4(-RJ)	MR-J3ACN

(1) MR-J4ACN15K

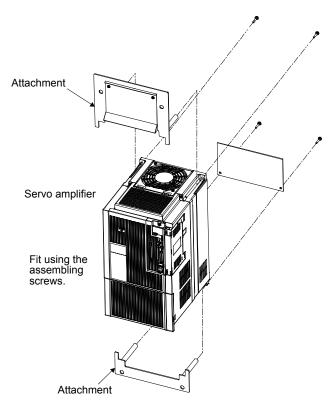
(a) Panel cut dimensions



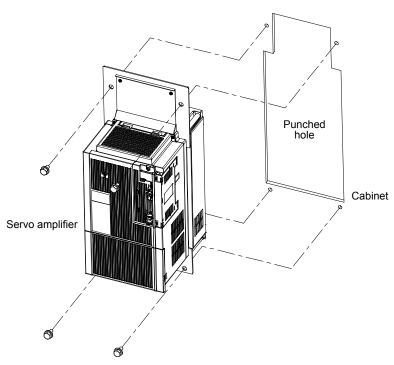
(b) How to assemble the attachment for panel through attachments



(c) Mounting method



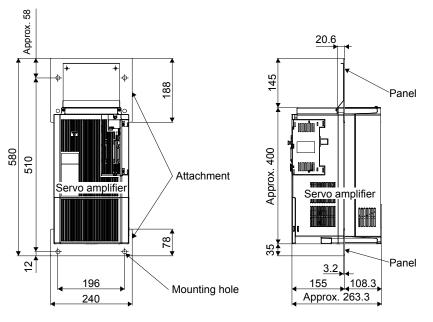
a. Assembling the panel through attachment



b. Mounting it to inside cabinet

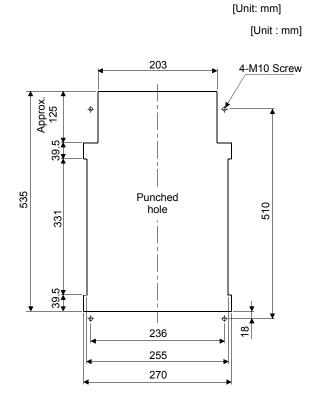
(d) Mounting dimensional diagram

[Unit: mm]

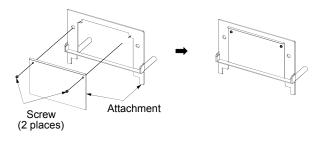


(2) MR-J3ACN

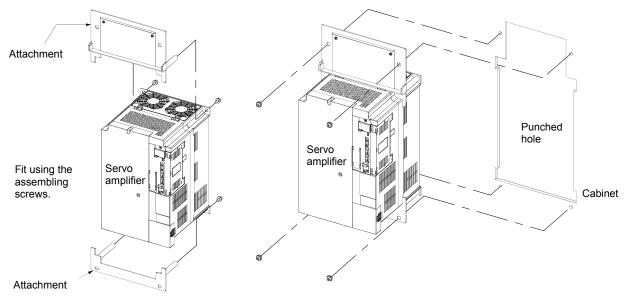
(a) Panel cut dimensions



(b) How to assemble the attachment for panel through attachment



(c) Mounting method

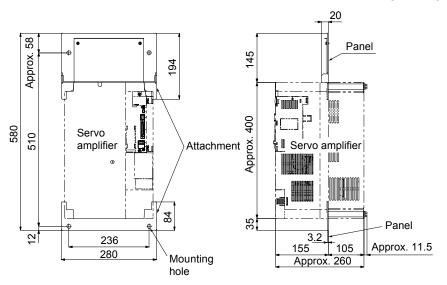


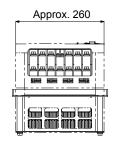
a. Assembling the panel through attachment

b. Mounting it to inside cabinet

(d) Mounting dimensional diagram

[Unit: mm]





12. ABSOLUTE POSITION DETECTION SYSTEM



- ●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.
- cause an unexpected operation.

 old [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 11.8 for the replacement procedure of the battery.
- ■There are four types of batteries, MR-BAT6V1SET, MR-BAT6V1BJ, MR-BAT6V1SET-A and MR-BT6VCASE available to construct the absolute position detection system. MR-BAT6V1BJ has the following advantages compared to other batteries.
 - You can disconnect the encoder cable from the servo amplifier.
 - You can replace the battery with the control circuit power supply off.
- 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.

MR-BAT6V1SET, MR-BAT6V1SET-A and MR-BT6VCASE

- The encoder cable was disconnected.
- The battery was replaced when the control circuit power supply was off. MR-BAT6V1BJ
- A connector or cable was disconnected between the servo motor and battery.
- The battery was replaced with procedures other than those of (6) in section 11.8.3.

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. ABSOLUTE POSITION DETECTION SYSTEM

12.1.2 Restrictions

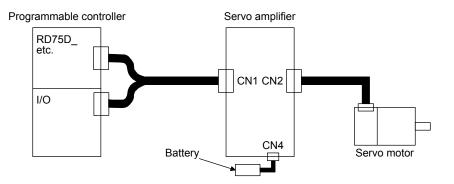
The system cannot be configured under the following conditions. Additionally, test operation cannot be performed in the absolute position detection system. To perform test operation, select incremental system in [Pr. PA03].

- (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 11.8 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 _{0N} series

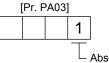


12.1.4 Parameter setting

POINT

●Set "___2" in [Pr. PA03] when using the absolute position detection system by communication. This parameter setting is supported by servo amplifier with software version A3 or later.

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 12.8 for the ABS transfer system by communication.

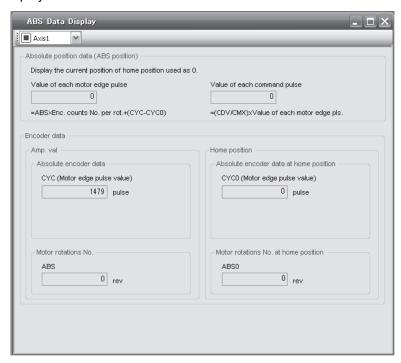


Absolute position detection system selection

- 0: Disabled (incremental system)
- 1: Enabled (absolute position detection system by DIO)
- 2: Enabled (absolute position detection system by communication-based) (available for the software version A3 or later)

12.1.5 Confirmation of absolute position detection data

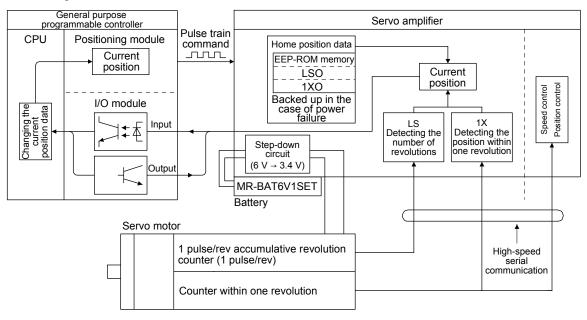
You can check the absolute position data with MR Configurator2. Choose "Monitor" and "ABS Data Display" to open the absolute position data display screen.



12.2 Battery

12.2.1 Using MR-BAT6V1SET battery or 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)	Rotary servo motor	6000
Maximum speed at power	•	(only when acceleration time until 6000 r/min is 0.2 s or more)
failure [r/min]	Direct drive motor	500 (only when acceleration time until 500 r/min is 0.1 s or more)
(Note 2)	Determination	Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C)
	Rotary servo motor	Approximately 29,000 hours (power-on time ratio: 25%, ambient temperature: 20 °C) (Note 3)
Battery backup time	Direct drive motor	Approximately 5,000 hours (equipment power supply: off, ambient temperature: 20 °C) Approximately 15,000 hours (power-on time ratio: 25%, ambient temperature: 20 °C) (Note 3)

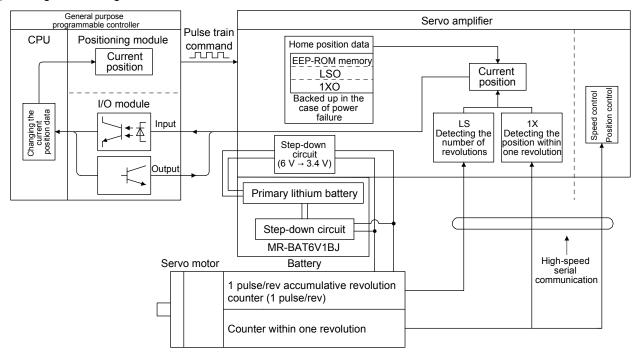
- Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like. Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like.
 - 2. The data-holding time by the battery using MR-BAT6V1SET or 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 MR-BAT6V1BJ battery for junction battery cable

POINT

- •MR-BAT6V1BJ is compatible only with HG series servo motors. It cannot be used with direct drive motors.
- ●MR-BAT6V1BJ cannot be used for fully closed loop system.

(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]	Rotary servo motor	6000 (only when acceleration time until 6000 r/min is 0.2 s or more)			
(Note 2) Battery backup time	Rotary servo motor	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.

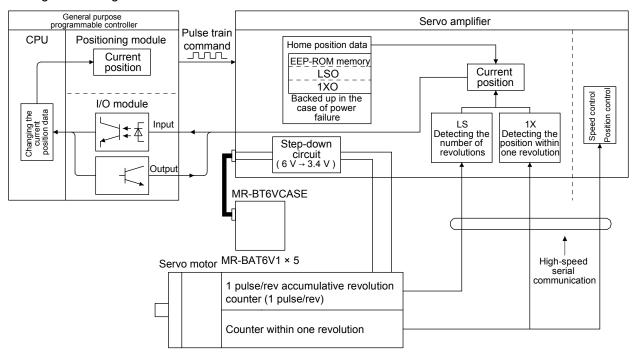
- 2. The data-holding time by the battery using MR-BAT6V1BJ. Replace the batteries within three years since the operation start regardless of the power supply of the servo amplifier on/off. If the battery is used out of specification, [AL. 25 Absolute position erased] may occur.
- 3. The power-on time ratio 25% is equivalent to 8 hours power on for a weekday and off for a weekend.

12.2.3 Using MR-BT6VCASE battery case

POINT

- ●One MR-BT6VCASE holds absolute position data up to eight axes servo motors.
- ●Always install five MR-BAT6V1 batteries to an MR-BT6VCASE.

(1) Configuration diagram



(2) Specification list

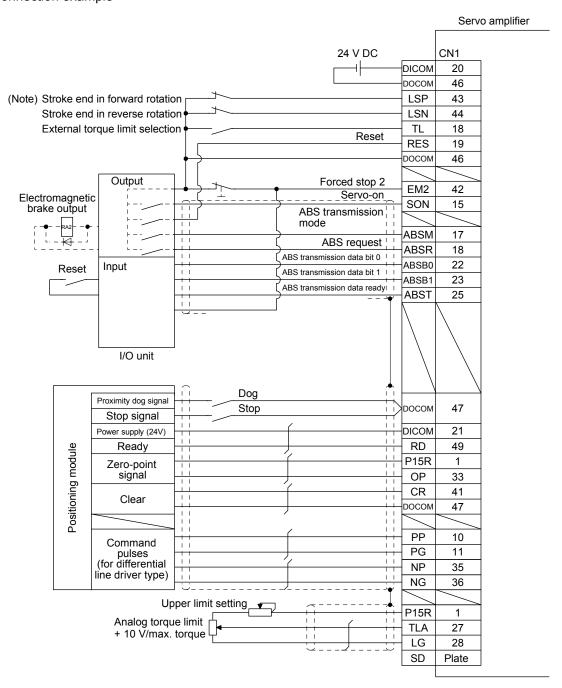
Item		Description				
System		Electronic battery backup type				
Maximum revolution range		Home position ± 32767 rev.				
(Nieto 1)	Rotary servo motor	6000				
(Note 1)	Rolary Servo motor	(only when acceleration time until 6000 r/min is 0.2 s or more)				
Maximum speed at power failure [r/min]	Direct drive motor	500				
Tanare [i/iiiii]	Direct drive motor	(only when acceleration time until 500 r/min is 0.1 s or more)				
		Approximately 40,000 hours/2 axes or less, 30,000 hours/3 axes, or 10,000 hours/8 axes				
	Rotary servo motor	(equipment power supply: off, ambient temperature: 20 °C)				
	Rotary servo motor	Approximately 55,000 hours/2 axes or less, 38,000 hours/				
		3 axes, or 15,000 hours/8 axes				
(Note 2)		(power-on time ratio: 25%, ambient temperature: 20 °C) (Note 4)				
Battery backup time		Approximately 10,000 hours/2 axes or less, 7,000 hours/				
		3 axes, or 5,000 hours/4 axes				
	Direct drive motor	(equipment power supply: off, ambient temperature: 20 °C)				
	Direct drive motor	Approximately 15,000 hours/2 axes or less, 13,000 hours/				
		3 axes, or 10,000 hours/4 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 the battery using five MR-BAT6V1s. The battery life varies depending on the number of 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 Standard connection example



Note. For operation, always turn on LSP and LSN.

12. ABSOLUTE POSITION DETECTION SYSTEM

12.4 Signal explanation

When the absolute position data is transferred, the signals of connector CN1 change as described in this section. They return to the previous status on completion of data transfer. The other signals are as described in section 3.5.

For the I/O interfaces (symbols in the I/O Category column in the table), refer to section 3.8.2.

Signal name	Code	CN1 connector pin No.	Function/Application	I/O category	Control mode
ABS transfer mode	ABSM	(Note) 17	While ABSM is on, the servo amplifier is in the ABS transfer mode, and the functions of CN1-22, CN1-23, and CN1-25 are as indicated in this table.	DI-1	
ABS request	ABSR	(Note) 18	Turn on ABSR to request the absolute position data in the ABS transfer mode.	DI-1	
ABS transmission data bit 0	ABSB0	22	Indicates the lower bit of the absolute position data (2 bits) which is sent from the servo to the programmable controller in the ABS transfer mode. If there is a signal, D01 turns on.	DO-1	P
ABS transmission data bit 1	ABSB1	23	Indicates the upper bit of the absolute position data (2 bits) which is sent from the servo to the programmable controller in the ABS transfer mode.	DO-1	(Position control)
ABS transmission data ready	ABST	25	Indicates that the data to be sent is being prepared in the ABS transfer mode. At the completion of the ready state, ABST turns on.	DO-1	
Home position setting	CR	41	When CR is turned on, the position control counter is cleared and the home position data is stored into the non-volatile memory (backup memory).	DI-1	

Note. When "Used in absolute position detection system" is selected in [Pr. PA03], pin 17 acts as ABSM and pin 18 as ABSR. They do not return to the original signals if data transfer ends.

12. ABSOLUTE POSITION DETECTION SYSTEM

12.5 Startup procedure

Battery installation.
 Refer to section 12.2.

(2) Parameter setting

Set "___ 1" in [Pr. PA03] of the servo amplifier and switch power off, then on.

(3) Resetting of [AL. 25 Absolute position erased]

After connecting the encoder cable, [AL. 25] occurs at first power-on. Turn off the power, then on to reset the alarm.

(4) Confirmation of absolute position data transfer

When SON is turned on, the absolute position data is transferred to the programmable controller. Transferring the proper absolute position data will trigger the followings.

- (a) RD (Ready) turns on.
- (b) The absolute position data ready contact of programmable controller turns on.
- (c) The MR Configurator2 ABS data display window (refer to section 12.1.5) and programmable controller side ABS data registers show the same value (at the home position address of 0). If any warning such as [AL. E5 ABS time-out warning] or programmable controller side transfer error occurs, refer to section 12.7 or chapter 8 and take corrective action.
- (5) Home position setting

The home position must be set if.

- (a) System set-up is performed;
- (b) The servo amplifier has been changed;
- (c) The servo motor has been changed; or
- (d) [AL. 25 Absolute position erased] occurred.

In the absolute position detection system, the absolute position coordinates are made up by making home position setting at the time of system set-up. The motor shaft may operate unexpectedly if positioning operation is performed without home position setting.

Always make home position setting before starting.

For the home position setting method and types, refer to section 12.6.3.

12.6 Absolute position data transfer protocol

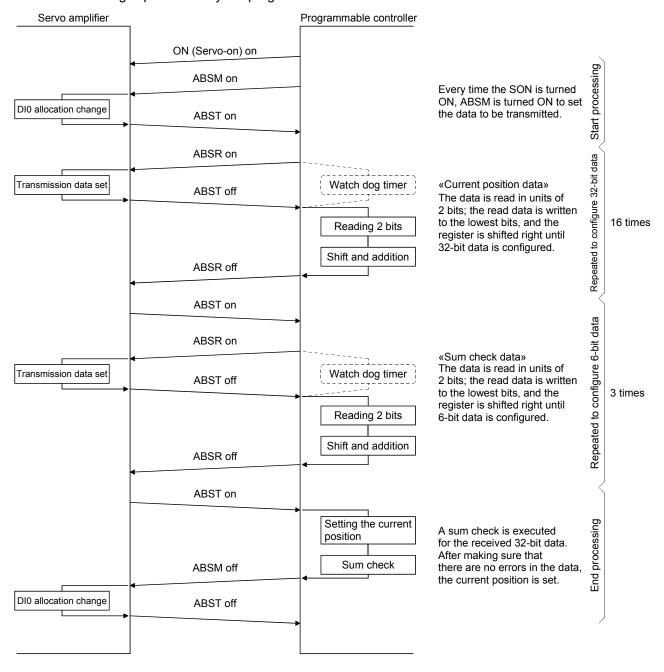
POINT

●After switching on ABSM, turn on SON. When the ABS transfer mode is off, turning on SON does not switch on the base circuit.

12.6.1 Data transfer procedure

Each time SON is turned on (when the power is switched on for example), the programmable controller reads the position data (present position) of the servo amplifier.

Time-out monitoring is performed by the programmable controller.

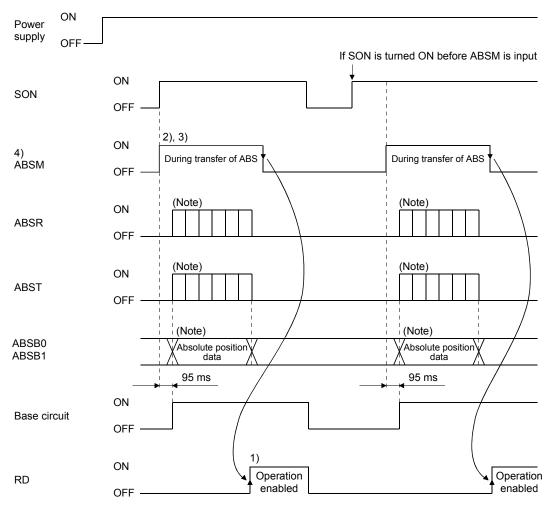


12.6.2 Transfer method

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 SON is turned on, ABSM should always be turned on to read the current position in the servo amplifier to the controller. The servo amplifier transmits to the controller the current position latched when ABSM switches from off to on. At the same time, this data is set as a position command value inside the servo amplifier. Unless ABSM (ABS transfer mode) is turned on, the base circuit cannot be turned on.

(1) At power-on

(a) Timing chart



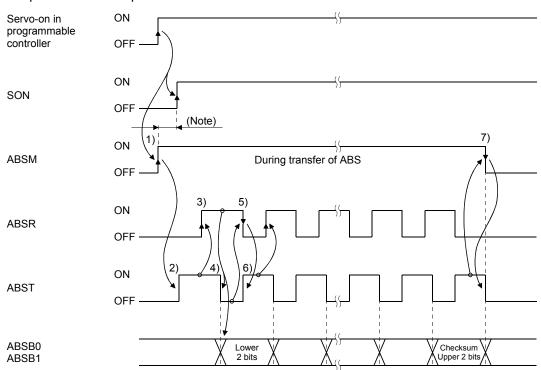
Note. For details, refer to (1) (b) of this section.

- After the absolute position data is transmitted, RD turns on by ABSM-off. When RD is on, ABSM-on is not received.
- 2) Even if SON is turned on before ABSM is turned on, the base circuit is not turned on until ABSM is turned on.
 - If an alarm has occurred, ABSM is not received. ABSM allows data transmission even while a warning is occurring.
- 3) If ABSM is turned off during the ABS transfer mode, the ABS transfer mode is interrupted and [AL. E5 ABS time-out warning] occurs.
 If SON is turned off, RES is turned on, and EM2 is turned off during the ABS transfer mode, [AL.
- 4) Note that if ABSM is turned on for a purpose other than absolute position data transmission, the output signals will be assigned the functions of absolute position data transmission.

CN1 Pin No.	Output signal				
CINT PIII INO.	ABSM (ABS transfer mode): off	ABSM (ABS transfer mode): on			
22	Positioning completion	transmission data bit 03			
23	Zero speed detection	transmission data bit 1			
25	During torque limit control	transmission data ready			

- 5) ABSM is not accepted while the base circuit is on. For re-transferring, turn off SON signal and keep the base circuit in the off state for 20 ms or longer.
- (b) Detailed description of absolute position data transfer

E5 ABS time-out warning] occurs.



Note. If SON does not turn on within 1 s after ABSM off, [AL. EA ABS servo-on warning] will occur. But it will not influence the transfer. SON on will cancel [AL. EA] automatically.

- The programmable controller turns on ABSM and SON at the leading edge of the internal servoon.
- 2) In response to ABS transfer mode, the servo detects and calculates the absolute position and turns on ABST to notify the programmable controller that the servo is ready for data transmission.
- 3) After acknowledging that ABST is turned on, the programmable controller will turn on ABSR.
- 4) In response to ABSR, the servo outputs the lower 2 bits of the absolute position data and ABST in the off state.
- 5) After acknowledging that ABST has been turned off, which implies that 2 bits of the absolute position data have been transmitted, the programmable controller reads the lower 2 bits of the absolute position data and then turns off ABSR.
- 6) The servo turns on ABST so that it can respond to the next request. Steps 3) to 6) are repeated until 32-bit data and the 6-bit checksum have been transmitted.
- 7) After receiving of the checksum, the programmable controller confirms that the 19th ABST is turned on, and then turns off ABSM. If ABSM is turned off during data transmission, ABSM is interrupted and the [AL. E5 ABS time-out warning] occurs.

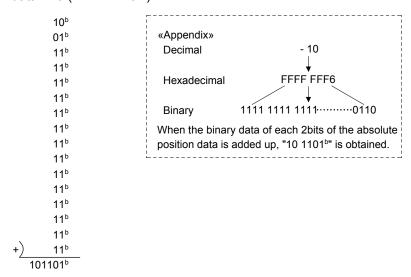
(c) Checksum

he checksum is the code which is used by the programmable controller to check for errors in the received absolute position data. The 6-bit checksum is transmitted following the 32-bit absolute position data.

At the programmable controller, calculate the sum of the received absolute position data using the ladder program and compare it with the checksum code sent from the servo.

The method of calculating the checksum is shown. Every time the programmable controller receives 2 bits of absolute position data, it adds the data to obtain the sum of the received data. The checksum is 6-bit data.

Example: absolute position data: -10 (FFFFFF6H)



Therefore, the checksum of "-10" (absolute position data) is "2DH"

(2) Transmission error

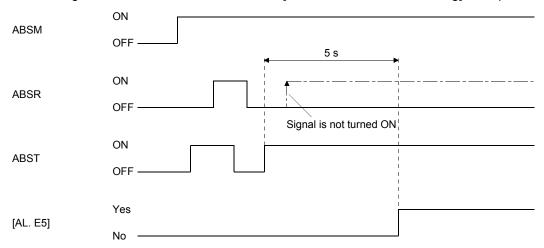
(a) [AL. E5 ABS time-out warning]

In the ABS transfer mode, the servo amplifier processes time-out below, and displays [AL. E5] when a time-out error occurs.

[AL. E5 ABS time-out warning] is cleared when ABSM changes from off to on.

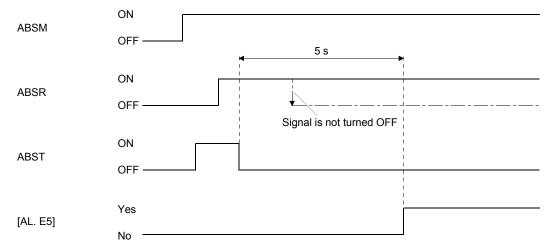
1) ABS request off-time time-out check (applied to 32-bit absolute position data in 2-bit units checksum)

If the ABS request signal is not turned on by the programmable controller within 5 s after ABST is turned on, this is regarded as a transmission error and [AL. E5 ABS time-out warning] is output.

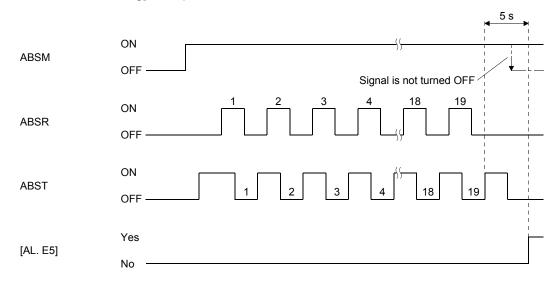


2) ABS request on-time time-out check (applied to 32-bit absolute position data in 2-bit units checksum)

If the ABSR is not turned off by the programmable controller within 5 s after ABST is turned off, this is regarded as the transmission error and [AL. E5 ABS time-out warning] is output.

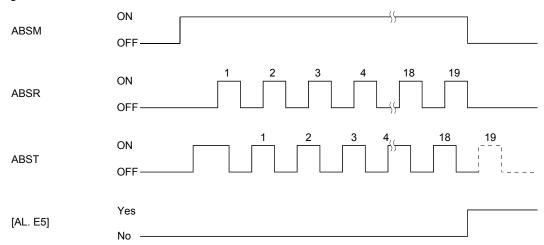


3) ABS transfer mode finish-time time-out check If ABSM is not turned off within 5 s after the last ABS transmission data ready (19th signal for absolute position data transmission) is turned on, it is regarded as the transmission error and the [AL. E5 ABS time-out warning] is output.

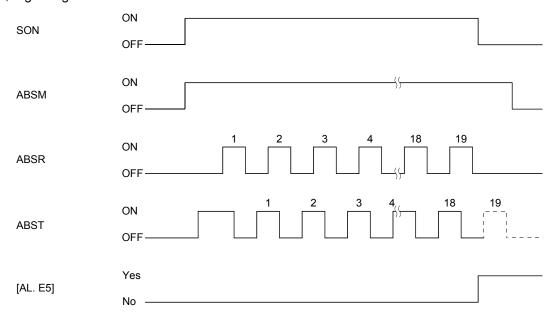


4) ABSM-off check during the ABS transfer

When the ABSM is turned on to start transferring and then the ABS transfer mode is turned off before the 19th ABS transmission data ready is turned on, [AL. E5 ABS time-out warning] occurs, regarding it as a transfer error.



5) SON off, RES on, and EM2 off check during the ABS transfer When the ABS transfer mode is turned on to start transferring and then SON is turned off, RES is turned on, or EM2 is turned on before the 19th ABST is turned on, [AL. E5 ABS time-out warning] occurs, regarding it as a transfer error.



(b) Checksum error

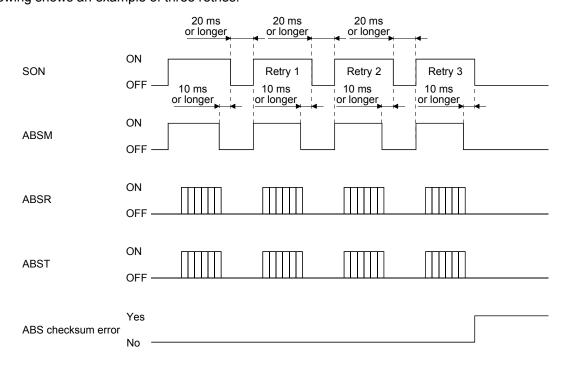
If the checksum error occurs, the programmable controller should retry transmission of the absolute position data.

Using the ladder check program of the programmable controller, turn off ABSM. After a lapse of 10 ms or longer, turn off SON (off time should be longer than 20 ms) and then turn it on again.

If the absolute position data transmission fails even after retry, process the ABS checksum error. The start command should be interlocked with ABST to disable positioning operation when an

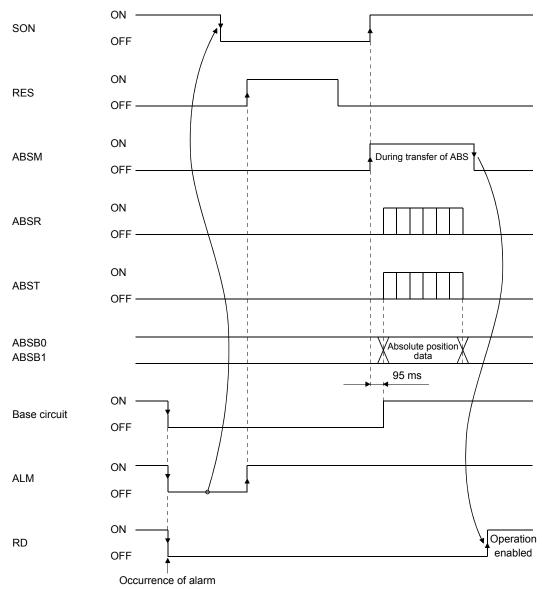
checksum error occurs.

The following shows an example of three retries.



(3) At the time of alarm reset

If an alarm occurs, turn off SON by detecting ALM. If an alarm has occurred, ABSM cannot be accepted. In the reset state, ABSM can be input.

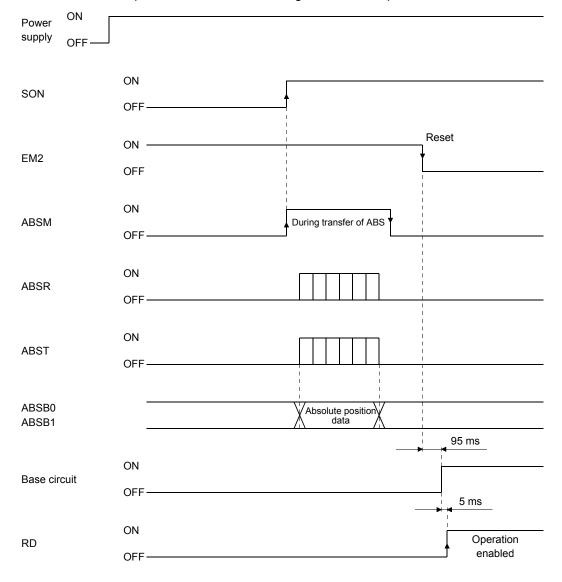


(4) At the time of forced stop reset

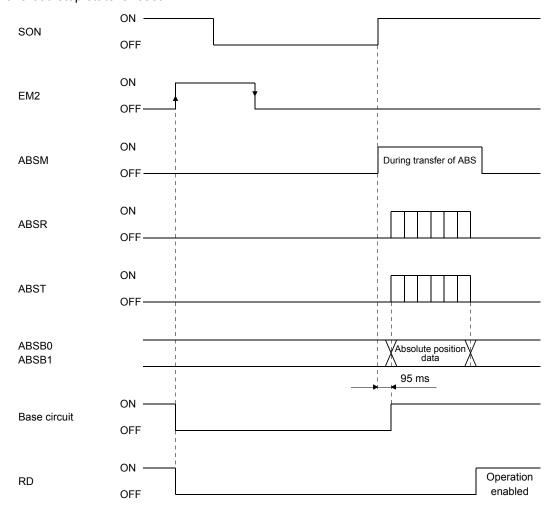
(a) If the power is switched on in the forced stop state

he forced stop state can be reset while the absolute position data is being transferred. If the forced stop state is reset while the absolute position data is transmitted, the base circuit is turned on 95 ms after resetting. If ABSM is off when the base circuit is turned on, RD is turned on 5 ms after the turning on of the base circuit. If ABSM is on when the base circuit is turned on, it is turned off and then RES is turned on. The absolute position data can be transmitted after the forced stop state is reset.

The current position in the servo amplifier is updated even during an forced stop. When SON or ABSM are turned on during an forced stop as shown below, the servo amplifier transmits to the controller the current position latched when ABSM switches from off to on, and at the same time, the servo amplifier sets this data as a position command value. However, since the base circuit is off during a forced stop, the servo-lock status is not encountered. Therefore, if the servo motor is rotated by external force or the like after ABSM is turned on, this travel distance is accumulated in the servo amplifier as droop pulses. If the forced stop is cleared in this status, the base circuit turns on and the motor returns to the original position rapidly to compensate for the droop pulses. To avoid this status, reread the absolute position data before clearing the forced stop.



(b) If forced stop is activated during servo-on ABSM is permissible while in the forced stop state. In this case, the base circuit and RD are turned on after the forced stop state is reset.



12.6.3 Home position setting

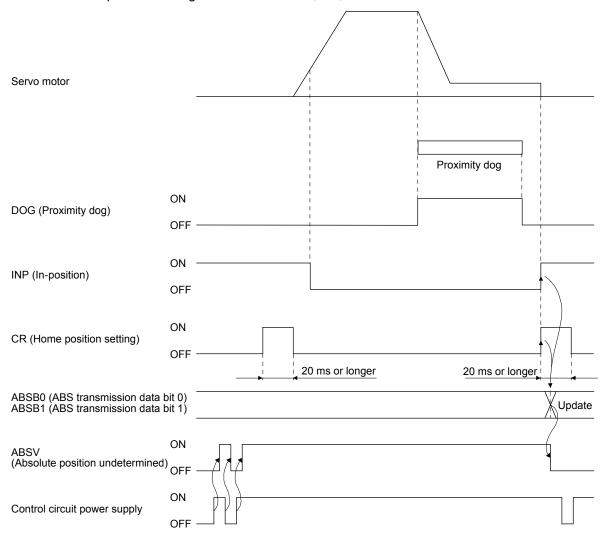
(1) Dog type home position return

Preset a home position return creep speed at which the machine will not be given impact.

On detection of a zero pulse, CR is turned from off to on. At the same time, the servo amplifier clears the droop pulses, comes to a sudden stop, and stores the stop position into the non-volatile memory as the home position absolute position data.

CR should be turned on after it has been confirmed that INP is on. If this condition is not satisfied, [AL. 96 Home position setting warning] will occur, but that warning will be reset automatically by making home position return correctly.

The number of home position setting times is limited to 1,000,000 times.



(2) Data set type home position return

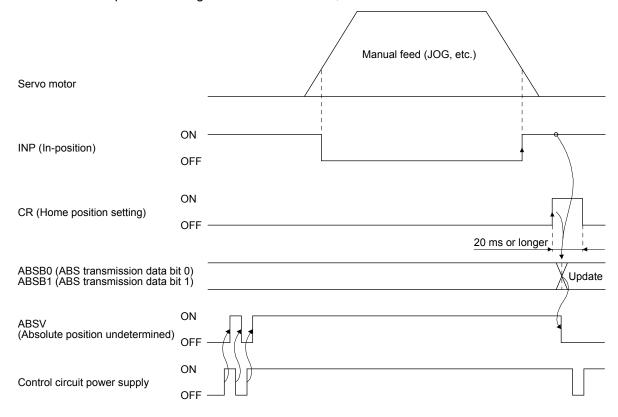
POINT

- ■Never make home position setting during command operation or servo motor rotation. It may cause home position sift.
- It is possible to execute data set type home position return during the servo off.

Move the machine to the position where the home position is to be set by performing manual operation such as JOG operation. When CR is on for longer than 20 ms, the stop position is stored into the non-volatile memory as the home position absolute position data.

When the servo on, set CR to on after confirming that INP is on. If this condition is not satisfied, [AL. 96 Home position setting warning] will occur, but that warning will be reset automatically by making home position return correctly.

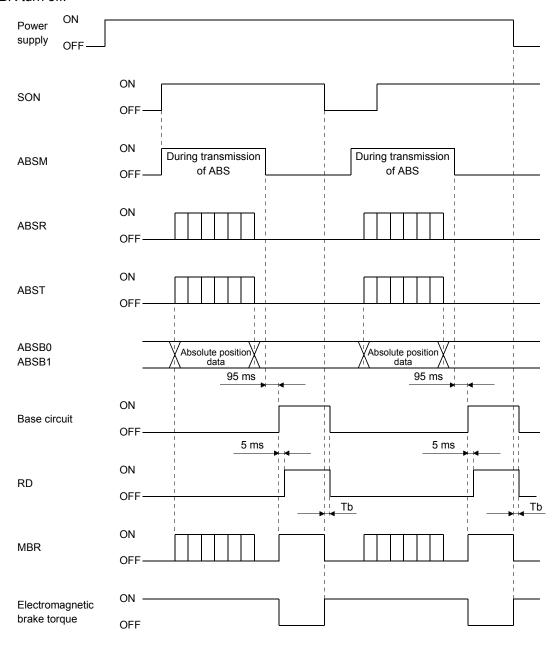
The number of home position setting times is limited to 100,000 times.



12.6.4 Use of servo motor with an electromagnetic brake

The timing charts at power on/off and SON on/off are given below.

Preset [Pr. PD23] to [Pr. PD26], [Pr. PD28], and [Pr. PD47] of the servo amplifier to enable MBR. When MBR is set for the CN1-23 pin, turning ABSM on will change the CN1-23 pin to ABSB1 (ABS transmission data bit 1). Therefore, configure an external sequence to generate the electromagnetic brake torque as soon as ABSM and MBR turn off.



12.6.5 How to process the absolute position data at detection of stroke end

The servo amplifier stops the acceptance of the command pulse when off of LSP or LSN are detected, clears the droop pulses to 0 at the same time, and stops the servo motor. At this time, the programmable controller keeps outputting the command pulse. Since this causes a discrepancy between the absolute position data of the servo amplifier and the programmable controller, position mismatch will occur if the operation is continued. To prevent this difference in position data from occurring, do as described below. When the servo amplifier has detected the stroke end, perform JOG operation or the like to clear the stroke end.

After that, switch SON off once, then on again, or switch the power off once, then on again. This causes the absolute position data of the servo amplifier to be transferred to the programmable controller, restoring the normal data.

12.7 Absolute position data transfer errors

POINT

●When the following alarm or warning occurs, refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" to remove the failure.

[AL. 25 Absolute position erased]

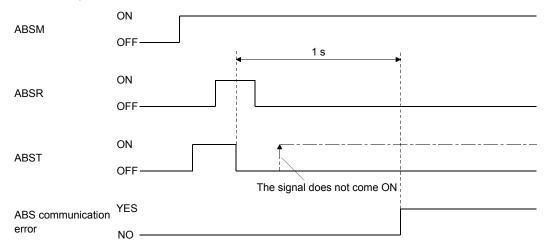
[AL. 96 Home position setting warning]

[AL. E3 Absolute position counter warning]

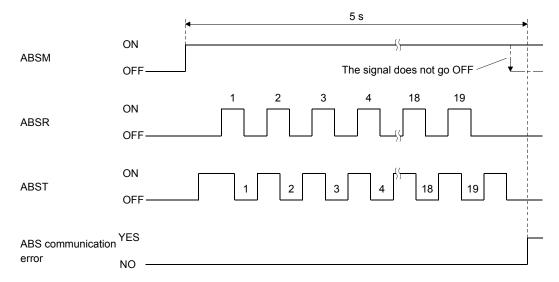
[AL. E5 ABS time-out warning]

[AL. EA ABS servo-on warning]

(1) The off period of the ABS transmission data ready signal output from the servo amplifier is checked. If the off period is 1 s or longer, regard as a transfer fault and generate the ABS communication error. Generate the ABS communication error if [AL. E5 ABS time-out warning] is generated at the servo amplifier due to an ABS request on time time-out.

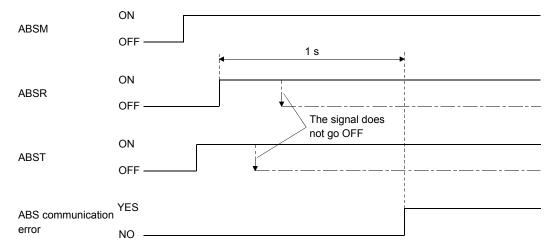


(2) The time required for the ABS transfer mode signal to go off after it has been turned on (ABS transfer time) is checked. If the ABS transfer time is longer than 5 s, regard that a transfer fault has occurred, and generate the ABS communication error. Generate the ABS communication error if [AL. E5 ABS time-out warning] is generated at the servo amplifier due to an ABS transfer mode completion time time-out.



12. ABSOLUTE POSITION DETECTION SYSTEM

- (3) The time required for the ABS request signal to go off after it has been turned on (ABS transfer time) is checked. To detect [AL. E5 ABS time-out warning] at the servo amplifier. If the ABS request remains on for longer than 1 s, regard that a fault relating to the ABS request signal or the ABST has occurred and generate the ABS communication error.
 - Generate the ABS communication error if [AL. E5 ABS time-out warning] is generated at the servo amplifier due to an ABS request off time time-out.



12.8 Communication-based absolute position transfer system

12.8.1 Serial communication command

The following commands are available for reading absolute position data using the serial communication function. When reading data, take care to specify the correct station number of the servo amplifier from where the data will be read.

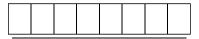
When the master station sends the data No. to the slave station (servo amplifier), the slave station returns the data value to the master station.

(1) Transmission

Transmit command [0] [2] and data No. [9] [1].

(2) Reply

The absolute position data in the command pulse unit is returned in hexadecimal.



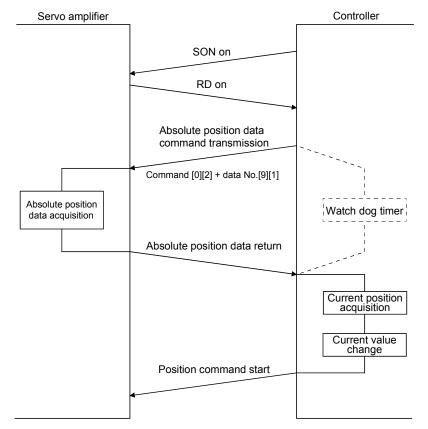
Data 32-bit length (hexadecimal representation)

12.8.2 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.

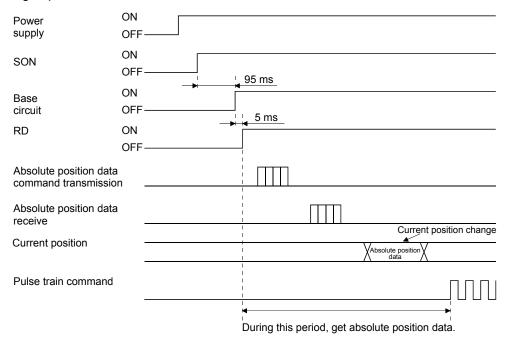
Time-out monitoring should be performed by the controller.



(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, always give the serial communication command to read the current position in the servo amplifier to the controller every time RD turns on. 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.

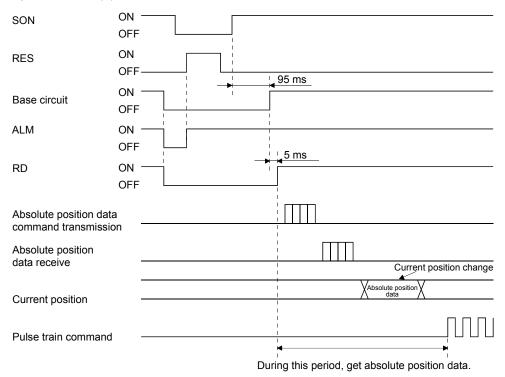
(b) Communication error

If a communication error occurs between the controller and servo amplifier, the servo amplifier sends the error code. The definition of the error code is the same as that of the communication function. Refer to section 14.3.3 for details.

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

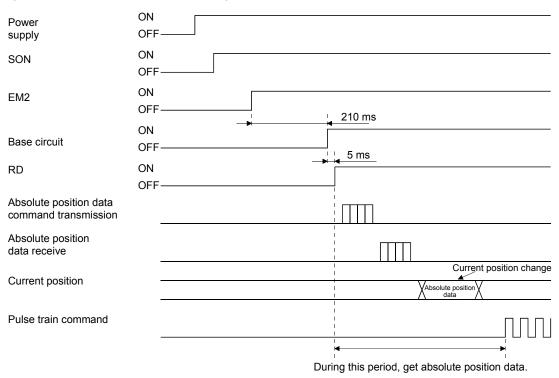
If an alarm has occurred, detect ALM and turn off SON. After removing the alarm occurrence factor and deactivating the alarm, get the absolute position data again from the servo amplifier in accordance with the procedure in (a) of this section.



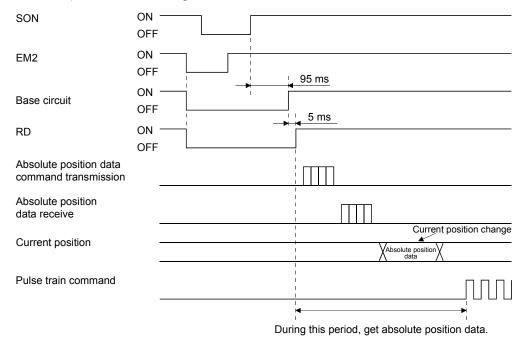
(d) At the time of forced stop reset

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



12. ABSOLUTE POSITION DETECTION SYSTEM

MEMO		

13. USING STO FUNCTION

POINT

- In the torque control mode, the forced stop deceleration function is not available.
- The MR-J4-03A6(-RJ) servo amplifier is not compatible with the STO function.

13.1 Introduction

This section provides the cautions of the STO function.

13.1.1 Summary

This servo amplifier complies with the following safety standards.

- ISO/EN ISO 13849-1 category 3 PL e
- IEC 61508 SIL 3
- IEC/EN 61800-5-2
- IEC/EN 62061 SIL CL3

13.1.2 Terms related to safety

The STO function shuts down energy to servo motors, thus removing torque. This function electronically cuts off power supply in the servo amplifier.

The purpose of this function is as follows.

- (1) Uncontrolled stop according to stop category 0 of IEC/EN 60204-1
- (2) Preventing unexpected start-up

13.1.3 Cautions

The following basic safety notes must be read carefully and fully in order to prevent injury to persons or damage to property.

Only qualified personnel are authorized to install, start-up, repair, or service the machines in which these components are installed.

They must be familiar with all applicable local regulations and laws in which machines with these components are installed, particularly the standards mentioned in this manual.

The staff responsible for this work must be given express permission from the company to perform start-up, programming, configuration, and maintenance of the machine in accordance with the safety standards.



• Improper installation of the safety related components or systems may cause improper operation in which safety is not assured, and may result in severe injuries or even death.

Protective Measures

• This servo amplifier satisfies the Safe Torque Off (STO) function described in IEC/EN 61800-5-2 by preventing the energy supply from the servo amplifier to the servo motor. If an external force acts upon the drive axis, additional safety measures, such as brakes or counterbalances must be used.

13.1.4 Residual risks of the STO function

Machine manufacturers are responsible for all risk evaluations and all associated residual risks. Below are residual risks associated with the STO function. Mitsubishi is not liable for any damages or injuries caused by these risks.

- (1) The STO function disables energy supply to the servo motor by electrical shut-off. The function does not mechanically disconnect electricity from the motor. Therefore, it cannot prevent exposure to electric shock. To prevent an electric shock, install a magnetic contactor or a molded-case circuit breaker to the main circuit power supply (L1, L2, and L3) of the servo amplifier.
- (2) The STO function disables energy supply to the servo motor by electrical shut-off. It does not guarantee the stop control or the deceleration control of the servo motor.
- (3) For proper installation, wiring, and adjustment, thoroughly read the manual of each individual safety related component.
- (4) In the safety circuit, use components that are confirmed safe or meet the required safety standards.
- (5) The STO function does not guarantee that the drive part of the servo motor will not rotate due to external or other forces.
- (6) Safety is not assured until safety-related components of the system are completely installed or adjusted.
- (7) When replacing this servo amplifier, confirm that the model name of servo amplifiers are exactly the same as those being replaced. Once installed, make sure to verify the performance of the functions before commissioning the system.
- (8) Perform all risk assessments to the machine or the whole system.
- (9) To prevent accumulation of malfunctions, perform malfunction checks at regular intervals based on the risk assessments of the machine or the system. Regardless of the system safety level, malfunction checks should be performed at least once per year.
- (10) If the upper and lower power module in the servo amplifier are shorted and damaged simultaneously, the servo motor may make a half revolution at a maximum.
- (11) The STO input signals (STO1 and STO2) must be supplied from one power source. Otherwise, the STO function may not function properly due to a sneak current, failing to bring the STO shut-off state.
- (12) For the STO I/O signals of the STO function, supply power by using a safety extra low voltage (SELV) power supply with the reinforced insulation.

13.1.5 Specifications

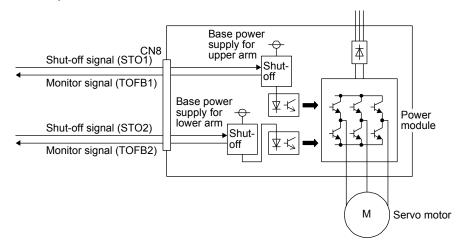
(1) Specifications

Item	Specifications
Functional safety	STO (IEC/EN 61800-5-2)
Safety performance (Note 2)	ISO/EN ISO 13849-1 category 3 PL e, IEC 61508 SIL 3, EN 62061 SIL CL3, EN 61800-5-2
Mean time to dangerous failure (MTTFd)	MTTFd ≥ 100 [years] (314a) (Note 1)
Diagnostic converge (DC)	DC = Medium, 97.6 [%] (Note 1)
Average probability of dangerous failures per hour (PFH)	PFH = 6.4 × 10 ⁻⁹ [1/h]
Number of on/off times of STO	1,000,000 times
	LVD: EN 61800-5-1
CE marking	EMC: EN 61800-3
	MD: EN ISO 13849-1, EN 61800-5-2, EN 62061

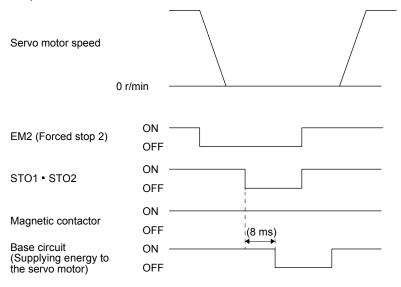
Note 1. This is the value required by safety standards.

2. The safety level depends on the setting value of [Pr. PF18 STO diagnosis error detection time] and whether STO input diagnosis by TOFB output is performed or not. For details, refer to the Function column of [Pr. PF18] in section 5.2.6.

(2) Function block diagram (STO function)



(3) Operation sequence (STO function)



13.1.6 Maintenance

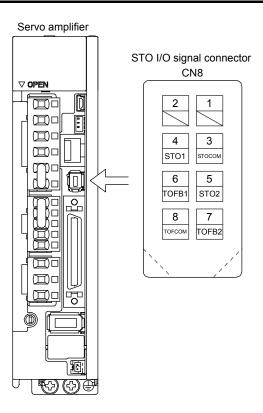
This servo amplifier has alarms and warnings for maintenance that supports the Mitsubishi drive safety function. (Refer to chapter 8.)

13.2 STO I/O signal connector (CN8) and signal layouts

13.2.1 Signal layouts

POINT

■The pin assignment of the connectors is as viewed from the cable connector wiring section.



13.2.2 Signal (device) explanations

(1) I/O device

Signal name	Connector pin No.	Description	I/O division
STOCOM	CN8-3	Common terminal for input signal of STO1 and STO2	DI-1
STO1	CN8-4	Inputs STO state 1.	DI-1
		STO state (base shut-off): Open between STO1 and STOCOM.	
		STO release state (in driving): Close between STO1 and STOCOM.	
		Be sure to turn off STO1 after the servo motor stops by the servo-off state or with forced stop deceleration by turning off EM2 (Forced stop 2).	
STO2	CN8-5	Inputs STO state 2.	DI-1
		STO state (base shut-off): Open between STO2 and STOCOM.	
		STO release state (in driving): Close between STO2 and STOCOM.	
		Be sure to turn off STO2 after the servo motor stops by the servo-off state or with forced stop deceleration by turning off EM2 (Forced stop 2).	
TOFCOM	CN8-8	Common terminal for monitor output signal in STO state	DO-1
TOFB1	CN8-6	Monitor output signal in STO1 state	DO-1
		STO state (base shut-off): Between TOFB1 and TOFCOM is closed.	
		STO release state (in driving): Between TOFB1 and TOFCOM is opened.	
TOFB2	CN8-7	Monitor output signal in STO2 state	DO-1
		STO state (base shut-off): Between TOFB2 and TOFCOM is closed.	
		STO release state (in driving): Between TOFB2 and TOFCOM is opened.	

(2) Signals and STO state

The following table shows the TOFB and STO states when the power is on in normal state and STO1 and STO2 are on (closed) or off (opened).

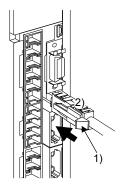
Input signal			State	
STO1	STO2	Between TOFB1 and TOFCOM (Monitoring STO1 state)	Between TOFB2 and TOFCOM (Monitoring STO2 state)	Between TOFB1 and TOFB2 (Monitoring STO state of servo amplifier)
Off	Off	On: STO state (base circuit shut-off)	On: STO state (base circuit shut-off)	On: STO state (base circuit shut-off)
Off	On	On: STO state (base circuit shut-off)	Off: STO release state	Off: STO state (base circuit shut-off)
On	Off	Off: STO release state	On: STO state (base circuit shut-off)	Off: STO state (base circuit shut-off)
On	On	Off: STO release state	Off: STO release state	Off: STO release state

(3) Test pulse of STO input signal

Set the test pulse off time inputted from outside to 1 ms or less.

13.2.3 How to pull out the STO cable

The following shows how to pull out the STO cable from the CN8 connector of the servo amplifier.

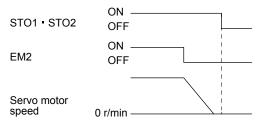


While pressing knob 1) of the STO cable plug in the direction of the arrow, pull out the plug 2). (This figure shows the MR-J4-_B_(-RJ) servo amplifier. This procedure also applies to the MR-J4-_A_(-RJ) servo amplifier.)

13.3 Connection example

POINT

■Turn off STO (STO1 and STO2) after the servo motor stops by the servo off state or with forced stop deceleration by turning off EM2 (Forced stop 2). Configure an external sequence that has the timings shown as below using an external device such as the MR-J3-D05 safety logic unit.



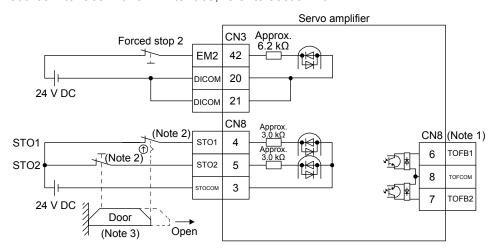
●If STO is turned off during operation, the servo motor is in dynamic brake stop (stop category 0), and [AL.63 STO timing error] will occur.

13.3.1 Connection example for CN8 connector

This servo amplifier is equipped with the connector (CN8) in accordance with the STO function. When this connector is used with a certified external safety relay, power to the motor can be safely removed and unexpected restart can be prevented. The safety relay used should meet the applicable safety standards and have forcibly guided or mirror contacts for the purpose of error detection.

In addition, the MR-J3-D05 safety logic unit can be used instead of a safety relay for implementation of various safety standards. Refer to app. 5 for details.

The following diagram is for source interface. For sink interface, refer to section 13.4.1.



Note 1. By using TOFB, whether the servo is in the STO state can be confirmed. For connection examples, refer to section 13.3.2 to 13.3.3. The safety level depends on the setting value of [Pr. PF18 STO diagnosis error detection time] and whether STO input diagnosis by TOFB output is performed or not. For details, refer to the Function column of [Pr. PF18] in section 5.2.6.

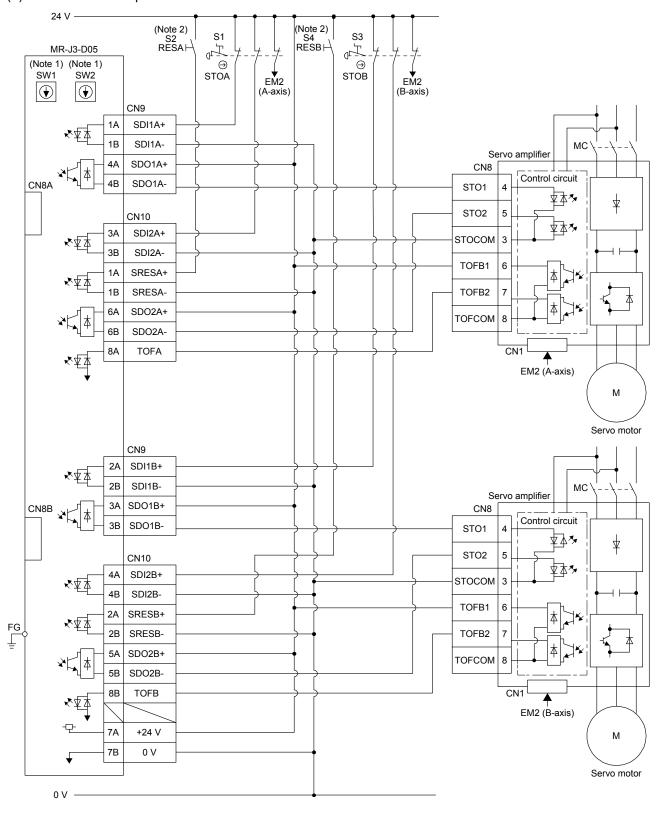
- 2. When using the STO function, turn off STO1 and STO2 at the same time. Turn off STO1 and STO2 after the servo motor stops by the servo off state or with forced stop deceleration by turning off EM2 (Forced stop 2).
- 3. Configure the interlock circuit so that the door is open after the servo motor is stopped.

13.3.2 External I/O signal connection example using an MR-J3-D05 safety logic unit

POINT

●This connection is for source interface. For the other I/O signals, refer to the connection examples in section 3.2.

(1) Connection example



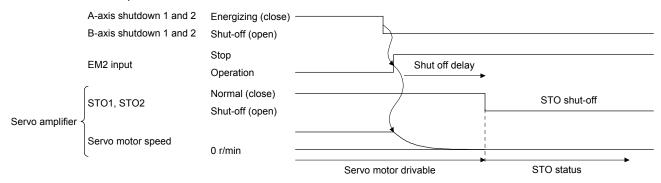
Note 1. Set the delay time of STO output with SW1 and SW2. These switches for MR-J3-D05 are located where dented from the front panel.

2. To release the STO state (base circuit shut-off), turn RESA and RESB on and turn them off.

(2) Basic operation example

The switch status of STOA is input to SDI2A+ of MR-J3-D05, and then it will be input to STO1 and STO2 of the servo amplifier via SDO1A and SDO2A of MR-J3-D05.

The switch status of STOB is input to SDI2B+ of MR-J3-D05, and then it will be input to STO1 and STO2 of the servo amplifier via SDO1B and SDO2B of MR-J3-D05.

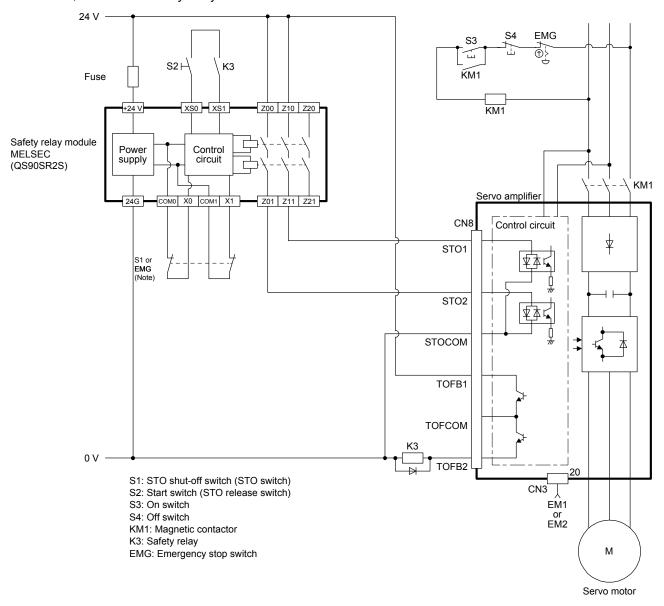


13.3.3 External I/O signal connection example using an external safety relay unit

POINT

● This connection is for source interface. For the other I/O signals, refer to the connection examples in section 3.2.

This connection example complies with the requirement of ISO/EN ISO 13849-1 category 3 PL d. For details, refer to the safety relay module user's manual.



Note. To enable the STO function of the servo amplifier by using "Emergency switching off", change S1 to EMG. The stop category at this time is "0". If STO is turned off while the servo motor is rotating, [AL. 63 STO timing error] will occur.

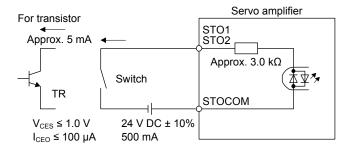
13.4 Detailed description of interfaces

This section provides the details of the I/O signal interfaces (refer to the I/O division in the table) given in section 13.2. Refer to this section and make connection with the external device.

13.4.1 Sink I/O interface

(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.



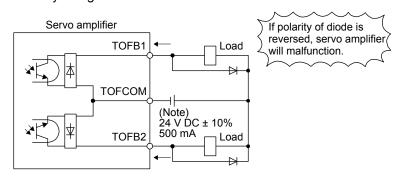
(2) Digital output interface DO-1

This is a circuit of collector output terminal of the output transistor. When the output transistor is turned on, collector terminal current will be applied for the output.

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.

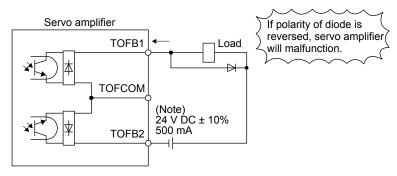
(Rated current: 40 mA or less, maximum current: 50 mA or less, inrush current: 100 mA or less) A maximum of 5.2 V voltage drop occurs in the servo amplifier.

(a) When outputting two STO states by using each TOFB



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.

(b) When outputting two STO states by using one TOFB



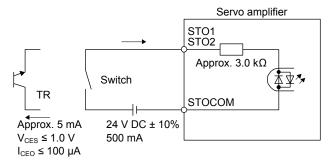
Note. If the voltage drop (maximum of 5.2 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

13.4.2 Source I/O interface

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 input terminal. Transmit signals from source (open-collector) type transistor output, relay switch, etc.

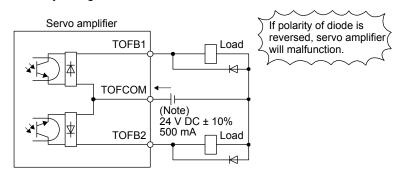


(2) Digital output interface DO-1

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

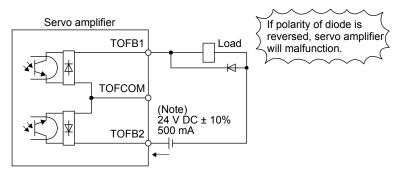
A maximum of 5.2 V voltage drop occurs in the servo amplifier.

(a) When outputting two STO states by using each TOFB



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.

(b) When outputting two STO states by using one TOFB



Note. If the voltage drop (maximum of $5.2\ V$) interferes with the relay operation, apply high voltage (maximum of $26.4\ V$) from external source.

MEMO		

14. COMMUNICATION FUNCTION (MITSUBISHI GENERAL-PURPOSE AC SERVO PROTOCOL)

CAUTION

● The CN3 connector is designed for RS-422/RS-485 communication and parameter unit only. Do not connect the CN3 connector to an Ethernet port, etc. Doing so may cause a malfunction.

POINT

- ■RS-422 serial communication function is supported by servo amplifier with software version A3 or later.
- ●The USB communication function (CN5 connector) and the RS-422 communication function (CN3 connector) are mutually exclusive functions. They cannot be used together.

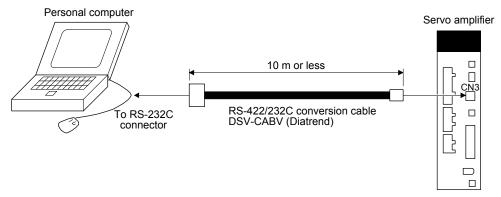
You can operate servo driving, parameter change, monitor function, etc. using RS-422 communication (Mitsubishi general-purpose AC servo protocol) with the servo amplifier.

14.1 Structure

14.1.1 Configuration diagram

(1) Single axis

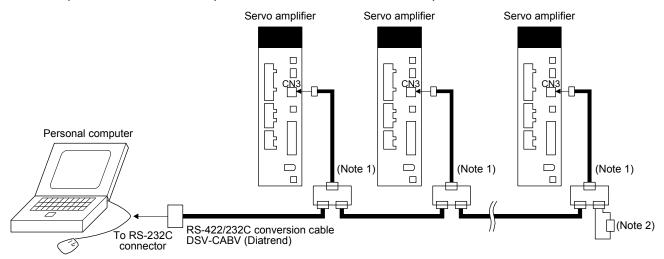
Operate the single-axis servo amplifier. It is recommended to use the following cable.



(2) Multi-drop connection

(a) Diagrammatic sketch

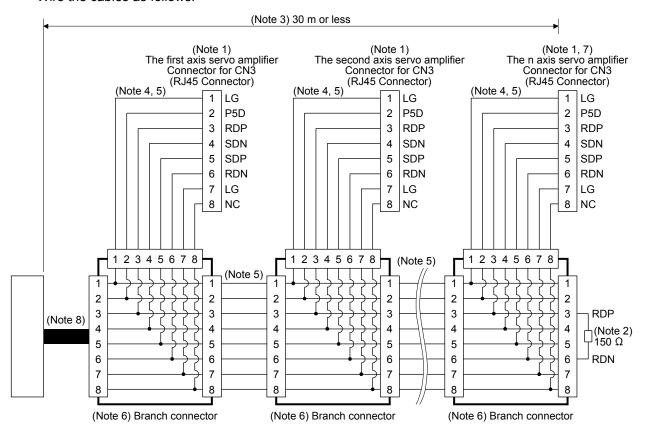
Up to 32 axes of servo amplifiers from stations 0 to 31 can be operated on the same bus.



Note 1. The BMJ-8 (Hachiko Electric) is recommended as the branch connector.

2. The final axis must be terminated between RDP (pin No.3) and RDN (pin No.6) on the receiving side (servo amplifier) with a 150Ω resistor.

(b) Cable connection diagramWire the cables as follows.

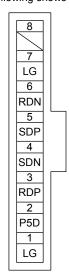


Note 1. Recommended connector (Hirose Electric)

Plug: TM10P-88P

Connection tool: CL250-0228-1

The following shows pin assignment viewed from connector wiring section.



- 2. The final axis must be terminated between RDP (pin No.3) and RDN (pin No.6) on the receiving side (servo amplifier) with a 150 Ω resistor.
- 3. The overall length is 30 m or less in low-noise environment.
- 4. The wiring between the branch connector and servo amplifier should be as short as possible.
- 5. Use the EIA568-compliant cable (10BASE-T cable, etc.).
- 6. Recommended branch connector: BMJ-8 (Hachiko Electric)
- 7. $n \le 32$ (Up to 32 axes can be connected.)
- 8. RS-422/232C conversion cable DSV-CABV (Diatrend)

14.1.2 Precautions for using RS-422/RS-232C/USB communication function

Note the following to prevent an electric shock and malfunction of the servo amplifier.

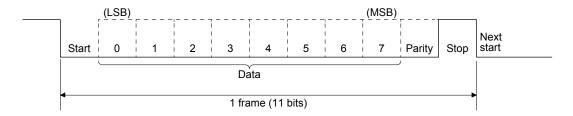
- Power connection of personal computers
 Connect your personal computer with the following procedures.
 - (a) When you use a personal computer with AC power supply
 - 1) When using a personal computer with a three-core power plug or power plug with grounding wire, use a three-pin socket or ground the 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.

14.2 Communication specifications

14.2.1 Outline of communication

Receiving a command, this servo amplifier returns data. The device which gives the command (e.g. personal computer) is called a master station and the device (servo amplifier) which returns data in response to the command is called a slave station. When fetching data successively, the master station repeatedly commands the slave station to send data.

Item	Definition					
Baud rate [bps]	9600/19200/38400/576 system	00/115200 asynchronous				
Transfer code	Start bit Data bit Parity bit Stop bit	1 bit 8 bits 1 bit (even) 1 bit				
Transfer method	Character method	Half-duplex communication method				



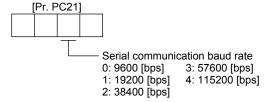
14.2.2 Parameter setting

When the RS-422 communication function is used to operate the servo, set the communication specifications of the servo amplifier with the parameters.

To enable the parameter values, cycle the power after setting.

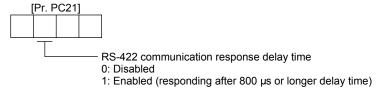
(1) Serial communication baud rate

Select the communication speed. Match this value to the communication speed of the sending end (master station).



(2) RS-422 communication response delay time

Set the time from when the servo amplifier (slave station) receives communication data to when it returns data. Set "0" to return data in less than 800 µs or "1" to return data in 800 µs or longer.



(3) Station No. setting

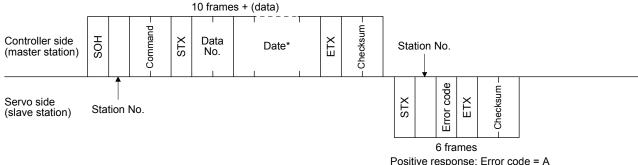
Set the station No. of the servo amplifier to [Pr. PC20]. The setting range is station No. 0 to 31.

14.3 Protocol

14.3.1 Transmission data configuration

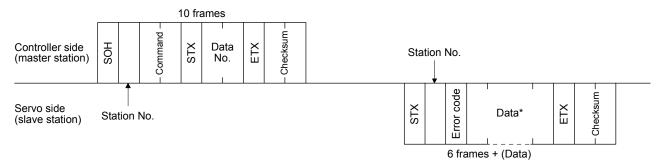
Since up to 32 axes may be connected to the bus, add a station No. to the command, data No., etc. to determine the destination servo amplifier of data communication. Set the station No. to each servo amplifier using the parameters. Transmission data is enabled for the servo amplifier of the specified station No. When "*" is set as the station No. added to the transmission data, the transmission data is enabled for all servo amplifiers connected. However, when return data is required from the servo amplifier in response to the transmission data, set "0" to the station No. of the servo amplifier which must provide the return data.

(1) Transmission of data from the controller to the servo

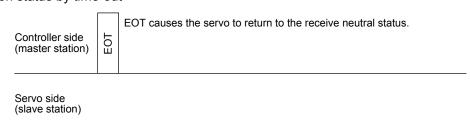


Positive response: Error code = A Negative response: Error code = other than A

(2) Transmission of data request from the controller to the servo

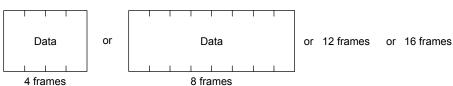


(3) Recovery of communication status by time-out



(4) Data frames

The data length depends on the command.



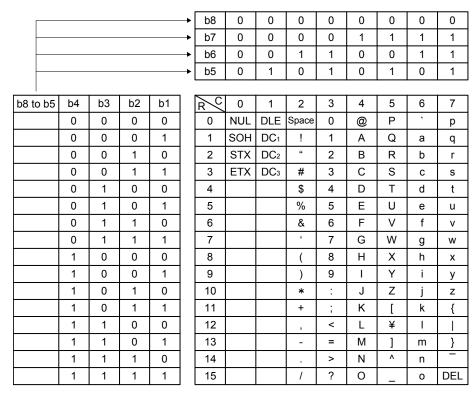
14.3.2 Character codes

(1) Control codes

Code name	Hexadecimal (ASCII code)	Description	Personal computer terminal key operation (general)
SOH	01H	start of head	ctrl + A
STX	02H	start of text	ctrl + B
ETX	03H	end of text	ctrl + C
EOT	04H	end of transmission	ctrl + D

(2) Codes for data

ASCII unit codes are used.



(3) Station numbers

You may set 32 station Nos. from station 0 to station 31 and the ASCII unit codes are used to specify the stations.

	No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ASCII co	ode	0	1	2	3	4	5	6	7	8	9	Α	В	O	D	Е	F

Station No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ASCII code	G	Н	I	J	K	L	М	N	0	Р	Q	R	S	Т	U	V

For example, "30H" is transmitted in hexadecimal for the station No. "0" (axis 1).

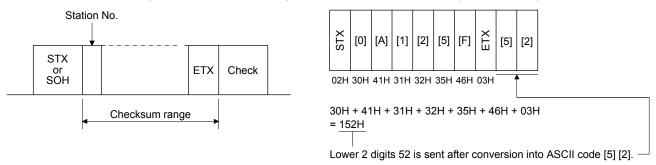
14.3.3 Error codes

Error codes are used in the following cases and an error code of single-code length is transmitted. Receiving data from the master station, the slave station sends the error code corresponding to that data to the master station. The error code sent in upper case indicates that the servo is normal and the one in lower case indicates that an alarm occurred.

Error	code	Error name	Explanation	Remark
Servo: normal	Servo: alarm	Enormanie	Explanation	Remark
[A]	[a]	Normal	Data transmitted was processed normally.	Positive response
[B]	[b]	Parity error	Parity error occurred in the transmitted data.	
[C]	[c]	Checksum error	Checksum error occurred in the transmitted data.	
[D]	[d]	Character error	The transmitted character is out of specifications.	Negative response
[E]	[e]	Command error	The transmitted command is out of specifications.	
[F]	[f]	Data No. error	The transmitted data No. is out of specifications.	

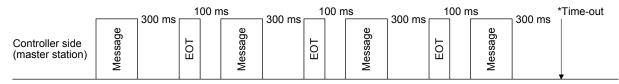
14.3.4 Checksum

The checksum is an ASCII-coded hexadecimal representing the lower two digits of the sum of ASCII-coded hexadecimal numbers up to ETX, with the exception of the first control code (STX or SOH).



14.3.5 Time-out processing

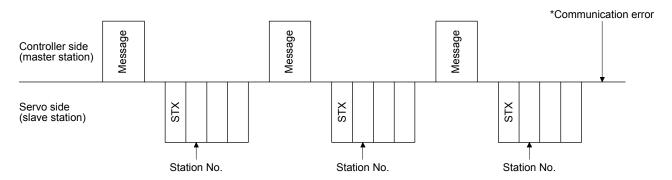
The master station transmits EOT when the slave station does not start return processing (STX is not received) 300 [ms] after the master station has ended communication processing. 100 ms after that, the master station retransmits the message. Time-out occurs if the slave station does not answer after the master station has performed the above communication processing three times. (communication error)



Servo side (slave station)

14.3.6 Retry processing

When a fault occurs in communication between the master and slave stations, the error code in the response data from the slave station is a negative response code ([B] to [F], [b] to [f]). In this case, the master station retransmits the message which was sent at the occurrence of the fault (retry processing). A communication error occurs if the above processing is repeated and results in the error three or more consecutive times.



Similarly, when the master station detects a fault (e.g. checksum, parity) in the response data from the slave station, the master station retransmits the message which was sent at the occurrence of the fault. A communication error occurs if the retry processing is performed three times.

14.3.7 Initialization

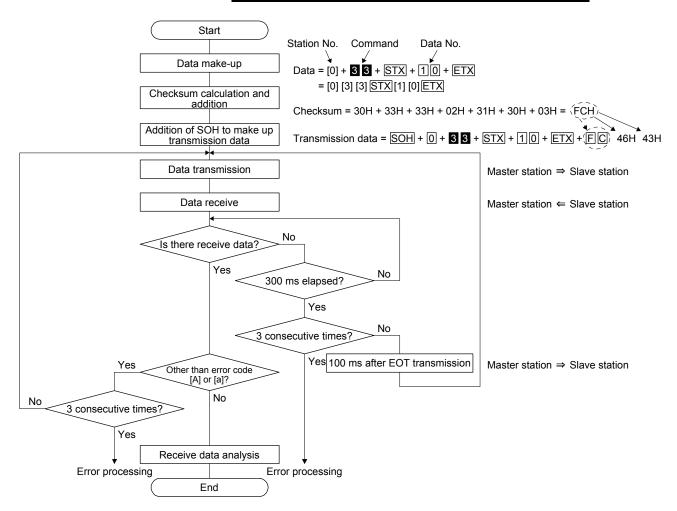
After the slave station is switched on, it cannot return to communication until the internal initialization processing terminates. Hence, at power-on, ordinary communication should be started after.

- (1) Wait for 3.5 s or longer after the slave station is switched on.
- (2) Check that normal communication can be made by reading the parameter or other data which does not pose any safety problems.

14.3.8 Communication procedure example

The following example reads the set value of alarm history (last alarm) from the servo amplifier of station 0.

Data item	Value	Description
Station No.	0	Servo amplifier station 0
Command	3 3	Reading command
Data No.	10	Alarm history (last alarm)



14.4 Command and data No. list

POINT

●Even if a command or data No. is the same between different model servo amplifiers, its description may differ.

14.4.1 Reading command

(1) Status display (command [0] [1])

Command	Data No.	Description	Status display	Frame length
[0] [1]	[0] [0]	Status display symbol and unit	Cumulative feedback pulses	16
			Motor-side cumu. feedback pulses (after gear)	
	[0] [1]		Servo motor speed	
			Servo motor speed	
	[0] [2]		Droop pulses	
			Motor-side droop pulses	
	[0] [3]		Cumulative command pulses	
	[0] [4]		Command pulse frequency	
	[0] [5]		Analog speed command voltage	
			Analog speed limit voltage	
	[0] [6]		Analog torque limit voltage	
			Analog torque command voltage	
	[0] [7]		Regenerative load ratio	
	[0] [8]		Effective load ratio	
	[0] [9]		Peak load ratio	
	[0] [A]		Instantaneous torque	
			Instantaneous thrust	
	[0] [B]		Position within one-revolution	
			Motor encoder position within one-revolution	
			Virtual position within one-revolution	
	[0] [C]		ABS counter	
			Motor encoder ABS counter	
			Virtual ABS counter	
	[0] [D]		Load to motor inertia ratio	
			Load to motor mass ratio	
	[0] [E]		Bus voltage	
	[0] [F] (Note)		Load-side cumulative feedback pulses	
	[1] [0] (Note)		Load-side droop pulses	
	[1] [1] (Note)		Load-side encoder information 1	
			Z-phase counter	
	[1] [2] (Note)		Load-side encoder information 2	
	[1] [6] (Note)		Temperature of motor thermistor	
	[1] [7] (Note)		Motor-side cumu. feedback pulses (before gear)	
	[1] [8] (Note)		Electrical angle	1
	[1] [E] (Note)		Motor-side/load-side position deviation	
	[1] [F] (Note)		Motor-side/load-side speed deviation	1
	[2] [0]		Internal temperature of encoder	†
	[2] [1]		Settling time	1
	[2] [2]		Oscillation detection frequency	1
	[2] [3]		Number of tough operations	†
	[2] [8]		Unit power consumption	1
	[2] [9]		Unit total power consumption	1
	[-] [-]		onit total power consumption	

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

14. COMMUNICATION FUNCTION (MITSUBISHI GENERAL-PURPOSE AC SERVO PROTOCOL)

Command	Data No.	Description	Status display	Frame length
[0] [1]	[8] [0]	Status display data value and	Cumulative feedback pulses	12
		processing information	Motor-side cumu. feedback pulses (after gear)	
	[8] [1]		Servo motor speed	
		-	Servo motor speed	
	[8] [2]		Droop pulses	
			Motor-side droop pulses	
	[8] [3]		Cumulative command pulses	
	[8] [4]		Command pulse frequency	
	[8] [5]		Analog speed command voltage	
	[8] [6]		Analog speed limit voltage	
			Analog torque limit voltage	
			Analog torque command voltage	
	[8] [7]		Regenerative load ratio	
	[8] [8]		Effective load ratio	
	[8] [9]		Peak load ratio	
	[8] [A]		Instantaneous torque	
			Instantaneous thrust	
	[8] [B]		Position within one-revolution	
	[8] [C]		Motor encoder position within one-revolution	
			Virtual position within one-revolution	
			ABS counter	
			Motor encoder ABS counter	
			Virtual ABS counter	
	[8] [D]		Load to motor inertia ratio	
			Load to motor mass ratio	
	[8] [E]		Bus voltage	
	[8] [F] (Note)		Load-side cumulative feedback pulses	
	[9] [0] (Note)		Load-side droop pulses	
	[9] [1] (Note)		Load-side encoder information 1	
			Z-phase counter	
	[9] [2] (Note)		Load-side encoder information 2	
	[9] [6] (Note)		Temperature of motor thermistor	
	[9] [7] (Note)		Motor-side cumu. feedback pulses (before gear)	
	[9] [8] (Note)		Electrical angle	
	[9] [E] (Note)		Motor-side/load-side position deviation	
	[9] [F] (Note)		Motor-side/load-side speed deviation	
	[A] [0]		Internal temperature of encoder	
	[A] [1]		Settling time	
			Oscillation detection frequency	
			Number of tough operations	1
			Unit power consumption	1
		1	Unit total power consumption	-
			Settling time Oscillation detection frequency Number of tough operations Unit power consumption	

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

(2) Parameters (command [0] [4], [0] [5], [0] [6], [0] [7], [0] [8], and [0] [9])

Command	Data No.	Description	Frame length
[0] [4]	[0] [1]	Parameter group reading	4
		0000: Basic setting parameters ([Pr. PA_])	
		0001: Gain/filter parameters ([Pr. PB_])	
		0002: Extension setting parameters ([Pr. PC_])	
		0003: I/O setting parameters ([Pr. PD])	
		0004: Extension setting 2 parameters ([Pr. PE])	
		0005: Extension setting 3 parameters ([Pr. PF])	
		000B: Linear servo motor/DD motor setting parameters ([Pr. PL]) (Note)	
[1] [5]	[0] [1] to [F] [F]	Current values of parameters	12
		Reads the current values of the parameters in the parameter group specified with the command [8] [5] + data No. [0] [0]. Before reading the current values, therefore, always specify the parameter group with the command [8] [5] + data No. [0] [0].	
		The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter No.	
[1] [6]	[0] [1] to [F] [F]	Upper limit values of parameter setting ranges	12
		Reads the permissible upper limit values of the parameters in the parameter group specified with the command [8] [5] + data No. [0] [0]. Before reading the upper limit values, therefore, always specify the parameter group with the command [8] [5] + data No. [0] [0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter No.	
[1] [7]	[0] [1] to [F] [F]	Lower limit values of parameter setting ranges	12
		Reads the permissible lower limit values of the parameters in the parameter group	
		specified with the command [8] [5] + data No. [0] [0]. Before reading the lower limit values,	
		therefore, always specify the parameter group with the command [8] [5] + data No. [0] [0].	
		The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter No.	
[8] [0]	[0] [1] to [F] [F]	Parameter symbols	12
		Reads the symbols of the parameters in the parameter group specified with the command [8] [5] + data No. [0] [0]. Before reading the symbols, therefore, always specify the parameter group with the command [8] [5] + data No. [0] [0].	
		The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter No.	
[0] [9]	[0] [1] to [F] [F]	Writing enable/disable of parameters	4
		Reads writing enable/disable of the parameters in the parameter group specified with the command [8] [5] + data No. [0] [0]. Before reading the lower limit values, therefore, always specify the parameter group with the command [8] [5] + data No. [0] [0]. 0000: Writing enabled	
		0001: Writing disabled	
		1 000 1. Withing diodoled	

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

(3) External I/O signals (command [1] [2])

Command	Data No.	Description	Frame length
[1] [2]	[0] [0]	Input device status	8
	[4] [0]	External input pin status	
	[6] [0]	Status of input device turned on by communication	
	[8] [0]	Output device status	
	[C] [0]	External output pin status	

(4) Alarm history (command [3] [3])

Command	Data No.	Description	Alarm occurrence sequence	Frame length
[3] [3]	[1] [0]	Alarm No. in alarm history	Most recent alarm	4
	[1] [1]		First alarm in past	
	[1] [2]		Second alarm in past	
	[1] [3]		Third alarm in past	
	[1] [4]		Fourth alarm in past	
	[1] [5]		Fifth alarm in past	
	[1] [6]		Sixth alarm in past	
	[1] [7]		Seventh alarm in past	
	[1] [8]		Eighth alarm in past	
	[1] [9]		Ninth alarm in past	
	[1] [A]		Tenth alarm in past	
	[1] [B]		Eleventh alarm in past	
	[1] [C]		Twelfth alarm in past	
	[1] [D]		Thirteenth alarm in past	
	[1] [E]		Fourteenth alarm in past	
	[1] [F]		Fifteenth alarm in past	
	[2] [0]	Alarm occurrence time in alarm history	Most recent alarm	8
	[2] [1]		First alarm in past	
	[2] [2]		Second alarm in past	
	[2] [3]		Third alarm in past	
	[2] [4]		Fourth alarm in past	
	[2] [5]		Fifth alarm in past	
	[2] [6]		Sixth alarm in past	
	[2] [7]		Seventh alarm in past	
	[2] [8]		Eighth alarm in past	
	[2] [9]		Ninth alarm in past	
	[2] [A]		Tenth alarm in past	
	[2] [B]		Eleventh alarm in past	
	[2] [C]		Twelfth alarm in past	
	[2] [D]		Thirteenth alarm in past	
	[2] [E]		Fourteenth alarm in past	
	[2] [F]		Fifteenth alarm in past	

(5) Current alarm (command [0] [2])

Command	Data No.	Description	Frame length
[0] [2]	[0] [0]	Current alarm No.	4

(6) Status display at alarm occurrence (command [3] [5])

Command	Data No.	Description	Status display	Frame length
[3] [5]	[0] [0]	Status display symbol and unit	Cumulative feedback pulses	16
			Motor-side cumu. feedback pulses (after gear)	
	[0] [1]		Servo motor speed	
			Servo motor speed	
	[0] [2]		Droop pulses	
			Motor-side droop pulses	
	[0] [3]		Cumulative command pulses	
	[0] [4]		Command pulse frequency	
	[0] [5]		Analog speed command voltage	
			Analog speed limit voltage	
	[0] [6]		Analog torque limit voltage	
			Analog torque command voltage	
	[0] [7]		Regenerative load ratio	
	[0] [8]		Effective load ratio	
	[0] [9]		Peak load ratio	1
	[0] [A]		Instantaneous torque	-
	1-71-7		Instantaneous thrust	
	[0] [B]		Position within one-revolution	1
	1-71-7		Motor encoder position within one-revolution	
			Virtual position within one-revolution	
	[0] [C]		ABS counter	1
			Motor encoder ABS counter	
			Virtual ABS counter	
	[0] [D]		Load to motor inertia ratio	
			Load to motor mass ratio	
	[0] [E]		Bus voltage	
	[0] [F] (Note)		Load-side cumulative feedback pulses	
	[1] [0] (Note)		Load-side droop pulses	1
	[1] [1] (Note)		Load-side encoder information 1	-
	,		Z-phase counter	
	[1] [2] (Note)		Load-side encoder information 2	
	[1] [6] (Note)		Temperature of motor thermistor	-
	[1] [7] (Note)		Motor-side cumu. feedback pulses (before gear)	
	[1] [8] (Note)		Electrical angle	1
	[1] [E] (Note)	1	Motor-side/load-side position deviation	
	[1] [F] (Note)		Motor-side/load-side speed deviation	1
	[2] [0]		Internal temperature of encoder	-
		1	Settling time	1
	[2] [1]	1	Oscillation detection frequency	1
		1		-
	[2] [3]	-	Number of tough operations	-
	[2] [8]	-	Unit power consumption	-
	[2] [9]		Unit total power consumption	

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

Command	Data No.	Description	Status display	Frame length
[3] [5]	[8] [0]	Status display data value and	Cumulative feedback pulses	12
		processing information	Motor-side cumu. feedback pulses (after gear)	
	[8] [1]	1	Servo motor speed	
			Servo motor speed	
	[8] [2]		Droop pulses	
			Motor-side droop pulses	
	[8] [3]	1	Cumulative command pulses	
	[8] [4]	1	Command pulse frequency	
	[8] [5]		Analog speed command voltage	
			Analog speed limit voltage	
	[8] [6]		Analog torque limit voltage	
			Analog torque command voltage	
	[8] [7]	1	Regenerative load ratio	
	[8] [8]	1	Effective load ratio	
	[8] [9]	1	Peak load ratio	
	[8] [A]	1	Instantaneous torque	
			Instantaneous thrust	
	[8] [B]		Position within one-revolution	
			Motor encoder position within one-revolution	
			Virtual position within one-revolution	
	[8] [C]	1	ABS counter	
			Motor encoder ABS counter	
			Virtual ABS counter	
	[8] [D]		Load to motor inertia ratio	
			Load to motor mass ratio	
	[8] [E]	1	Bus voltage	
	[8] [F] (Note)		Load-side cumulative feedback pulses	
	[9] [0] (Note)		Load-side droop pulses	
	[9] [1] (Note)		Load-side encoder information 1	
	,		Z-phase counter	
	[9] [2] (Note)		Load-side encoder information 2	
	[9] [6] (Note)	1	Temperature of motor thermistor	
	[9] [7] (Note)		Motor-side cumu. feedback pulses (before gear)	
	[9] [8] (Note)	1	Electrical angle	
	[9] [E] (Note)	1	Motor-side/load-side position deviation	
	[9] [F] (Note)		Motor-side/load-side speed deviation	
	[A] [0]	1	Internal temperature of encoder	
	[A] [1]	1	Settling time	╡ !
	[A] [2]	1	Oscillation detection frequency	-
	[A] [3]	1	Number of tough operations	┥ !
	[A] [8]	4	Unit power consumption	-
	[A] [9]	-	Unit total power consumption	-
	[√] [ع]		Onit total power consumption	

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

(7) Test operation mode (command [0] [0])

Command	Data No.	Description	Frame length
[0] [0]	[1] [2]	Test operation mode reading	4
		0000: Normal mode (not test operation mode)	
		0001: JOG operation	
		0002: Positioning operation	
		0003: Motor-less operation	
		0004: Output signal (DO) forced output	

(8) Software version (command [0] [2])

Command	Data No.	Description	Frame length
[0] [2]	[9] [0]	Servo motor-side pulse unit absolute position	8
	[9] [1]	Command unit absolute position	8
	[7] [0]	Software version	16

14.4.2 Writing commands

(1) Status display (command [8] [1])

Command	Data No.	Description	Setting range	Frame length
[8] [1]	[0] [0]	Status display data deletion	1EA5	4

(2) Parameters (command [9] [4], [8] [5])

Command	Data No.	Description	Setting range	Frame length
[9] [4]	[0] [1] to [F] [F]	Writing each parameter Writes the values of the parameters in the parameter group specified with the command [8] [5] + data No. [0] [0]. Before writing the values, therefore, always specify the parameter group with the command [8] [5] + data No. [0] [0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter No.	Depending on the parameter	12
[8] [5]	[0] [0]	Parameter group writing 0000: Basic setting parameters ([Pr. PA]) 0001: Gain/filter parameters ([Pr. PB]) 0002: Extension setting parameters ([Pr. PC]) 0003: I/O setting parameters ([Pr. PD]) 0004: Extension setting 2 parameters ([Pr. PE]) 0005: Extension setting 3 parameters ([Pr. PF]) 0008: Linear servo motor/DD motor setting parameters ([Pr. PL]) (Note)	0000 to 0005	4

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

(3) External I/O signals (command [9] [2])

Command	Data No.	Description	Setting range	Frame length
[9] [2]	[6] [0]	Communication input device signal	Refer to section	8
[0] [2]	[0] [0]	Communication input device signal	14.5.5.	

(4) Alarm history (command [8] [2])

Command	Data No.	Description	Setting range	Frame length
[8] [2]	[2] [0]	Alarm history clear	1EA5	4

(5) Current alarm (command [8] [2])

Command	Data No.	Description	Setting range	Frame length
[8] [2]	[0] [0]	Alarm clear	1EA5	4

(6) I/O device prohibition (command [9] [0])

Command	Data No.	Description	Setting range	Frame length
[9] [0]	[0] [0]	Turns off the input device, external analog input signal or pulse train input, except EMG, LSP and LSN, independently of the external on/off status.	1EA5	4
	[0] [3]	Disables all output devices (DO).	1EA5	4
	[1] [0]	Cancels the prohibition of the input device, external analog input signal or pulse train input, except EMG, LSP and LSN.	1EA5	4
	[1] [3]	Cancels the prohibition of the output device.	1EA5	4

(7) Operation mode selection (command [8] [B])

Command	Data No.	Description	Setting range	Frame length
[8] [B]	[0] [0]	Selection of test operation mode	0000 to 0002, 0004	4
		0000: Test operation mode cancel		
		0001: JOG operation		
		0002: Positioning operation		
		0004: Output signal (DO) forced output		

(8) Test operation mode data (command [9] [2], [A] [0])

Command	Data No.	Description	Setting range	Frame length
[9] [2]	[0] [0]	Input signal for test operation	Refer to section 14.5.7.	8
	[A] [0]	Forced output of signal pin	Refer to section 14.5.9.	8
[A] [0]	[1] [0]	Writes the servo motor speed in the test operation mode (JOG operation and positioning operation).	0000 to 7FFF	4
	[1] [1]	Writes the acceleration/deceleration time constant in the test operation mode (JOG operation and positioning operation).	00000000 to 7FFFFFF	8
	[2] [0]	Sets the travel distance in the test operation mode (Positioning operation).	00000000 to 7FFFFFF	8
	[2] [1]	Selects the positioning direction of test operation (positioning operation). O O O O: Forward rotation direction 1: Reverse rotation direction O: Command pulse unit 1: Encoder pulse unit	0000 to 0101	4
	[4] [0]	This is a start command for test operation (positioning operation).	1EA5	4
	[4] [1]	This is used to make a temporary stop during test operation (positioning operation). "□" in the data indicates a blank. STOP: Temporary stop GO□□: Restart for remaining distance CLR□: Remaining distance clear	STOP GO□□ CLR□	4

14.5 Detailed explanations of commands

14.5.1 Data processing

When the master station transmits a command data No. or a command + data No. + data to a slave station, the servo amplifier returns a response or data in accordance with the purpose.

When numerical values are represented in these send data and receive data, they are represented in decimal, hexadecimal, etc.

Therefore, data must be processed in accordance with the application.

Since whether data must be processed or not and how to process data depend on the monitoring, parameters, etc., follow the detailed explanation of the corresponding command.

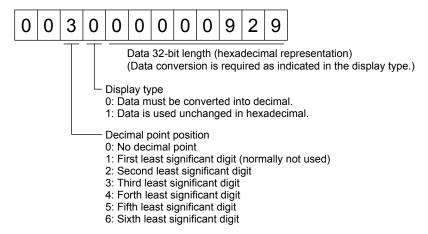
The following methods are how to process send and receive data when reading and writing data.

(1) Processing a read data

When the display type is 0, the eight-character data is converted from hexadecimal to decimal and a decimal point is placed according to the decimal point position information.

When the display type is 1, the eight-character data is used unchanged.

The following example indicates how to process the receive data "003000000929" given to show. The receive data is as follows.



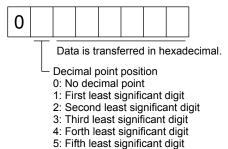
Since the display type is "0" in this case, the hexadecimal data is converted into decimal. $00000929H \rightarrow 2345$

As the decimal point position is "3", a decimal point is placed in the third least significant digit. Hence, "23.45" is displayed.

(2) Writing processed data

When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, the data cannot be written. When the data is handled as hexadecimal, specify "0" as the decimal point position.

The data to be sent is the following value.



For example, here is described how to process the set data when a value of "15.5" is sent. Since the decimal point position is the second least significant digit, the decimal point position data is "2".

As the data to be sent is hexadecimal, the decimal data is converted into hexadecimal.

 $155 \rightarrow 9B$

Hence, "0200009B" is transmitted.

14.5.2 Status display mode

(1) Reading the status display name and unit

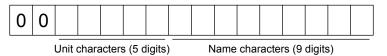
The following shows how to read the status display name and unit.

(a) Transmission

Transmit the command [0] [1] and the data No. corresponding to the status display item to be read, [0] [0] to [0] [E] and [2] [0] to [2] [9]. (Refer to section 14.4.1.)

(b) Return

The slave station returns the status display name and unit requested.



(2) Status display data reading

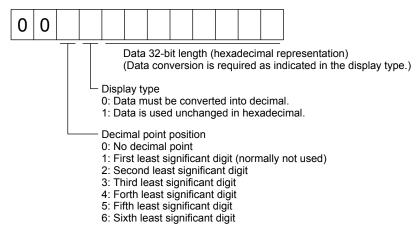
The following shows how to read the status display data and processing information.

(a) Transmission

Transmit the command [0] [1] and the data No. corresponding to the status display item to be read, [8] [0] to [8] [E] and [A] [0] to [A] [9]. (Refer to section 14.4.1.)

(b) Return

The slave station returns the status display data requested.



(3) Status display data clear

To clear the cumulative feedback pulse data of the status display, send this command immediately after reading each status display item. The data of the status display item transmitted is cleared to "0".

Com	mand	Data No.	Data
[8]	[1]	[0] [0]	1EA5

For example, after sending command [0] [1] and data No. [8] [0] and receiving the status display data, send command [8] [1], data No. [0] [0] and data [1EA5] to clear the cumulative feedback pulse value to "0".

14.5.3 Parameter

(1) Specification of the parameter group

To read or write the parameter settings, etc., the group of the parameters to be operated must be specified in advance. Write data to the servo amplifier as follows to specify the parameter group.

Command	Data No.	Transmission data	Parameter group
[8] [5]	[0] [0]	0000	Basic setting parameters ([Pr. PA_])
		0001	Gain/filter parameters ([Pr. PB])
		0002	Extension setting parameters ([Pr. PC])
		0003	I/O setting parameters ([Pr. PD_])
		0004	Extension setting 2 parameters ([Pr. PE_])
		0005	Extension setting 3 parameters ([Pr. PF])
		000B	Linear servo motor/DD motor setting parameters
		(Note)	([Pr. PL])

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

(2) Parameter group reading

The following shows how to read the parameter group set with slave station.

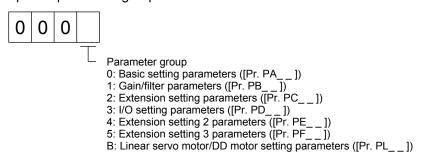
(a) Transmission

Transmit command [0] [4] and data No. [0] [1].

Command	Data No.
[0] [4]	[0] [1]

(b) Return

The slave station returns the preset parameter group.



(3) Reading symbols

The following shows how to read symbols of parameters. Specify a parameter group in advance. (Refer to (1) of this section.)

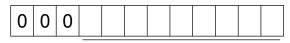
(a) Transmission

Transmit the command [0] [8] and the data No. [0] [1] to [F] [F] corresponding to the parameter No. (Refer to section 14.4.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter No.

(b) Return

The slave station returns the symbol of the parameter requested.



Symbol characters (9 digits)

(4) Reading the setting

The following shows how to read the parameter setting. Specify a parameter group in advance. (Refer to (1) of this section.)

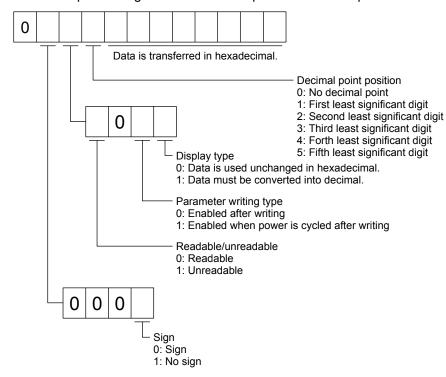
(a) Transmission

Transmit the command [1] [5] and the data No. corresponding to the parameter No [0] [1] to [F] [F]. (Refer to section 14.4.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter No.

(b) Return

The slave station returns the data and processing information of the parameter No. requested.



For example, data "00120000270F" means 999.9 (decimal display format) and data "000000003ABC" means 3ABC (hexadecimal display format).

When the display type is "0" (hexadecimal) and the decimal point position is other than 0, the display type is a special hexadecimal display format and "F" of the data value is handled as a blank. Data "0001FFFFF053" means 053 (special hexadecimal display format).

"00800000000" is transferred when the parameter that was read is the one inaccessible for reference in the parameter writing inhibit setting of [Pr. PA19].

(5) Reading the setting range

The following shows how to read the parameter setting range. Specify a parameter group in advance. (Refer to (1) of this section.)

(a) Transmission

When reading an upper limit value, transmit the command [1] [6] and the data No. [0] [1] to [F] [F] corresponding to the parameter No. When reading an lower limit value, transmit the command [1] [7] and the data No. [0] [1] to [F] [F] corresponding to the parameter No. (Refer to section 14.4.1.) The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter No.

(b) Return

The slave station returns the data and processing information of the parameter No. requested.



Data is transferred in hexadecimal.

For example, data "FFFFFEC" means "-20".

(6) Writing setting values

POINT

● If setting values need to be changed with a high frequency (i.e. one time or more per one hour), write the setting values to the RAM, not the EEP-ROM. The EEPROM has a limitation in the number of write times and exceeding this limitation causes the servo amplifier to malfunction. Note that the number of write times to the EEP-ROM is limited to approximately 100, 000.

Write the parameter setting into EEP-ROM of the servo amplifier. Specify a parameter group in advance. (Refer to (1) of this section.)

Write any value within the setting enabled range. For the setting enabled range, refer to chapter 5 or read the setting range by performing operation in (4) of this section.

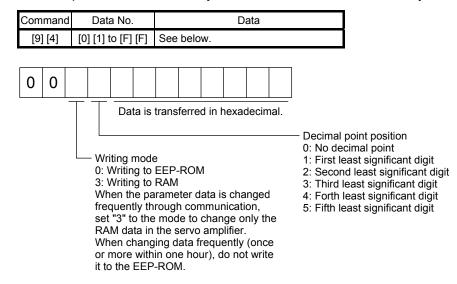
Transmit command [9] [4], the data No., and the set data.

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter No.

When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, the data cannot be written. When the data is handled as hexadecimal, specify "0" as the decimal point position.

Check the writing data is within the upper/lower limit value before writing. To prevent an error, read the parameter data to be written, confirm the decimal point position, and create transmission data.

On completion of writing, read the same parameter data to verify that data has been written correctly.



14.5.4 External I/O signal status (DIO diagnosis)

(1) Reading input device status

The following shows how to read the status of the input devices.

(a) Transmission

Transmit command [1] [2] and data No. [0] [0].

Command	Data No.
[1] [2]	[0] [0]

(b) Return

The slave station returns the status of the input devices.



Command of each bit is transmitted to the master station as hexadecimal data.

Bit	Symbol
0	SON
1	LSP
2	LSN
3	TL
4	TL1
5	PC
6	RES
7	CR

Bit	Symbol
8	SP1
9	SP2
10	SP3
11	ST1/RS2
12	ST2/RS1
13	CM1
14	CM2
15	LOP

Bit	Symbol
16	
17	
18	
19	
20	STAB2
21	
22	
23	

Bit	Symbol
24	
25	
26	
27	CDP
28	CLD (Note)
29	MECR (Note)
30	
31	

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

(2) Reading external input pin status

The following shows how to read the on/off status of the external input pins.

(a) Transmission

Transmit command [1] [2] and data No. [4] [0].

Command	Data No.
[1] [2]	[4] [0]

(b) Return

The on/off status of the input pins are returned.



Command of each bit is transmitted to the master station as hexadecimal data.

Bit	CN1 connector pin
0	43
1	44
2	42
3	15
4	19
5	41
6	16
7	17

Bit	CN1 connector pin
8	18
9	45
10	
11	
12	
13	
14	
15	

Bit	CN1 connector pin
16	
17	
18	
19	
20	
21	
22	
23	

Bit CN1 connector pi 24 25 26 27	n
25 26	"
26	
27	
28	
29	
30	
31	

(3) Reading the status of input devices switched on with communication

The following shows how to read the on/off status of the input devices switched on with communication.

(a) Transmission

Transmit command [1] [2] and data No. [6] [0].

Command	Data No.
[1] [2]	[6] [0]

(b) Return

The slave station returns the status of the input devices.



Command of each bit is transmitted to the master station as hexadecimal data.

Bit	Symbol
0	SON
1	LSP
2	LSN
3	TL
4	TL1
5	PC
6	RES
7	CR

Bit	Symbol
8	SP1
9	SP2
10	SP3
11	ST1/RS2
12	ST2/RS1
13	CM1
14	CM2
15	LOP

Bit	Symbol
16	
17	
18	
19	
20	STAB2
21	
22	
23	

Bit	Symbol
24	
25	
26	
27	CDP
28	CLD (Note)
29	MECR (Note)
30	
31	

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

(4) Reading external output pin status

The following shows how to read the on/off status of the external output pins.

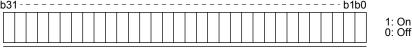
(a) Transmission

Transmit command [1] [2] and data No. [C] [0].

Command	Data No.
[1] [2]	[C] [0]

(b) Return

The slave station returns the status of the output devices.



Command of each bit is transmitted to the master station as hexadecimal data.

Bit	CN1 connector pin
0	49
1	24
2	23
3	25
4	22
5	48
6	33
7	13 (Note)

Bit	CN1 connector pin
8	14 (Note)
9	
10	
11	
12	
13	
14	
15	

Bit	CN1 connector pin
16	
17	
18	
19	
20	
21	
22	
23	

Bit	CN1 connector pin
24	
25	
26	
27	
28	
29	
30	
31	

Note. This is available when devices are assigned to the CN1-13 pin and CN1-14 pin with MR-J4-_A_-RJ 100 W or more servo amplifiers with software version B3 or later. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

(5) Reading output device status

The following shows how to read the on/off status of the output devices.

(a) Transmission

Transmit command [1] [2] and data No. [8] [0].

Command	Data No.
[1] [2]	[8] [0]

(b) Return

The slave station returns the status of the input/output devices.



Command of each bit is transmitted to the master station as hexadecimal data.

Bit	Symbol	
0	RD	
1	SA	
2	ZSP	
3	TLC	
4	VLC	
5	INP	
6		
7	WNG	

Bit	Symbol
8	ALM
9	OP
10	MBR
11	DB (Note)
12	ACD0
13	ACD1
14	ACD2
15	BWNG

Bit	Symbol
16	
17	
18	
19	
20	
21	
22	
23	

Bit	Symbol
24	
25	CDPS
26	CLDS (Note)
27	ABSV
28	
29	
30	
31	MTTR (Note)

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

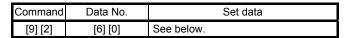
14.5.5 Input device on/off

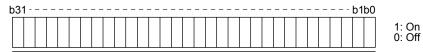
POINT

●The on/off status of all devices in the servo amplifier are the status of the data received at last. Therefore, when there is a device which must be kept on, transmit data which turns the device on every time.

Each input device can be switched on/off. However, when the device to be switched off is in the external input signal, also switch off the input signal.

Transmit command [9] [2], data No. [6] [0], and data.





Command of each bit is transmitted to the master station as hexadecimal data.

Bit	Symbol	
0	SON	
1	LSP	
2	LSN	
3	TL	
4	TL1	
5	PC	
6	RES	
7	CR	

Bit	Symbol
8	SP1
9	SP2
10	SP3
11	ST1/RS2
12	ST2/RS1
13	CM1
14	CM2
15	LOP

Bit	Symbol
16	
17	
18	
19	
20	STAB2
21	
22	
23	

Bit	Symbol
24	
25	
26	
27	CDP
28	CLD (Note)
29	MECR (Note)
30	
31	

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

14.5.6 Disabling/enabling I/O devices (DIO)

You can disable inputs regardless of the I/O device status. When inputs are disabled, the input signals (devices) are recognized as follows. However, EM2 (Forced stop 2), LSP (Forward rotation stroke end), and LSN (Reverse rotation stroke end) cannot be disabled.

Signal	Status
Input device (DI)	Off
External analog input signal	0 V
Pulse train input	None

- (1) Disabling/enabling the input devices (DI), external analog input signals and pulse train inputs except EM2 (Forced stop 2), LSP (Forward rotation stroke end), and LSN (Reverse rotation stroke end). Transmit the following communication commands.
 - (a) Disabling

Con	nmand	Data No.	Data
[9	[0]	[0] [0]	1EA5

(b) Enabling

Command	Data No.	Data
[9] [0]	[1] [0]	1EA5

- (2) Disabling/enabling the output devices (DO) Transmit the following communication commands.
 - (a) Disabling

(Command	Data No.	Data
	[9] [0]	[0] [3]	1EA5

(b) Enabling

Command	Data No.	Data
[9] [0]	[1] [3]	1EA5

14.5.7 Input devices on/off (test operation)

Each input devices can be turned on/off for test operation. However, when the device to be switched off is in the external input signal, also switch off the input signal.

Transmit command [9] [2], data No. [0] [0], and data.

Command	Data No.	Set data	
[9] [2]	[0] [0]	See below.	
L04			



Command of each bit is transmitted to the master station as hexadecimal data.

Bit	Symbol
0	SON
1	LSP
2	LSN
3	TL
4	TL1
5	PC
6	RES
7	CR

Bit	Symbol
8	SP1
9	SP2
10	SP3
11	ST1
12	ST2
13	CM1
14	CM2
15	LOP

Bit	Symbol
16	
17	
18	
19	
20	STAB2
21	
22	
23	

Bit	Symbol
24	
25	
26	
27	CDP
28	CLD (Note)
29	MECR (Note)
30	
31	

Note. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

14.5.8 Test operation mode

POINT

- ■The test operation mode is used to check operation. Do not use it for actual operation.
- If communication stops for longer than 0.5 s during test operation, the servo amplifier decelerates to a stop, resulting in servo-lock. To prevent this, continue communication all the time by monitoring the status display, etc.
- ●Even during operation, you can switch the servo amplifier to the test operation mode. In this case, switching to the test operation mode will shut off the base circuit to coast the motor.
- (1) How to prepare and cancel the test operation mode
 - (a) Preparing the test operation mode

 Set the test operation mode type with the following procedure.
 - Selection of test operation mode
 Send the command [8] [B] + data No. [0] [0] + data to select the test operation mode.

Command	Data No.	Transmission data	Selection of test operation mode
		0001	JOG operation
[8] [B]	[0] [0]	0002	Positioning operation
		0004	Output signal (DO) forced output (Note)

Note. Refer to section 14.5.9 for output signal (DO) forced output.

2) Check of test operation mode

Read the test operation mode set for the slave station, and check that it is set correctly.

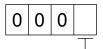
a) Transmission

Transmit command [0] [0] and data No. [1] [2].

Command	Data No.
[0] [0]	[1] [2]

b) Reply

The slave station returns the preset operation mode.



- Test operation mode reading

- 0: Normal mode (not test operation mode)
- 1: JOG operation
- 2: Positioning operation
- 3: Motor-less operation
- 4: Output signal (DO) forced output

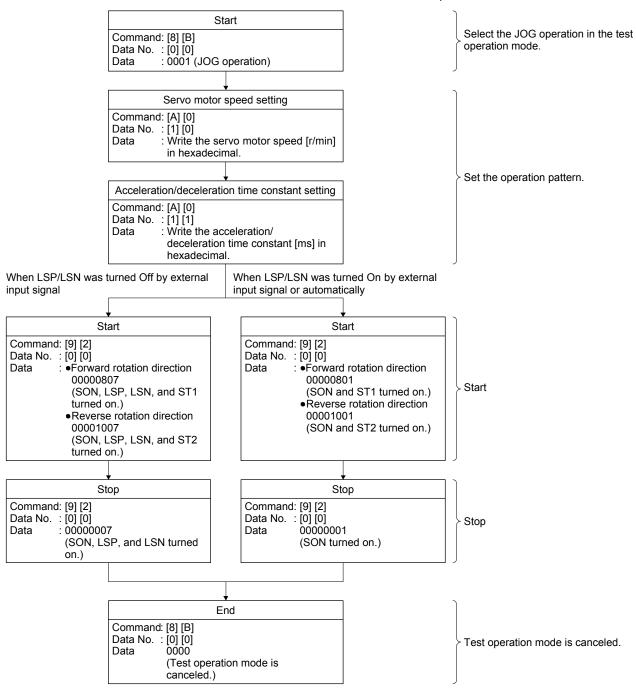
(b) Cancel of test operation mode

To terminate the test operation mode, send the command [8] [B] + data No. [0] [0] + data.

Command	Data No.	Transmission data	Selection of test operation mode
[8] [B]	[0] [0]	0000	Test operation mode cancel

(2) JOG operation

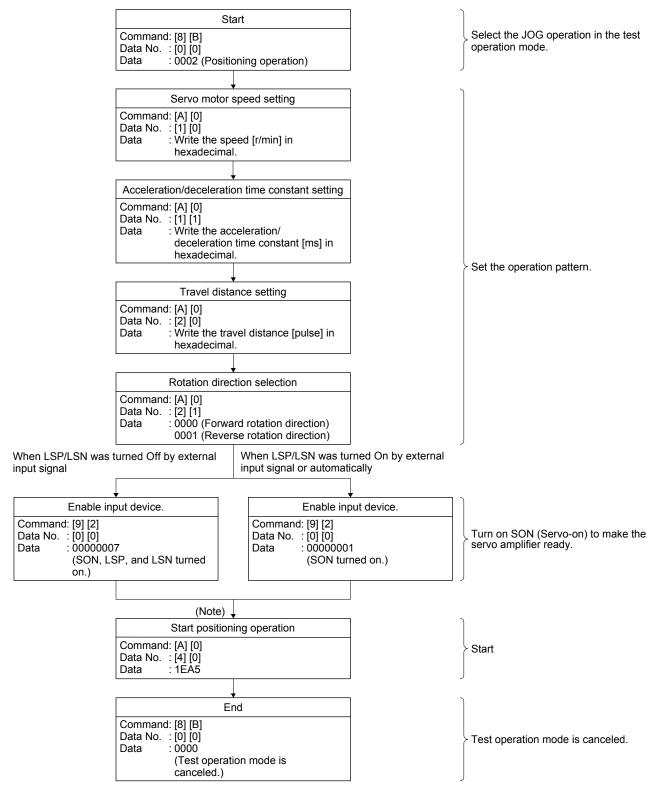
Transmit the command, data No., and data as follows to execute JOG operation.



(3) Positioning operation

(a) Operation procedure

Transmit the command, data No., and data as follows to execute positioning operation.



Note. It has 100 ms delay.

(b) Temporary stop/restart/remaining distance clear Transmit the following command, data No., and data during positioning operation to make deceleration to a stop.

Command	Data No.	Data
[A] [0]	[4] [1]	STOP

Transmit the following command, data No., and data during a temporary stop to restart.

Command	Data No.	(Note) Data
[A] [0]	[4] [1]	GO□□

Note. "

" indicates a blank.

Transmit the following command, data No., and data during a temporary stop to stop positioning operation and erase the remaining travel distance.

Command	Data No.	(Note) Data
[A] [0]	[4] [1]	CLR□

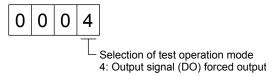
Note. "□" indicates a blank.

14.5.9 Output signal pin on/off (output signal (DO) forced output)

In the test operation mode, the output signal pins can be turned on/off regardless of the servo status. Using command [9] [0], disable the external output signals in advance.

(1) Selecting output signal (DO) forced output in the test operation mode

Transmit command + [8] [B] + data No. [0] [0] + data "0004" to select output signal (DO) forced output.



(2) External output signal on/off

Transmit the following communication commands.

Command	Data No.	Set data	
[9] [2]	[A] [0]	See below.	
b31	of each bit is tran	smitted to the master station as hexadecimal data.	1: On 0: Off

Bit	CN1 connector pin
0	49
1	24
2	23
3	25
4	22
5	48
6	33
7	13 (Note)

Bit	CN1 connector pin
8	14 (Note)
9	
10	
11	
12	
13	
14	
15	

Bit	CN1 connector pin
16	
17	
18	
19	
20	
21	
22	
23	

Bit	CN1 connector pin
24	
25	
26	
27	
28	
29	
30	
31	

Note. The MR-J4-_A_-RJ 100 W or more servo amplifier is available with software version B3 or later. This is not available with the MR-J4-03A6(-RJ) servo amplifier.

(3) Output signal (DO) forced output

Transmit command [8] [B] + data No. [0] [0] + data to stop output signal (DO) forced output.

Comman	Data No.	Transmission data	Selection of test operation mode
[8] [B]	[0] [0]	0000	Test operation mode cancel

14.5.10 Alarm history

(1) Alarm No. reading

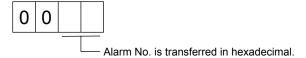
The following shows how to read alarm Nos. which occurred in the past. Alarm Nos. and occurrence times of No. 0 (last alarm) to No. 15 (sixteenth alarm in the past) are read.

(a) Transmission

Transmit command [3] [3] + data No. [1] [0] to [1] [F]. Refer to section 14.4.1.

(b) Return

Alarm Nos. corresponding to the data No. is provided.



For example, "0032" means [AL. 32] and "00FF" means [AL. _ _] (no alarm).

(2) Alarm occurrence time reading

The following shows how to read alarm occurrence times which occurred in the past.

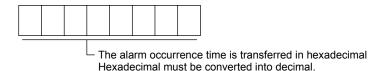
Alarm occurrence time corresponding to the data No. is provided in terms of the total time beginning with operation start, with the minute unit omitted.

(a) Transmission

Transmit command [3] [3] + data No. [2] [0] to [2] [F].

Refer to section 14.4.1.

(b) Return



For example, data "01F5" means that the alarm occurred in 501 hours after starting operation.

(3) Clearing the alarm history

Alarm history is cleared.

Transmit command [8] [2] and data No. [2] [0].

Command	Data No.	Data
[8] [2]	[2] [0]	1EA5

14.5.11 Current alarm

(1) Current alarm reading

The following shows how to read the alarm No. which is occurring currently.

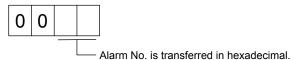
(a) Transmission

Transmit command [0] [2] and data No. [0] [0].

Command	Data No.
[0] [2]	[0] [0]

(b) Return

The slave station returns the alarm currently occurring.



For example, "0032" means [AL. 32] and "00FF" means [AL. _ _] (no alarm).

(2) Reading status display at alarm occurrence

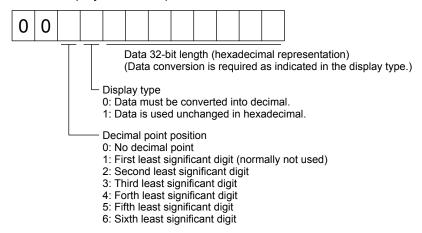
The following shows how to read the status display data at alarm occurrence. When the data No. corresponding to the status display item is transmitted, the data value and data processing information will be returned.

(a) Transmission

Transmit the command [3] [5] + the data No. corresponding to the status display item to read, [8] [0] to [8] [E] and [A] [0] to [A] [9]. Refer to section 14.4.1.

(b) Return

The slave station returns the status display data of requested alarm at occurrence.



(3) Current alarm reset

As by the reset (RES) on, reset the servo amplifier alarm to make the servo amplifier ready to operate. After removing the cause of the alarm, reset the alarm with no command entered.

Command	Data No.	Data
[8] [2]	[0] [0]	1EA5

14.5.12 Other commands

(1) Servo motor-side pulse unit absolute position

The following shows how to read the absolute position in the servo motor-side pulse unit. Note that overflow will occur in the position of 8192 or more revolutions from the home position.

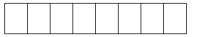
(a) Transmission

Transmit command [0] [2] and data No. [9] [0].

Command	Data No.
[0] [2]	[9] [0]

(b) Return	r
------------	---

The slave station returns the requested servo motor-side pulses.



Absolute position is sent back in hexadecimal in the servo motor-side pulse unit (Data must be converted into decimal.)

For example, data "000186A0" is 100000 pulses in the motor-side pulse unit.

(2) Command unit absolute position

The following shows how to read the absolute position in the command unit.

(a) Transmission

Transmit command [0] [2] and data No. [9] [1].

Command	Data No.		
[0] [2]	[9] [1]		

(b) Return

The slave station returns the requested command pulses.



Absolute position is sent back in hexadecimal in the command unit. (Data must be converted into decimal.)

For example, data "000186A0" is 100000 pulses in the command unit.

(3) Software version

The following shows how to read the software version of the servo amplifier.

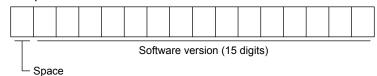
(a) Transmission

Transmit command [0] [2] and data No. [7] [0].

Command	Data No.
[0] [2]	[7] [0]

(b) Return

The slave station returns the requested software version.



15. USING A LINEAR SERVO MOTOR

WARNING •When using the linear servo motor, read "Linear Servo Motor Instruction Manual" and "Linear Encoder Instruction Manual".

POINT

- The linear servo system is available for the servo amplifiers of which software version is A5 or later.
- The MR-J4-03A6(-RJ) servo amplifier is not compatible with linear servo motor.

15.1 Functions and configuration

15.1.1 Summary

The fields of semiconductor/LCD manufacturing systems, mounters, and others have strong demands for high accuracy, high speed, and efficiency. Therefore, the number of systems using a linear servo motor for a drive axis has been increasing. Since the linear servo system can obtain the characteristics of the high speed and the high acceleration/deceleration greater than the ball screw drive system. The linear servo system also does not have a ball screw wear which is a weak point in the ball screw drive system. This will extend the life of the equipment. In addition, since a response error due to backlash and friction does not occur, you can establish a high-accuracy system.

The following shows the differences between the linear servo motor and the rotary servo motor.

Category	Item		Differences		Remark	
Calegory		пеш	Linear servo motor	Rotary servo motor	Kemark	
Motor pole adjustment	Magnetic pole detection		Required	Not required (default setting)	Automatically executed at the first servo-on after the power is turned on. For the absolute position linear encoder, [Pr. PL01] can disable the magnetic pole detection. The timing of the magnetic pole detection can be changed with [Pr. PL01]. (Refer to (2) (b) of section 15.3.3.)	
Home position return	Reference home position		1048576 pulses unit (initial value)	One servo motor revolution unit	Home position return pitch can be changed with parameter setting. (Refer to section 15.3.3.)	
Absolute position detection system	Absolute position encoder battery		Not required	Required	The following alarms and warnings are not provided for the linear servo motor. • [AL. 25 Absolute position erased] • [AL. 92 Battery cable disconnection warning] • [AL. 9F Battery warning] • [AL. E3 Absolute position counter warning]	
Auto tuning	Load to motor inertia ratio (J)		Load to motor mass ratio	Load to motor inertia ratio		
MR Configurator2 (SW1DNC-MRC2)	Motor speed (Data display and setting)		mm/s unit	r/min unit		
(software version 1.19V or later)	Test operation	Positioning operation	Supported	Supported		
	function	Motor-less operation	Not supported	Supported		
		JOG operation	Not supported	Supported		
		Program operation	Supported	Supported		

15.1.2 Configuration including peripheral equipment

♠CAUTION

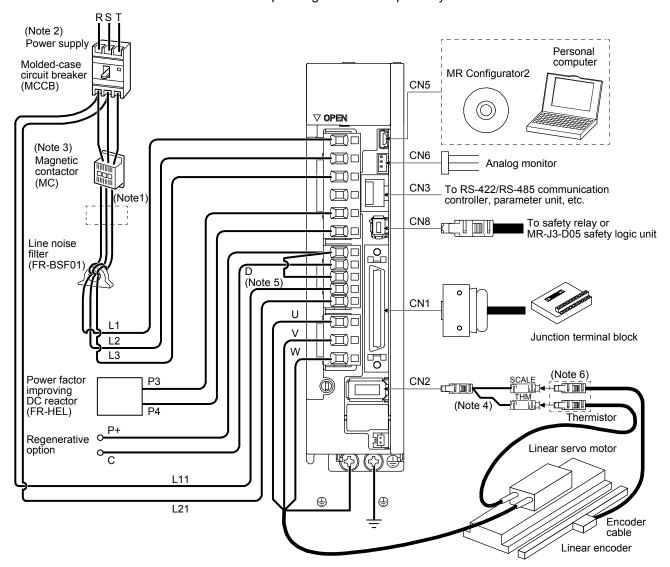
Connecting a linear servo motor of the wrong axis to the U, V, W, or CN2 may cause a malfunction.

POINT

- Equipment other than the servo amplifier and linear servo motor are optional or recommended products.
- ●When using the linear servo motor, set [Pr. PA01] to "__4_".

(1) MR-J4-_A_

The configuration diagram is an example of MR-J4-20A. When using the other servo amplifiers, the configuration will be the same as rotary servo motors except for connections of linear servo motors and linear encoders. Refer to section 1.8 depending on servo amplifiers you use.

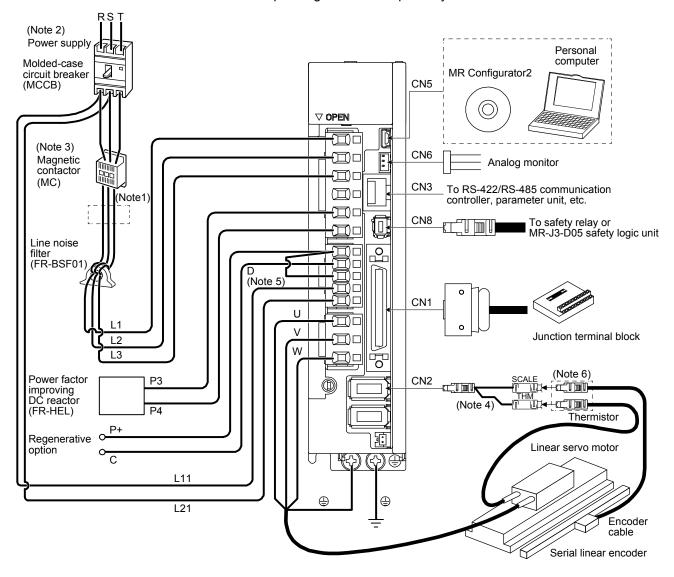


15. USING A LINEAR SERVO MOTOR

- Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
 - 2. A 1-phase 200 V AC to 240 V AC power supply may be used with the servo amplifier of MR-J4-200A or less. 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.
 - 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
 - 4. For the branch cable, use the MR-J4THCBL03M (optional).
 - 5. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.
 - 6. Connect the thermistor to THM of branch cable and connect the encoder cable to SCALE correctly. Incorrect setting will trigger [AL. 16].

(2) When using serial linear encoder with MR-J4- A -RJ

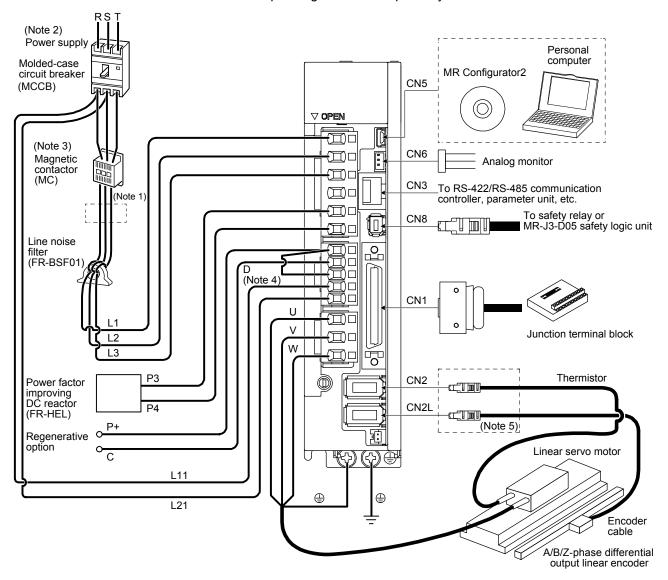
The configuration diagram is an example of MR-J4-20A-RJ. When using the other servo amplifiers, the configuration will be the same as rotary servo motors except for connections of linear servo motors and linear encoders. Refer to section 1.8 depending on servo amplifiers you use.



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

- 2. A 1-phase 200 V AC to 240 V AC power supply may be used with the servo amplifier of MR-J4-200A-RJ or less. 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.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. For the branch cable, use the MR-J4THCBL03M (optional).
- 5. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.
- 6. Connect the thermistor to THM of branch cable and connect the encoder cable to SCALE correctly. Incorrect setting will trigger [AL. 16].

(3) When using A/B/Z-phase differential output linear encoder with MR-J4-_A_-RJ
The configuration diagram is an example of MR-J4-20A-RJ. When using the other servo amplifiers, the configuration will be the same as rotary servo motors except for connections of linear servo motors and linear encoders. Refer to section 1.8 depending on servo amplifiers you use.



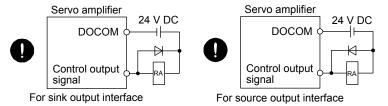
Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

- 2. A 1-phase 200 V AC to 240 V AC power supply may be used with the servo amplifier of MR-J4-J4-200A-RJ or less. 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.
- 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration.
- When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.
- 5. Connect the thermistor to CN2 of servo amplifier and connect the encoder cable to CN2L correctly. Incorrect setting will trigger [AL. 16].

15.2 Signals and wiring

- 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. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. 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.

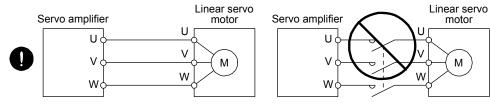
- MARNING ●Ground the servo amplifier and the linear servo motor securely.
 - ■Do not attempt to wire the servo amplifier and the linear servo motor until they have been installed. Otherwise, it may cause an electric shock.
 - ●The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
 - ■To avoid an electric shock, insulate the connections of the power supply terminals.
 - •Wire the equipment correctly and securely. Otherwise, the linear 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.





•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 (-H)) with the power wire of the linear 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.
- ●Connect the servo amplifier power output (U, V, and W) to the linear servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.



Connecting a linear servo motor of the wrong axis to the U, V, W, or CN2 may cause a malfunction.



Do not modify the equipment.

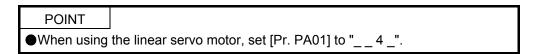
■The cables such as power wires deriving from the primary side cannot stand the long-term bending action. Avoid the bending action by fixing the cables to the moving part, etc. Also, use the cable that stands the long-term bending action for the wiring to the servo amplifier.

This section does not describe the following items. For details of the items, refer to each section of the detailed description field.

Item	Detailed explanation
Input power supply circuit	Section 3.1
Explanation of power supply system	Section 3.3
Signal (device) explanations	Section 3.5
Alarm occurrence timing chart	Section 3.8
Interface	Section 3.9
Grounding	Section 3.11
Display and operation sections	Section 4.5

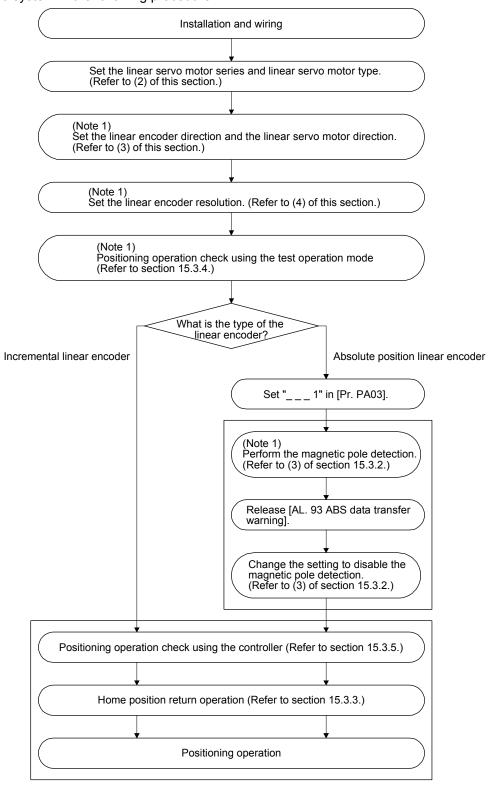
15.3 Operation and functions

15.3.1 Startup



(1) Startup procedure

Start up the linear servo system in the following procedure.



Note 1. Use MR Configurator2.

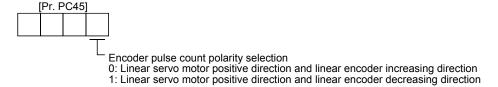
2. To cancel [AL. 93 ABS data transfer warning], cycle SON (Servo-on) or set a home position.

(2) Setting of linear servo motor series and linear servo motor type

To use the linear servo motor, set the linear servo motor series and linear servo motor type with [Pr. PA17 Servo motor series setting] and [Pr. PA18 Servo motor type setting]. (Refer to section 5.2.1.)

(3) Setting of linear encoder direction and linear servo motor direction

Set the first digit of [Pr. PC45] (Encoder pulse count polarity selection) so that the positive direction of the linear servo motor matches with the increasing direction of the linear encoder feedback.

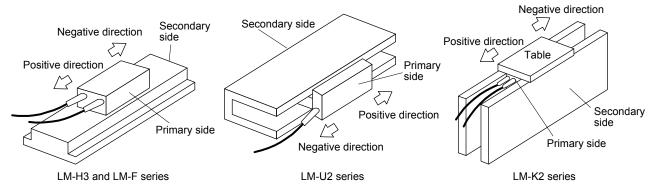


(a) Parameter setting method

1) Confirm the positive direction of the linear servo motor. [Pr. PA14] determines the relation of the travel direction of the linear servo motor under commands as shown below.

	Travel direction of linear servo motor		
[Pr. PA14] setting	Address increasing command	Address decreasing command	
0	Positive direction	Negative direction	
1	Negative direction	Positive direction	

The positive/negative directions of the linear servo motor are as follows.



- 2) Confirm the increasing direction of the linear encoder.
- 3) If the positive direction of the linear servo motor matches with the increasing direction of the linear encoder, set [Pr. PC45] to "_ _ _ 0". If the positive direction of the linear servo motor does not match with the increasing direction of the linear encoder, set [Pr. PC45] to "_ _ _ 1".
- (b) Confirmation method

Confirm the positive direction of the linear servo motor and the increasing direction of the linear encoder in the following procedure.

- 1) In servo-off status, move the linear servo motor in the positive direction manually.
- Confirm the motor speed (in the positive and negative directions) at that time with MR Configurator2.
- 3) When [Pr. PC45] is set to "____0" and the positive direction of the linear servo motor matches with the increasing direction of the linear encoder, if the linear servo motor operates in the positive direction, the motor speed will be a positive value. If the positive direction of the linear servo motor does not match with the increasing direction of the linear encoder, the motor speed will be a negative value. When [Pr. PC45] is set to "____1" and the positive direction of the linear servo motor matches with the increasing direction of the linear encoder, if the linear servo motor operates in the positive direction, the motor speed will be a negative value.

(4) Linear encoder resolution setting

POINT

- ■To enable the parameter values, cycle the power after setting.
- If an incorrect value is set for [Pr. PL02] or [Pr. PL03], the linear servo motor may not operate properly, or [AL. 27] or [AL. 42] may occur at the positioning operation or the magnetic pole detection.

Set the ratio of the electronic gear to the linear encoder resolution with [Pr. PL02 Linear encoder resolution - Numerator] and [Pr. PL03 Linear encoder resolution - Denominator].

(a) Parameter setting

Set the values that apply to the following equation.

(b) Parameter setting example

When the linear encoder resolution is 0.5 µm

$$\frac{\text{[Pr. PL02]}}{\text{[Pr. PL03]}} = \text{Linear encoder resolution} = 0.5 \ \mu\text{m} = \frac{1}{2}$$

The following shows the simplified chart for the setting values of [Pr. PL02] and [Pr. PL03].

					ar encoder	resolution	[µm]		
		0.01	0.02	0.05	0.1	0.2	0.5	1.0	2.0
Setting	[Pr. PL02]	1	1	1	1	1	1	1	2
value	[Pr. PL03]	100	50	20	10	5	2	1	1

15.3.2 Magnetic pole detection

POINT

● Set [Pr. PE47 Torque offset] to "0 (initial value)" before executing the magnetic pole detection.

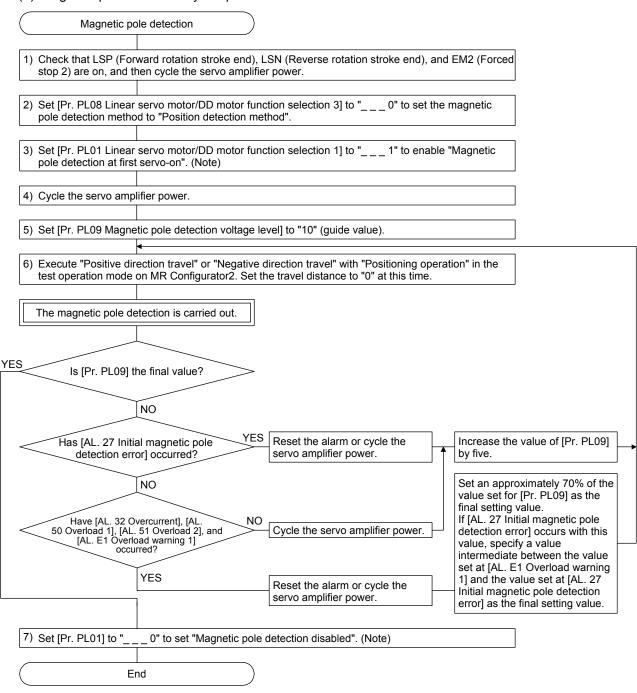
Before the positioning operation of the linear servo motor, make sure to perform the magnetic pole detection. When [Pr. PL01] is set to the initial value, perform the magnetic pole detection only at the first servo-on after the power is turned on.

The magnetic pole detection includes the following two methods. Each method has advantages and disadvantages. Select a magnetic pole detection method suitable for your usage. The position detection method is selected the initial value.

Magnetic pole detection	Advantage	Disadvantage
Position detection method	The magnetic pole detection has a high degree of accuracy. The adjustment procedure at the magnetic pole detection is simple.	The travel distance at the magnetic pole detection is long. For equipment with small friction, the initial magnetic pole detection error may occur.
Minute position detection method	The travel distance at the magnetic pole detection is short. Even for equipment with small friction, the magnetic pole detection is available.	 The adjustment procedure at the magnetic pole detection is complex. If a disturbance occurs during the magnetic pole detection, [AL. 27 Initial magnetic pole detection error] may occur.

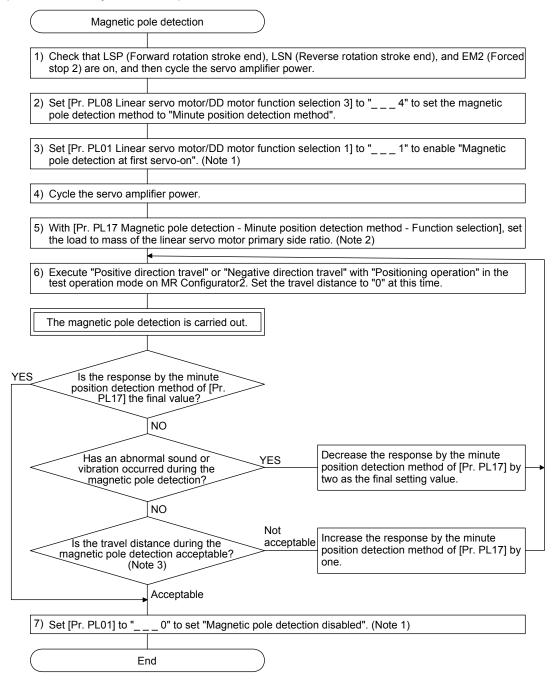
- (1) Magnetic pole detection method by using MR Configurator2

 The following shows the magnetic pole detection procedure by using MR Configurator2.
 - (a) Magnetic pole detection by the position detection method



Note. For the incremental system, the [Pr. PL01] setting is not required.

(b) Magnetic pole detection by the minute position detection method



Note 1. For the incremental system, the [Pr. PL01] setting is not required.

- 2. If the load to primary-side linear servo motor mass ratio is unknown, perform the magnetic pole detection by the position detection method, and then perform the auto tuning to set an estimated value.
- 3. For the magnetic pole detection by the minute position detection method, the maximum travel distance at the magnetic pole detection must be 0.5 mm or less. To shorten the travel distance, increase the response by the minute position detection method in [Pr. PL17].

(2) Operation at the magnetic pole detection

∱WARNING

● Note that the magnetic pole detection automatically starts simultaneously with the turning-on of the servo-on command.

!CAUTION

• If the magnetic pole detection is not executed properly, the linear servo motor may operate unexpectedly.

POINT

- Establish the machine configuration to use LSP (Upper stroke end) and LSN (Lower stroke end). The machine may be damaged due to a collision without LSP and LSN.
- Assign LSP and LSN and perform the magnetic pole detection also in the torque control mode.
- At the magnetic pole detection, whether the linear servo motor moves in the positive or negative direction is unpredictable.
- Depending on the setting value of [Pr. PL09 Magnetic pole detection voltage level], an overload, overcurrent, magnetic pole detection alarm, or others may occur.
- After the magnetic pole detection, check the positioning accuracy with the test operation (positioning operation function) of MR Configurator2.
- When the absolute position linear encoder is used, if a gap is generated to the positional relation between the linear encoder and the linear servo motor, perform the magnetic pole detection again.
- ●The accuracy of the magnetic pole detection improves with no load.
- •An alarm may occur when the linear encoder is not mounted properly, or when the linear encoder resolution setting ([Pr. PL02] and [Pr. PL03]) or the setting value of [Pr. PL09 Magnetic pole detection voltage level] is incorrect.
- For the machine that its friction becomes 30% or more of the continuous thrust, the linear servo motor may not operate properly after the magnetic pole detection.
- For the horizontal shaft of the machine that its unbalanced thrust becomes 20% or more of the continuous thrust, the linear servo motor may not operate properly after the magnetic pole detection.
- ●For the machine that multiple axes are connected like a tandem configuration, if you try to perform the magnetic pole detection simultaneously for multiple axes, the magnetic pole detection may not be executed. Perform the magnetic pole detection for each axis. At this time, set the axes that the magnetic pole detection is not performed for to servo-off.

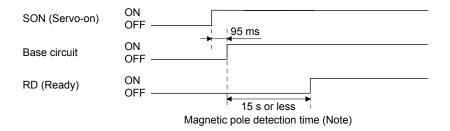
(a) For the incremental linear encoder

POINT

● For the incremental linear encoder, the magnetic pole detection is required every time the power is turned on.

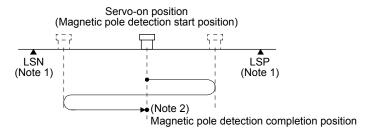
By turning on SON (Servo-on) after power-on, the magnetic pole detection is automatically carried out. Therefore, there is no need to set the parameter (first digit of [Pr. PL01]) for executing the magnetic pole detection.

1) Timing chart



Note. The magnetic pole detection time indicates the operation time when LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end) are on.

2) Linear servo motor movement (when LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end) are on)



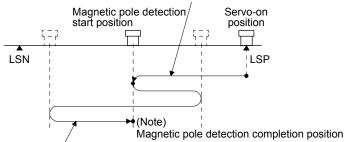
- Note 1. When you turn off LSP (Forward rotation stroke end) or LSN (Reverse rotation stroke end) during the magnetic pole detection, the operation of the magnetic pole detection is carried on to the opposite direction. When both LSP and LSN are off, [AL. 27 Initial magnetic pole detection error] occurs.
 - 2. The following shows the pitch against the magnetic pole.

		LM-		
Linear servo motor series	LM-H3 LM-F	Medium thrust (Continuous thrust: Less than 400 N)	Large thrust (Continuous thrust: 400 N or more)	LM-K2
Pitch against magnetic pole [mm]	48	30	60	48

3) Linear servo motor movement (when LSP (Forward rotation stroke end) or LSN (Reverse rotation stroke end) is off)

When LSP or LSN is off at servo-on, the magnetic pole detection is carried out as follows.

The linear servo motor moves to a magnetic pole detection start position upon servo-on, and the magnetic pole detection is executed.



The linear servo motor reciprocates several times and returns to the magnetic pole detection start position to complete the magnetic pole detection and to go into the servo-lock status. At this time, there may be a gap, approximately a quarter of the pitch against magnetic pole, from the start position.

Note. For the pitch against magnetic pole, refer to (2) (a) 2) Note 2 of this section.

(b) For the absolute position linear encoder

POINT

- The magnetic pole detection is required at the following timing.
 - When the system is set up (at the first startup of equipment)
 - After a servo amplifier is replaced
 - After a linear servo motor (primary-side or secondary-side) is replaced
 - After a linear encoder (scale or head) is replaced or remounted
- If a gap is generated to the positional relation between the linear encoder and the linear servo motor, perform the magnetic pole detection again.

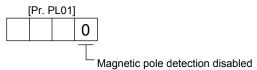
Perform the magnetic pole detection in the following procedure.

1) Set [Pr. PL01 Linear servo motor/DD motor function selection 1] to "_ _ 1" (Magnetic pole detection at first servo-on).



2) Execute the magnetic pole detection. (Refer to (2) (a) of this section.)

3) After the completion of the magnetic pole detection, change [Pr. PL01] to "_ _ _ 0" (Magnetic pole detection disabled).



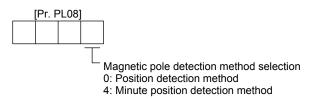
After the magnetic pole detection, by disabling the magnetic pole detection function with [Pr. PL01], the magnetic pole detection after each power-on is not required.

(3) Magnetic pole detection method setting

POINT

- ●In the following cases, set the magnetic pole detection method to the minute position detection method.
 - When a shorten travel distance at the magnetic pole detection is required
 - When the magnetic pole detection by the position detection method is not completed

Set the magnetic pole detection method using the first digit of [Pr. PL08] (Magnetic pole detection method selection).



- (4) Setting of the magnetic pole detection voltage level by the position detection method For the magnetic pole detection by the position detection method, set the voltage level with [Pr. PL09 Magnetic pole detection voltage level]. For the magnetic pole detection by the minute position detection method, the voltage level setting is not required.
 - (a) Guideline of parameter settingsSet the parameters by referring to the following table.

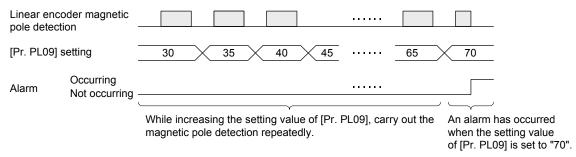
[Pr. PL09] setting (guide value) Servo status	Small ← Medium → Large		
Thrust at operation	Small	Large	
Overload, overcurrent alarm	Seldom occurs	Frequently occurs	
Magnetic pole detection alarm	Frequently occurs	Seldom occurs	
Magnetic pole detection accuracy	Low	High	

(b) Setting procedure

 Perform the magnetic pole detection, and increase the setting value of [Pr. PL09 Magnetic pole detection voltage level] until [AL. 50 Overload 1], [AL. 51 Overload 2], [AL. 33 Overvoltage], [AL. E1 Overload warning 1], and [AL. EC Overload warning 2] occur. Increase the setting value by five as a guide value. When these alarms and warnings occur during the magnetic pole detection by using MR Configurator2, the test operation of MR Configurator2 automatically completes and the servo-off status is established.

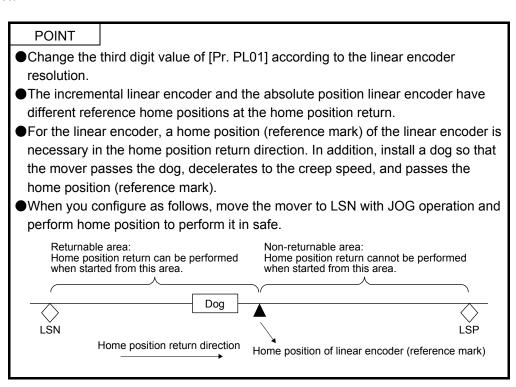
- 2) Specify the setting value that is an approximately 70% of the value set when [AL. 50 Overload 1], [AL. 51 Overload 2], [AL. 33 Overvoltage], [AL. E1 Overload warning 1], and [AL. EC Overload warning 2] occurred as the final setting value. However, if [AL. 27 Initial magnetic pole detection error] occurs with this value, specify a value intermediate between the value set at [AL. 50 Overload 1], [AL. 51 Overload 2], [AL. 33 Overvoltage], [AL. E1 Overload warning 1], and [AL. EC Overload warning 2] and the value set at the magnetic pole detection alarm as the final setting value.
- 3) Perform the magnetic pole detection again with the final setting value to check there is no problem.

(c) Setting example



In this example, the final setting value of [Pr. PL09] is 49 (Setting value at the alarm occurrence = 70×0.7).

15.3.3 Home position return

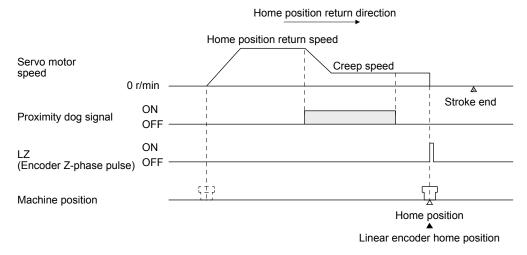


(1) Incremental linear encoder



- ●If the resolution or the stop interval (the third digit of [Pr. PL01]) of the linear encoder is large, it is very dangerous since the linear servo motor may crash into the stroke end.
- (a) When the linear encoder home position (reference mark) exists in the home position return direction When you use an incremental linear encoder, LZ (Encoder Z-phase pulse) from the servo amplifier will be the home position (reference mark) of the linear encoder.

When two or more reference marks exist during the full stroke of the linear encoder, select "Enabled (1 _ _ _)" of "Linear scale multipoint Z-phase input function selection" in [Pr. PC28].

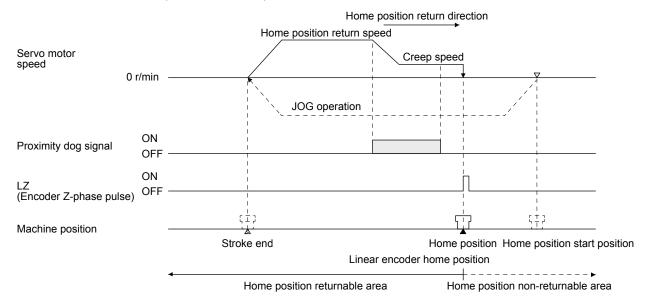


(b) When the linear encoder home position (reference mark) does not exist in the home position return direction

POINT

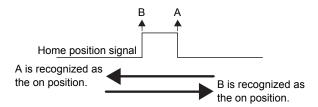
- To execute a home position return securely, start a home position return after moving the linear servo motor to the opposite stroke end with JOG operation and others.
- Change the third digit value of [Pr. PL01] according to the linear encoder resolution.

The home position return cannot be performed from the position which the home position of the linear encoder does not exist in the home position return direction. Move the mover to the stroke end on the opposite side of the home position return direction with the JOG operation from the controller and others, and then perform a home position return.



(c) Caution for passing the home position (reference mark) An interval for turning on home position (reference mark) signal of the linear encoder has a certain width. (Specifications differ depending on the linear encoders. For details, refer to "Linear Encoder Instruction Manual".)

Example: When Z-phase is recognized at startup



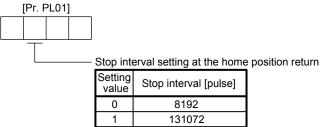
The position which turns on LZ (Encoder Z-phase pulse) differs depending on the directions of home position passing. When you need to set the home position return completion to the same position each time such as dog type home position return, always start home position return with the same direction.

- (d) Caution for linear encoder which does not have the home position (reference mark) The linear encoder which does not have the home position (reference mark), LZ (Encoder Z-phase pulse) of the servo amplifier does not be outputted. It is depending on positioning controllers to use whether LZ (Encoder Z-phase pulse) is necessary or not for home position return. Check the specifications of controllers.
- (2) Absolute position linear encoder

POINT

●The data set type home position return can also be carried out.

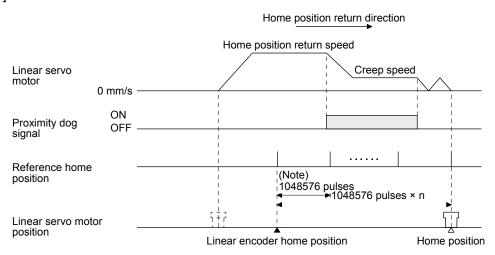
The home position reference position using an absolute type linear encoder will be per 1048576 pulses based on the linear encoder home position (absolute position data = 0). You can change the stop interval at home position return with the third digit of [Pr. PL01].



The following shows the relation between the stop interval at the home position return and the linear encoder resolution. For example, when the linear encoder resolution is 0.001 µm and the parameter for the stop interval at the home position return, [Pr.PL01], is set to "_ 5 _ _" (16777216 pulses), the stop interval is 16.777 mm. The value inside a bold box indicates the recommended stop interval for each linear encoder resolution.

											[Unit: mm]
Pr. PL01	Linear encoder resolution [µm] Stop interval [pulse]	0.001	0.005	0.01	0.02	0.05	0.1	0.2	0.5	1	2
_0	8192	0.008	0.041	0.082	0.164	0.410	0.819	1.638	4.096	8.192	16.384
_1	131072	0.131	0.655	1.311	2.621	6.554	13.107	26.214	65.536	131.072	262.144
_2	262144	0.262	1.311	2.621	5.243	13.107	26.214	52.429	131.072	262.144	524.288
_3	1048576	1.049	5.243	10.486	20.972	52.429	104.858	209.715	524.288	1048.576	2097.152
_4	4194304	4.194	20.972	41.943	83.886	209.715	419.430	838.861	2097.152	4194.304	8388.608
_5	16777216	16.777	83.886	167.772	335.544	838.861	1677.722	3355.443	8388.608	16777.216	33554.432
_6	67108864	67.109	335.544	671.089	1342.177	3355.443	6710.886	13421.773	33554.432	67108.864	134217.728

In the case of a proximity dog type home position return, the nearest reference home position after proximity dog off is the home position. The linear encoder home position can be set in any position. LZ (Encoder Z-phase pulse) is outputted based on "Stop interval selection at the home position return" in [Pr. PL01].



Note. Changeable with [Pr. PL01].

15.3.4 Test operation mode in MR Configurator2



- 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 linear 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 the environment where the servo amplifier and a personal computer are directly connected.

By using a personal computer and MR Configurator2, you can execute the positioning operation, the output signal (DO) forced output, and the program operation without connecting the controller.

(1) Positioning operation

Positioning operation can be performed when there is no command from the controller. Use this operation with the forced stop reset. This operation may be used independently of whether servo-on, servo-off, or whether a controller is connected or not.

Exercise control on the positioning operation screen of MR Configurator2.

(a) Operation pattern

Item	Initial value	Setting range
Travel distance [pulse]	1048576	0 to 9999999
Speed [mm/s]	10	0 to Maximum speed
Acceleration/decelerati on time constant [ms]		0 to 50000
Repeat pattern	Positive direction travel → Negative direction travel	Positive direction travel → Negative direction travel Positive direction travel → Positive direction travel Negative direction travel Positive direction travel Negative direction travel → Negative direction travel
Dwell time [s]	2.0	0.1 to 50.0
Number of repeats [time]	1	1 to 9999

(b) Operation method

Operation	Screen control
Positive direction travel	Click "Positive Direction Movement".
Negative direction travel	Click "Reverse Direction Movement".
Pause	Click "Pause".
Stop	Click "Stop".
Forced stop	Click "Forced Stop".

(2) Output signal (DO) forced output

Output signals can be switched on/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.

(3) Program operation

Positioning operation can be performed in two or more operation patterns combined, without using a controller. Use this operation with the forced stop reset. This operation may be used independently of whether servo-on, servo-off, or whether a controller is connected or not.

Exercise control on the program operation screen of MR Configurator2. For full information, refer to the MR Configurator2 Installation Guide.

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

15.3.5 Function

(1) Linear servo control error detection function

POINT

●For the linear servo control error detection function, the position and speed deviation error detections are enabled by default. ([Pr. PL04]: _ _ _ 3)

If the linear servo control gets unstable for some reasons, the linear servo motor may not operate properly. To detect this state and to stop operation, the linear servo control error detection function is used as a protective function.

The linear servo control error detection function has three different detection methods: the position deviation, speed deviation, and thrust deviation. An error is detected when each method is enabled with [Pr. PL04 Linear servo motor/DD motor function selection 2]. The detection level can be changed with [Pr. PL05], [Pr. PL06], and [Pr. PL07].

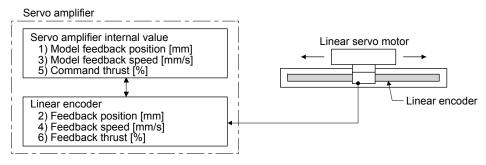


Figure 15.1 Outline of linear servo control error detection function

(a) Position deviation error detection

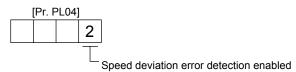
Set [Pr. PL04] to "___ 1" to enable the position deviation error detection.



When you compare the model feedback position (1)) and the feedback position (2)) in figure 15.1, if the deviation is more than the value of [Pr. PL05 Position deviation error detection level] (1 mm to 1000 mm), [AL. 42.1 Servo control error by position deviation] will occur and the linear servo motor will stop. The initial value of this detection level is 50 mm. Change the set value as necessary.

(b) Speed deviation error detection

Set [Pr. PL04] to "___ 2" to enable the speed deviation error detection.



When you compare the model feedback speed (3)) and the feedback speed (4)) in figure 15.1, if the deviation is more than the value of [Pr. PL06 Speed deviation error detection level] (1 mm/s to 5000 mm/s), [AL. 42.2 Servo control error by speed deviation] will occur and the linear servo motor will stop. The initial value of this detection level is 1000 mm/s. Change the set value as necessary.

(c) Thrust deviation error detection level

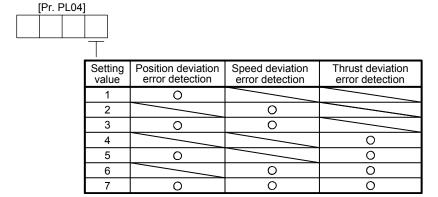
Set [Pr. PL04] to "___ 4" to enable the thrust deviation error detection.



When you compare the command thrust (5)) and the feedback thrust (6)) in figure 15.1, if the deviation is more than the value of [Pr. PL07 Torque/thrust deviation error detection level] (1% to 1000%), [AL. 42.3 Servo control error by torque/thrust deviation] will occur and the linear servo motor will stop. The initial value of this detection level is 100%. Change the set value as necessary.

(d) Detecting multiple deviation errors

When [Pr. PL04] is set as follows, multiple deviation errors can be detected. For the error detection methods, refer to (1) (a), (b), (c) of this section.



(2) Auto tuning function

POINT

- ●The auto tuning mode 1 may not be performed properly if the following conditions are not satisfied.
 - Time to reach 2000 mm/s is the acceleration/deceleration time constant of 5 s or less.
 - The linear servo motor speed is 150 mm/s or higher.
 - The load to mass of the linear servo motor primary-side ratio is 100 times or less.
 - The acceleration/deceleration thrust is 10% or less of the continuous thrust.

The auto tuning function during the linear servo motor operation is the same as that of the rotary servo motor. However, the calculation method of the load to motor mass ratio (J ratio) differs. The load to motor mass ratio (J ratio) on the linear servo motor is calculated by dividing the load mass by the mass of the linear servo motor primary side.

Example) Mass of linear servo motor primary side = 2 kg
Load mass (excluding the mass of the linear servo motor primary side) = 4 kg
Mass ratio = 4/2 = 2 times

For the parameters set by the auto tuning function, refer to chapter 6.

(3) Machine analyzer function

POINT

- Make sure to perform the machine analyzer function after the magnetic pole detection. If the magnetic pole detection is not performed, the machine analyze function may not operate properly.
- The stop position at the completion of the machine analyzer function can be any position.

15. USING A LINEAR SERVO MOTOR

15.3.6 Absolute position detection system

When the linear servo motor is used with the absolute position detection system, an absolute position linear encoder is required.

- (1) Operating conditions of absolute position detection system
 - (a) Use an absolute type linear encoder.
 - (b) Perform the magnetic pole detection in the incremental system and disable the magnetic pole detection after the detection.
 - (c) Enable the absolute position detection system with [Pr. PA03 Absolute position detection system].

(2) Alarm detection

[AL. 25 Absolute position erased], [AL. 92 Battery cable disconnection warning], [AL. 9F Battery warning], and [AL. E3 Absolute position counter warning] are not provided for the linear servo motor.

(3) Backup

The linear encoder backs up the absolute position data. Therefore, the encoder battery need not be installed to the servo amplifier.

(4) Absolute position data transfer to controller

Refer to section 12.8 for absolute position data transfer to the controller.

15.4 Characteristics

15.4.1 Overload protection characteristics

An electronic thermal is built in the servo amplifier to protect the linear servo motor, servo amplifier and linear 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. 15.2. [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.

Use the linear servo motor with 70% or less of the effective load ratio when it is in the servo lock state or in a small reciprocating motion.

This servo amplifier has solid-state linear servo motor overload protection. (The servo motor overload current (full load current) is set on the basis of 120% rated current of the servo amplifier.)

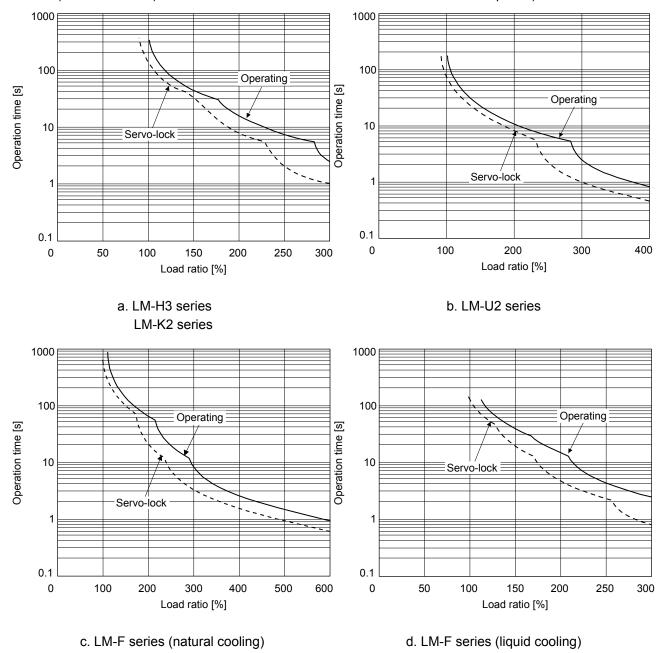


Fig. 15.2 Electronic thermal protection characteristics

15.4.2 Power supply capacity and generated loss

Table 15.1 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 linear 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.

Mounting a heat sink outside of the cabinet enables to reduce heat in the cabinet and design a compact enclosed type cabinet.

Table 15.1 Power supply capacity and generated loss per linear servo motor at rated output

Linear servo motor (primary side)	Servo amplifier	Power supply capacity [kVA]	Servo amplifier-go (No	Area required for heat dissipation	
(primary side)		(Note 1)	At rated output	With servo-off	[m ²]
LM-H3P2A-07P-BSS0	MR-J4-40A(-RJ)	0.9	35	15	0.7
LM-H3P3A-12P-CSS0	MR-J4-40A1(-RJ)	0.9	35	15	0.7
LM-H3P3B-24P-CSS0	MD 14 704 (D I)	1.3	50	15	1.0
LM-H3P3C-36P-CSS0	MR-J4-70A(-RJ)	1.9	75	15	1.5
LM-H3P3D-48P-CSS0	MR-J4-200A(-RJ)	3.5	90	20	1.8
LM-H3P7A-24P-ASS0	MR-J4-70A(-RJ)	1.3	50	15	1.0
LM-H3P7B-48P-ASS0	MR-J4-200A(-RJ)	3.5	90	20	1.8
LM-H3P7C-72P-ASS0	WIR-34-200A(-R3)	3.8	100	20	1.1
LM-H3P7D-96P-ASS0	MR-J4-350A(-RJ)	5.5	130	20	2.7
LM-U2PAB-05M-0SS0	MR-J4-20A(-RJ) MR-J4-20A1(-RJ)	0.5	25	15	0.5
LM-U2PAD-10M-0SS0	MR-J4-40A(-RJ)	0.9	35	15	0.7
LM-U2PAF-15M-0SS0	MR-J4-40A1(-RJ)	0.9	35	15	0.7
LM-U2PBB-07M-1SS0	MR-J4-20A(-RJ) MR-J4-20A1(-RJ)	0.5	25	15	0.5
LM-U2PBD-15M-1SS0	MR-J4-60A(-RJ)	1.0	40	15	0.8
LM-U2PBF-22M-1SS0	MR-J4-70A(-RJ)	1.3	50	15	1.0
LM-U2P2B-40M-2SS0	MR-J4-200A(-RJ)	3.5	90	20	1.8
LM-U2P2C-60M-2SS0	MR-J4-350A(-RJ)	5.5	130	20	2.7
LM-U2P2D-80M-2SS0	MR-J4-500A(-RJ)	7.5	195	25	3.9
LM-FP2B-06M-1SS0	MR-J4-200A(-RJ)	3.5	90	20	1.8
LM-FP2D-12M-1SS0	MR-J4-500A(-RJ)	7.5	195	25	3.9
LM-FP2F-18M-1SS0	MR-J4-700A(-RJ)	10	300	25	6.0
LM-FP4B-12M-1SS0	MR-J4-500A(-RJ)	7.5	195	25	3.9
LM-FP4D-24M-1SS0	MR-J4-700A(-RJ)	10	300	25	6.0
LM-FP4F-36M-1SS0	MR-J4-11KA(-RJ)	14	460	45	9.2
LM-FP4H-48M-1SS0	MR-J4-15KA(-RJ)	18	580	45	11.6
LM-FP5H-60M-1SS0	MR-J4-22KA4(-RJ)	22	640	45	12.8
LM-K2P1A-01M-2SS1	MR-J4-40A(-RJ) MR-J4-40A1(-RJ)	0.9	35	15	0.7
LM-K2P1C-03M-2SS1	MR-J4-200A(-RJ)	3.5	90	20	1.8
LM-K2P2A-02M-1SS1	MR-J4-70A(-RJ)	1.3	50	15	1.0
LM-K2P2C-07M-1SS1	MR-J4-350A(-RJ)	5.5	130	20	2.7
LM-K2P2E-12M-1SS1	MR-J4-500A(-RJ)	7.5	195	25	3.9
LM-K2P3C-14M-1SS1	MR-J4-350A(-RJ)	5.5	130	20	2.7
LM-K2P3E-24M-1SS1	MR-J4-500A(-RJ)	7.5	195	25	3.9

Note 1. The power supply equipment capacity changes with the power supply impedance. This value is applicable when the power factor improving AC reactor or power factor improving DC reactor are 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.

15.4.3 Dynamic brake characteristics

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 mass 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 the linear servo motor stops when using EM1 (Forced stop 1) frequently in other than emergency.

The approximate coasting distance from when the dynamic break is activated until when the linear servo motor stops can be calculated with the equation below.

Lmax =
$$V_0 \cdot (0.03 + M \cdot (A + B \cdot V_0^2))$$

Lmax: Coasting distance of the machine [m] V_0 : Speed when the brake is activated [m/s]

M: Full mass of the moving part [kg]

A: Coefficient (Refer to the following tables.)

B: Coefficient (Refer to the following tables.)

Linear servo motor (primary side)	Coefficient A	Coefficient B
LM-H3P2A-07P-BSS0	7.15E-03	2.94E-03
LM-H3P3A-12P-CSS0	2.81E-03	1.47E-03
LM-H3P3B-24P-CSS0	7.69E-03	2.27E-04
LM-H3P3C-36P-CSS0	7.22E-03	1.13E-04
LM-H3P3D-48P-CSS0	1.02E-03	2.54E-04
LM-H3P7A-24P-ASS0	7.69E-03	2.14E-04
LM-H3P7B-48P-ASS0	9.14E-04	2.59E-04
LM-H3P7C-72P-ASS0	7.19E-04	1.47E-04
LM-H3P7D-96P-ASS0	6.18E-04	9.59E-05

LM-H3P7D-96P-ASS0	6.18E-04	9.59E-05
Linear servo motor (primary side)	Coefficient A	Coefficient B
LM-FP2B-06M-1SS0	8.96 × 10 ⁻⁴	1.19 × 10 ⁻³
LM-FP2D-12M-1SS0	5.55 × 10 ⁻⁴	4.81 × 10 ⁻⁴
LM-FP2F-18M-1SS0	4.41 × 10 ⁻⁴	2.69 × 10 ⁻⁴
LM-FP4B-12M-1SS0	5.02 × 10 ⁻⁴	4.36 × 10 ⁻⁴
LM-FP4D-24M-1SS0	3.55 × 10 ⁻⁴	1.54 × 10 ⁻⁴
LM-FP4F-36M-1SS0	1.79 × 10 ⁻⁴	1.36 × 10 ⁻⁴
LM-FP4H-48M-1SS0	1.15 × 10 ⁻⁴	1.19 × 10 ⁻⁴

1.95 × 10⁻⁴

Linear servo motor (primary side)	Coefficient A	Coefficient B
LM-U2PAB-05M-0SS0	5.72 × 10 ⁻²	1.72 × 10 ⁻⁴
LM-U2PAD-10M-0SS0	2.82 × 10 ⁻²	8.60 × 10 ⁻⁵
LM-U2PAF-15M-0SS0	1.87 × 10 ⁻²	5.93 × 10 ⁻⁵
LM-U2PBB-07M-1SS0	3.13 × 10 ⁻²	1.04 × 10 ⁻⁴
LM-U2PBD-15M-1SS0	1.56 × 10 ⁻²	5.18 × 10 ⁻⁵
LM-U2PBF-22M-1SS0	4.58 × 10 ⁻²	1.33 × 10 ⁻⁵
LM-U2P2B-40M-2SS0	1.47 × 10 ⁻³	1.27 × 10 ⁻⁵
LM-U2P2C-60M-2SS0	1.07 × 10 ⁻³	7.66 × 10 ⁻⁶
LM-U2P2D-80M-2SS0	9.14 × 10 ⁻⁴	5.38 × 10 ⁻⁶

Linear servo motor (primary side)	Coefficient A	Coefficient B
LM-K2P1A-01M-2SS1	5.36 × 10 ⁻³	6.56 × 10 ⁻³
LM-K2P1C-03M-2SS1	1.17 × 10 ⁻³	3.75 × 10 ⁻⁴
LM-K2P2A-02M-1SS1	2.49 × 10 ⁻²	1.02 × 10 ⁻³
LM-K2P2C-07M-1SS1	6.85 × 10 ⁻⁴	2.80 × 10 ⁻⁴
LM-K2P2E-12M-1SS1	5.53 × 10 ⁻⁴	1.14 × 10 ⁻⁴
LM-K2P3C-14M-1SS1	2.92 × 10 ⁻⁴	1.16 × 10 ⁻⁴
LM-K2P3E-24M-1SS1	2.53 × 10 ⁻⁴	5.52 × 10 ⁻⁵



LM-FP5H-60M-1SS0

■The coasting distance is a theoretically calculated value which ignores the running load such as friction. The calculated value is considered to be longer than the actual distance. However, if an enough breaking distance is not obtained, the linear servo motor 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. No linear servo motor with an electromagnetic brake is available.

 4.00×10^{-5}

15.4.4 Permissible load to motor mass ratio when the dynamic brake is used

Use the dynamic brake under the load to motor mass 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 mass ratio in the table are the values when the linear servo motor is used at the maximum speed.

Linear servo motor	Permissible load to motor mass ratio	
(primary side)	[Multiplier]	
LM-H3 series	40	
LM-U2 series	100	
LM-F series	100	
LM-K2 series	50	

When actual speed does not reach the maximum speed of the linear servo motor, calculate the permissible load to motor mass ratio at the time of using the dynamic brake by the following equation. (The upper limit is 300 times.)

Permissible load to motor mass ratio of the dynamic brake = Value in the table \times (Servo motor maximum speed²/Actual using speed²)

For example, when an actual using speed is 2 m/s or less for the LM-H3P2A-07P motor (maximum speed: 3.0 m/s), the equation will be as follows.

Permissible load to motor mass ratio of dynamic brake = $40 \times 3^2/2^2 = 90$ [times]

15. USING A LINEAR SERVO MOTOR

MEMO		

16. USING A DIRECT DRIVE MOTOR

CAUTION ●When using the direct drive motor, read "Direct Drive Motor Instruction Manual".

POINT

- ●The direct drive servo system is available for the servo amplifiers of which software version is A5 or later.
- The MR-J4-03A6(-RJ) servo amplifier is not compatible with direct drive motor.

16.1 Functions and configuration

16.1.1 Summary

The fields of semiconductor/LCD manufacturing systems, mounters, and others have strong demands for high accuracy and efficiency. Therefore, the number of systems using a direct drive motor for a drive axis has been increasing. The direct drive servo system includes the following features.

(1) Performance

- (a) The direct drive servo system ensures the high-rigidity and the high-torque. A high-resolution encoder enables the high-accuracy control.
- (b) The high-resolution encoder contributes to the high-accuracy indexing.
- (c) Since reducer is no longer required, no backlash occurs. In addition, the settling time is reduced, and the high-frequency operation is enabled.
- (d) Since reducer is no longer required, the motor does not deteriorate with time by reducer.

(2) Mechanism

- (a) The motor's low profile design contributes to compact moving part of the machine and a low center of gravity for enhanced equipment stability.
- (b) The motor has an inner rotor with hollow shaft which enables cables and pipes to be passed through.
- (c) Lubrication and the maintenance due to abrasion are not required.

The following shows the differences between the direct drive motor and the rotary servo motor.

Catagony	Item	Differences		Remark
Category		Direct drive motor	Rotary servo motor	Remark
Motor pole adjustment	Magnetic pole detection	Required	Not required (default setting)	Automatically executed at the first servo-on after the power is turned on. For the absolute position detection system, [Pr. PL01] can disable the magnetic pole detection. (Refer to (2) (b) of 16.3.3.)
Absolute position detection system	Absolute position encoder battery	Required	Required	
	Absolute position storage unit (MR-BTAS01)	Required	Not required	

16.1.2 Configuration including peripheral equipment

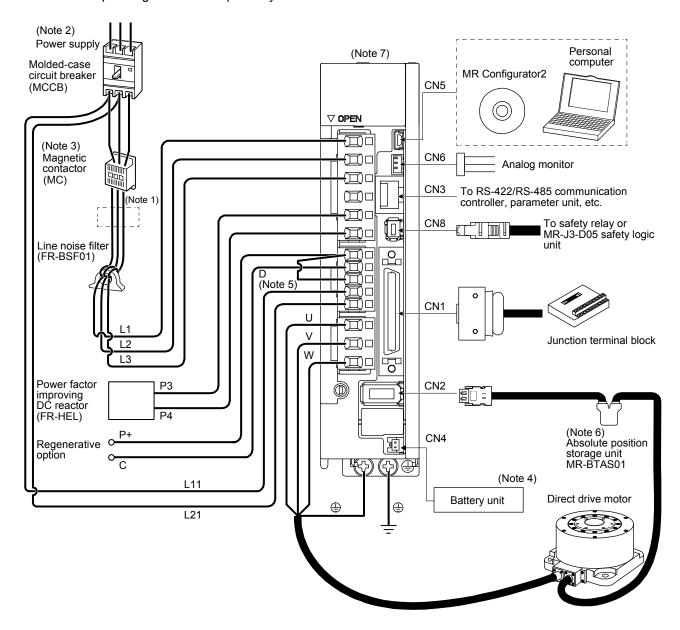
ACAUTION

■Connecting a direct drive motor of the wrong axis to the U, V, W, or CN2 may cause a malfunction.

POINT

- Equipment other than the servo amplifier and direct drive motor are optional or recommended products.
- ●When using the direct drive motor, set [Pr. PA01] to "___6 _".

The configuration diagram is an example of MR-J4-20A. When using the other servo amplifiers, the configuration will be the same as rotary servo motors except for connections of direct drive motors. Refer to section 1.8 depending on servo amplifiers you use.



- Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
 - 2. A 1-phase 200 V AC to 240 V AC power supply may be used with the servo amplifier of MR-J4-200A(-RJ) or less. 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.
 - 3. Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
 - 4. The battery unit is used for the absolute position detection system. (Refer to chapter 12.)
 - 5. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.
 - 6. The absolute position storage unit is used for the absolute position detection system.
 - 7. This is for MR-J4-_A_, MR-J4-_A_-RJ has a CN2L connector. However, CN2L is not used for the direct drive servo system.

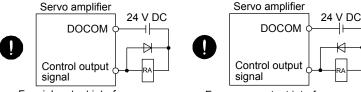
16.2 Signals and wiring

- 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. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. 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.



- MARNING ●Ground the servo amplifier and the direct drive motor securely.
 - Do not attempt to wire the servo amplifier and direct drive 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.
 - Wire the equipment correctly and securely. Otherwise, the direct drive motor may operate unexpectedly, resulting in injury.
 - ●Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may
 - ●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.





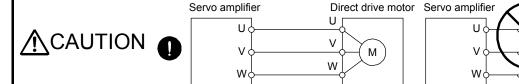
For sink output interface For source output interface

- 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 (FR-BIF option) on the power wire of the direct drive 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, and W) to the direct drive motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.

Direct drive motor

Μ



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

This section does not describe the following items. For details of the items, refer to each section of the detailed description field.

Item	Detailed explanation
Input power supply circuit	Section 3.1
Explanation of power supply system	Section 3.3
Signal (device) explanations	Section 3.5
Alarm occurrence timing chart	Section 3.8
Interface	Section 3.9
Grounding	Section 3.11
Display and operation sections	Section 4.5
Parameter	Chapter 5
Troubleshooting	Chapter 8

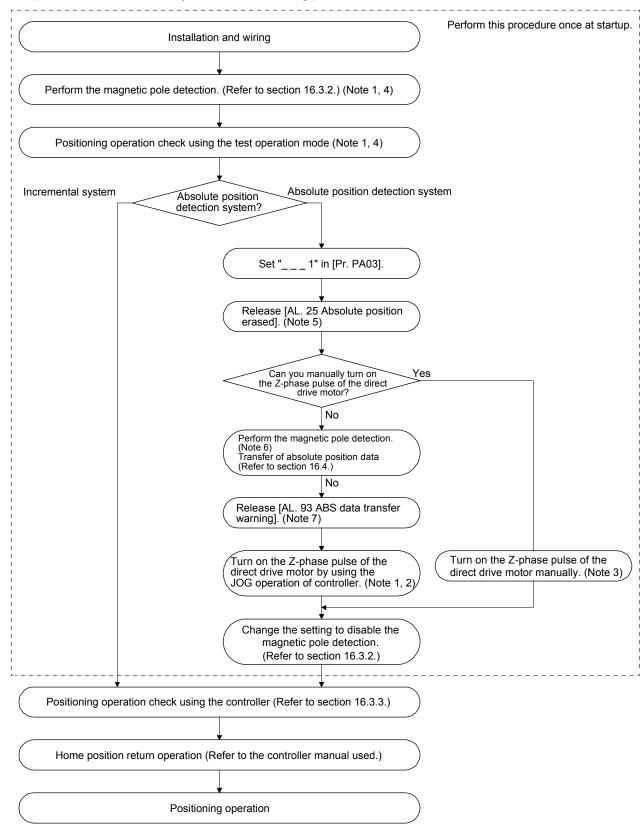
16.3 Operation and functions

POINT

- ●When using the direct drive motor, set [Pr. PA01] to " 6 ".
- For the test operation, refer to section 4.2.3, 4.3.3, 4.4.3, and 4.5.9.
- After power on, the Z-phase mark of the direct drive motor must pass the connector area once. In a system which prevents the direct drive motor from making a full rotation, install the direct drive motor in a position where the Z-phase mark can pass over the connector area.

16.3.1 Startup procedure

Start up the direct drive servo system in the following procedure.



Note 1. Use MR Configurator2.

- 2. For the absolute position detection system, always turn on the Z-phase pulse of the direct drive motor while the servo amplifier power is on, and then turn the servo amplifier power supply off and on again. By turning off and on the power supply, the absolute position becomes confirmed. Without this operation, the absolute position will not be regained properly, and a warning will occur at the controller.
- 3 If the Z-phase pulse of the direct drive motor can be turned on manually, the Z-phase pulse does not have to be turned on by the magnetic pole detection or the JOG operation.
 - For this operation, always connect the direct drive motor encoder and the servo amplifier, and turn on only the control circuit power supply of the servo amplifier (L11 and L21) (turn off the main circuit power supply L1, L2, and L3). Perform this operation by considering the safety.
- 4. Test operation cannot be performed in the absolute position detection system, either. To perform test operation, select "Disabled (incremental system) (_ _ _ 0)" in [Pr. PA03]. Refer to section 16.3.2 (1) for details.
- 5. After the servo amplifier is connected to the direct drive motor with an encoder cable, [AL. 25 Absolute position erased] will occur at the first power on. Cancel the alarm by turning on/off the power.
- 6. When the magnetic pole detection is performed with absolute position detection system by DIO transfer, [AL. 93 ABS data transfer warning] will occur. Refer to section 16.4 for details.
- 7. To cancel [AL. 93 ABS data transfer warning], cycle SON (Servo-on) or set a home position.

16.3.2 Magnetic pole detection

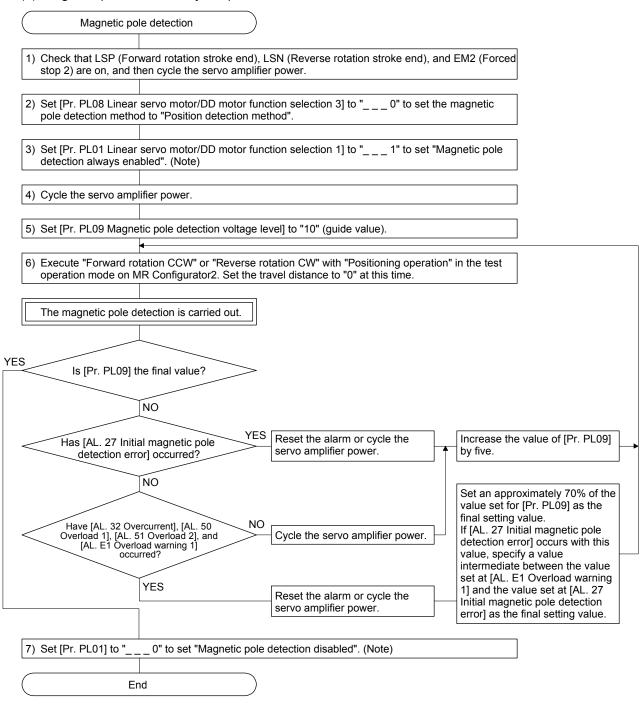
POINT

- The magnetic pole detection is not required for the configured absolute position detection system where the Z-phase pulse of the direct drive motor can be turned on manually.
 - For this operation, always connect the direct drive motor encoder and the servo amplifier and turn on the control circuit power supply of the servo amplifier. Perform this operation by considering the safety.
- •When performing a magnetic pole detection without using LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end), set [Pr. PL08 Linear servo motor/DD motor function selection 3] to "_ 1 _ _" to disable LSP and LSN.
- Set [Pr. PE47 Torque offset] to "0 (initial value)" before executing the magnetic pole detection.
- For the magnetic pole detection of vertical axis with direct drive motors, refer to section 2.1 of "Direct Drive Motor Instruction Manual".

Before the positioning operation of the direct drive motor, make sure to perform the magnetic pole detection. Before starting up the equipment, perform the test operation (positioning operation) of MR Configurator2.

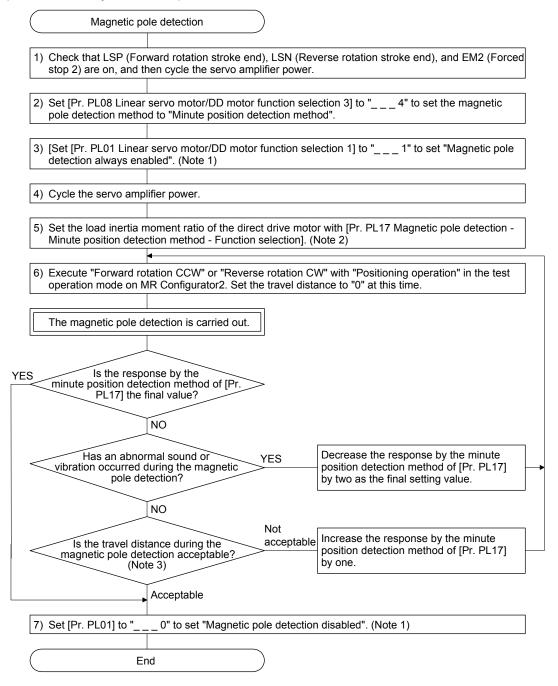
- (1) Magnetic pole detection method by using MR Configurator2

 The following shows the magnetic pole detection procedure by using MR Configurator2.
 - (a) Magnetic pole detection by the position detection method



Note. For the incremental system, the [Pr. PL01] setting is not required.

(b) Magnetic pole detection by the minute position detection method



Note 1. For the incremental system, the [Pr. PL01] setting is not required.

- 2. If the load to direct drive motor inertia ratio is unknown, perform the magnetic pole detection by the position detection method, and then perform the auto tuning to set an estimated value.
- 3. For the magnetic pole detection by the minute position detection method, the maximum rotation angle at the magnetic pole detection must be five degrees or less. To shorten the travel distance, increase the response by the minute position detection method in [Pr. PL17].

(2) Operation at the magnetic pole detection

^WARNING

● Note that the magnetic pole detection automatically starts simultaneously with the turning-on of the servo-on command.

!CAUTION

If the magnetic pole detection is not executed properly, the direct drive motor may operates unexpectedly.

POINT

- Establish the machine configuration to use LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end). The machine may be damaged due to a collision without LSP and LSN.
- Assign LSP and LSN and perform the magnetic pole detection also in the torque control mode.
- At the magnetic pole detection, whether the motor rotates in the forward or reverse direction is unpredictable.
- Depending on the setting value of [Pr. PL09 Magnetic pole detection voltage level], an overload, overcurrent, magnetic pole detection alarm, or others may occur.
- After the magnetic pole detection, check the positioning accuracy with the test operation (positioning operation function) of MR Configurator2.
- ●The accuracy of the magnetic pole detection improves with no load.

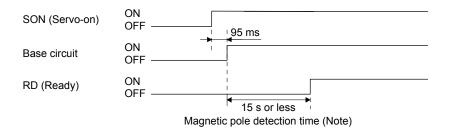
(a) Incremental system

POINT

● For the incremental system, the magnetic pole detection is required every time the power is turned on.

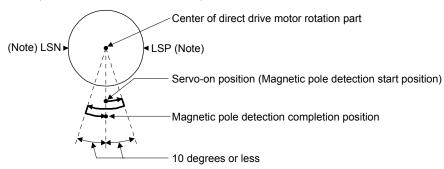
By turning on SON (Servo-on) after power-on, the magnetic pole detection is automatically carried out. Therefore, there is no need to set the parameter (first digit of [Pr. PL01]) for executing the magnetic pole detection.

1) Timing chart



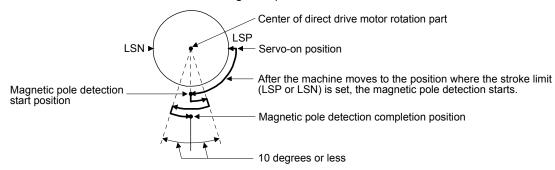
Note. The magnetic pole detection time indicates the operation time when LSP (Forward rotation stroke end) and LSN (Reverse rotation stroke end) are on.

2) Direct drive motor movement (when LSP and LSN are on)



Note. When the stroke limit (LSP or LSN) is turned off during the magnetic pole detection, the magnetic pole detection is carried on to the opposite direction. When both LSP and LSN are off, [AL. 27 Initial magnetic pole detection error] occurs.

Direct drive motor movement (when LSP or LSN is off)
 When LSP or LSN is off at servo-on, the magnetic pole detection is carried out as follows.



(b) Absolute position detection system

POINT

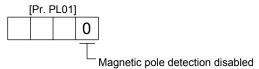
- ■When the absolute position detection system is used with the following timing, the magnetic pole detection is required.
 - System set-up (at the first startup of equipment)
 - When the Z-phase pulse of the direct drive motor is not turned on at the system setup (When the Z-phase pulse of the direct drive motor can be turned on manually, the magnetic pole detection is not required.)
 - After a direct drive motor is replaced
 - When [AL. 25 Absolute position erased] has occurred
- ■Turn on the Z-phase pulse of the direct drive motor in JOG operation from the controller after the magnetic pole detection.

Perform the magnetic pole detection in the following procedure.

 Set [Pr. PL01 Linear servo motor/DD motor function selection 1] to "___ 1" (Magnetic pole detection at first servo-on).

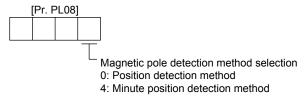


- 2) Execute the magnetic pole detection. (Refer to (2) (a) of this section.)
- 3) After the completion of the magnetic pole detection, change [Pr. PL01] to "___ 0" (Magnetic pole detection disabled).



After the magnetic pole detection, by turning on the Z-phase pulse of the direct drive motor in JOG operation and by disabling the magnetic pole detection function with [Pr. PL01], the magnetic pole detection after each power-on is not required.

(3) Magnetic pole detection method setting
Set the magnetic pole detection method using the first digit of [Pr. PL08] (Magnetic pole detection method selection).



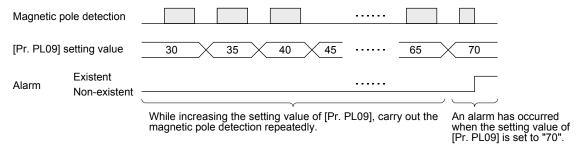
- (4) Setting of the magnetic pole detection voltage level by the position detection method For the magnetic pole detection by the position detection method, set the voltage level with [Pr. PL09 Magnetic pole detection voltage level]. For the magnetic pole detection by the minute position detection method, the voltage level setting is not required.
 - (a) Guideline of parameter settings
 Set the parameters by referring to the following table.

[Pr. PL09] setting (guide value) Servo status	Small ← Medium → Large	
Torques required for operation	Small	Large
Overload, overcurrent alarm	Seldom occurs	Frequently occurs
Magnetic pole detection alarm	Frequently occurs	Seldom occurs
Magnetic pole detection accuracy	Low	High

(b) Setting procedure

- Perform the magnetic pole detection, and increase the setting value of [Pr. PL09 Magnetic pole detection voltage level] until [AL. 50 Overload 1], [AL. 51 Overload 2], [AL. E1 Overload warning 1], and [AL. EC Overload warning 2] occur. Increase the setting value by five as a guide value. When these alarms and warnings occur during the magnetic pole detection by using MR Configurator2, the test operation of MR Configurator2 automatically completes and the servo-off status is established.
- 2) Specify the setting value that is an approximately 70% of the value set when [AL. 50 Overload 1], [AL. 51 Overload 2], [AL. E1 Overload warning 1], and [AL. EC Overload warning 2] occurred as the final setting value. However, if [AL. 27 Initial magnetic pole detection error] occurs with this value, specify a value intermediate between the value set at [AL. 50 Overload 1], [AL. 51 Overload 2], [AL. E1 Overload warning 1], or [AL. EC Overload warning 2] and the value set at the magnetic pole detection alarm as the final setting value.
- 3) Perform the magnetic pole detection again with the final setting value.

(c) Setting example



In this example, the final setting value of [Pr. PL09] is 49 (Setting value at the alarm occurrence = 70×0.7).

16.3.3 Function

(1) Servo control error detection function

POINT

●For the servo control error detection function, the position and speed deviation error detections are enabled by default. ([Pr. PL04]: _ _ _ 3)

If the servo control gets unstable for some reasons, the direct drive motor may not operate properly. To detect this state and to stop operation, the servo control error detection function is used as a protective function.

The servo control error detection function has three different detection methods: the position deviation, speed deviation, and torque deviation. An error is detected when each method is enabled with [Pr. PL04 Linear servo motor/DD motor function selection 2]. The detection level can be changed with [Pr. PL05], [Pr. PL06], and [Pr. PL07].

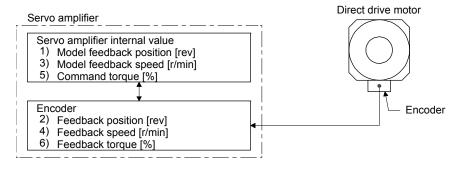


Figure 16.1 Outline of servo control error detection function

(a) Position deviation error detection

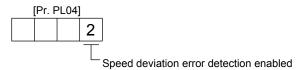
Set [Pr. PL04] to "___ 1" to enable the position deviation error detection.



When you compare the model feedback position (1)) and the feedback position (2)) in figure 16.1, if the deviation is more than the value of [Pr. PL05 Position deviation error detection level] (1 (0.01 rev) to 1000 (10 rev)), [AL. 42.1 Servo control error by position deviation] will occur and the linear servo motor will stop. The initial value of this detection level is 0.09 rev. Change the set value as necessary.

(b) Speed deviation error detection

Set [Pr. PL04] to "___ 2" to enable the speed deviation error detection.



When you compare the model feedback speed (3)) and the feedback speed (4)) in figure 16.1, if the deviation is more than the value of [Pr. PL06 Speed deviation error detection level] (1 r/min to 2000 r/min), [AL. 42.2 Servo control error by speed deviation] will occur and the linear servo motor will stop. The initial value of this detection level is 100 r/min. Change the set value as necessary.

(c) Torque deviation error detection level

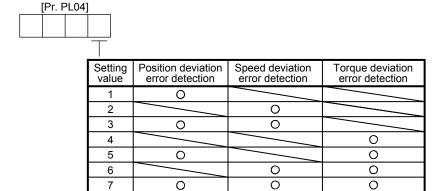
Set [Pr. PL04] to "___ 4" to enable the torque deviation error detection.



When you compare the command torque (5)) and the feedback torque (6)) in figure 16.1, if the deviation is more than the value of [Pr. PL07 Torque/thrust deviation error detection level] (1% to 1000%), [AL. 42.3 Servo control error by torque/thrust deviation] will occur and the linear servo motor will stop. The initial value of this detection level is 100%. Change the set value as necessary.

(d) Detecting multiple deviation errors

When [Pr. PL04] is set as follows, multiple deviation errors can be detected. For the error detection methods, refer to (1) (a), (b), (c) of this section.



16.4 Absolute position detection system

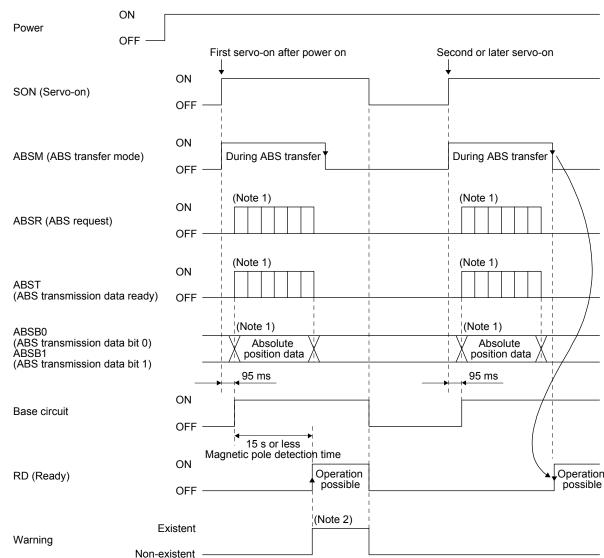
POINT

- ■To configure the absolute position detection system by using the direct drive motor, the battery and the absolute position storage unit (MR-BTAS01) are required.
- For encoder cables and absolute position storage units, refer to "Direct Drive Motor Instruction Manual".
- Replacing the absolute position storage unit (MR-BTAS01) will erase the absolute position. Start up the direct drive motor again and perform home positioning.
- Replace the battery while the control circuit power is on. Replacing the unit during control circuit power supply off will cause [AL. 25 Absolute position erased]. A battery cannot be replaced using battery connection cable (MR-J3BTCBL03M).
- [AL. 25 Absolute position erased] will occur if the encoder cable is disconnected.

When you use the system with absolute position detection system by DIO transfer (set [Pr. PA03] to "___ 1") with the following conditions, the first servo-on after power on will trigger the magnetic pole detection and [AL. 93 ABS data transfer warning] will occur.

- Magnetic pole detection always enabled (Set [Pr. PL03] to "_ _ _ 1".)
- The Z-phase pulse of the direct drive motor has not turned on.

When the magnetic pole detection is performed with absolute position detection system by DIO transfer, a deviation occurs between absolute position data of the servo amplifier side and controller side. If the operation is continued, positions will be mismatched. Therefore, [AL. 93 ABS data transfer warning] will occur on the servo amplifier side. To cancel [AL. 93 ABS data transfer warning], cycle SON (Servo-on) or set a home position.



Timing chart at power on under the condition of performing magnetic pole detection

Note 1. Refer to section 12.8.2 (1) (b) for details.

2. Performing the magnetic pole detection triggers [AL. 93 ABS data transfer warning].

For transferring absolute position data to the controller, refer to section 12.8.

16.5 Characteristics

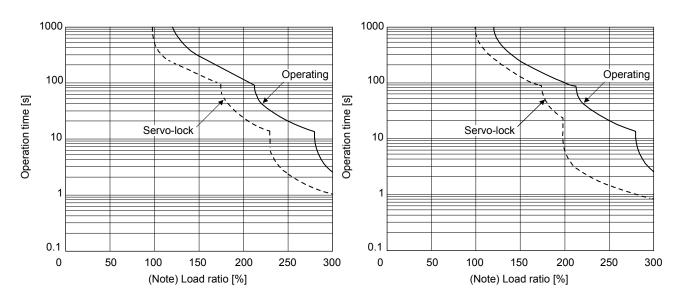
16.5.1 Overload protection characteristics

An electronic thermal is built in the servo amplifier to protect the servo amplifier, the direct drive motor, and direct drive motor power wires from overloads.

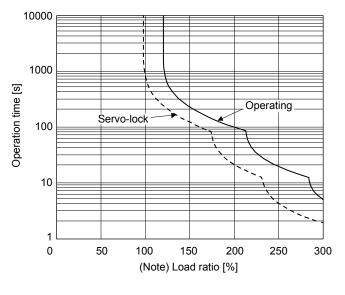
[AL. 50 Overload 1] occurs if overload operation performed is above the electronic thermal protection curve shown in fig. 16.2. [AL. 51 Overload 2] occurs if the maximum current is applied continuously for several seconds due to machine collision, etc. Use the equipment on the left-side area of the continuous 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 less of the rated torque.

This servo amplifier has solid-state direct drive motor overload protection for each axis. (The direct drive motor overload current (full load current) is set on the basis of 120% rated current of the servo amplifier.)



TM-RFM002C20/TM-RFM004C20/ TM-RFM006C20/TM-RFM006E20/ TM-RFM012E20/TM-RFM018E20/ TM-RFM012G20/TM-RFM040J10 TM-RFM048G20/TM-RFM072G20/ TM-RFM120J10



TM-RFM240J10

Note. If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a direct drive motor stop status (servo-lock status) or in a 30 r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal protection.

Fig. 16.2 Electronic thermal protection characteristics

16.5.2 Power supply capacity and generated loss

Table 16.1 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 direct drive 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 16.1 Power supply capacity and generated loss per direct drive motor at rated output

Direct drive motor	Servo amplifier	Power supply	Servo amplifier-go	Area required for	
Direct drive motor	ocivo ampilio	capacity [kVA]	At rated output	With servo-off	heat dissipation [m ²]
TM-RFM002C20	MR-J4-20A(-RJ)	0.25	25	15	0.5
TIVI-KI WOOZGZO	MR-J4-20A1(-RJ)	0.25	25	15	0.5
TM-RFM004C20	MR-J4-40A(-RJ)	0.38	35	15	0.7
11VI-RF1VIUU4G2U	MR-J4-40A1(-RJ)	0.36	33	15	0.7
TM-RFM006C20	MR-J4-60A(-RJ)	0.53	40	15	0.8
TM-RFM006E20	WIK-34-00A(-R3)	0.46	40	15	0.8
TM-RFM012E20	MR-J4-70A(-RJ)	0.81	50	15	1.0
TM-RFM018E20	MR-J4-100A(-RJ)	1.3	50	15	1.0
TM-RFM012G20	MR-J4-70A(-RJ)	0.71	50	15	1.0
TM-RFM048G20	MR-J4-350A(-RJ)	2.7	90	20	1.8
TM-RFM072G20	MR-J4-350A(-RJ)	3.8	110	20	2.2
TM-RFM040J10	MR-J4-70A(-RJ)	1.2	50	15	1.0
TM-RFM120J10	MR-J4-350A(-RJ)	3.4	90	20	1.8
TM-RFM240J10	MR-J4-500A(-RJ)	6.6	160	25	3.2

16.5.3 Dynamic brake characteristics

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 the direct drive motor stops when using EM1 (Forced stop 1) frequently in other than emergency.

(1) Dynamic brake operation

(a) Calculation of coasting distance

Fig. 16.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use equation 16.1 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the direct drive motor and machine operation speeds. (Refer to (1) (b) of this section.)

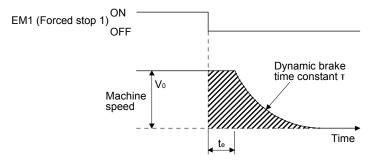


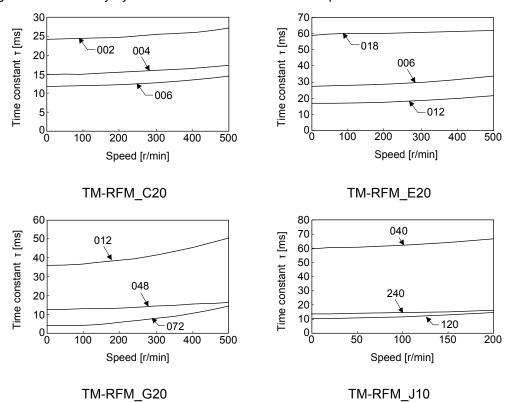
Fig. 16.3 Dynamic brake operation diagram

$$L_{\text{max}} = \frac{V_0}{60} \cdot \left\{ t_{\text{e}} + \tau \left(1 + \frac{J_L}{J_M} \right) \right\}$$
 (16.1)

L _{max} : Maximum coasting distance	[mm]
V ₀ : Machine's fast feed speed	[mm/min]
J _M : Moment of inertia of direct drive motor	[kg•cm²]
J _L : Load moment of inertia converted into equivalent value on direct drive motor rotor	[kg•cm²]
τ: Dynamic brake time constant	[s]
t _e : Delay time of control section	[s]
There is internal relay delay time of about 10 ms.	[5]

(b) Dynamic brake time constant

The following shows necessary dynamic brake time constant T for equation 16.1.



(2) Permissible load to motor inertia ratio 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 direct drive motor.

The value in the parenthesis shows the value at the rated speed of the direct drive motor.

Direct drive motor	Permissible load to motor inertia ratio [multiplier]
TM-RFM_C20	100 (300)
TM-RFM_E20	100 (300)
TM-RFM_G20	50 (300)
TM-RFM_J10	50 (200)

16. USING A DIRECT DRIVE MOTOR

MEMO	

17. FULLY CLOSED LOOP SYSTEM

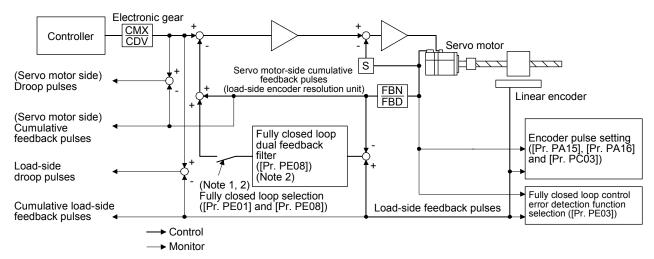
POINT

- The fully closed loop system is available for the servo amplifiers of which software version is A5 or above.
- ●When fully closed loop control system is used with this servo amplifier, "Linear Encoder Instruction Manual" is needed.
- Fully closed loop control system is available with position control mode.
- ●When fully closed loop control system is configured with MR-J4-_A_ servo amplifier, the following restrictions will be applied. However, these restrictions will not be applied for MR-J4-_A_-RJ servo amplifiers.
 - A/B/Z-phase differential output method encoder cannot be used.
 - The load-side encoder and servo motor encoder is compatible with only the two-wire type. The four-wire type load-side encoder and servo motor encoder cannot be used.
 - When you use the KG-KR and HG-MR series for driving and load-side encoder, the optional four-wire type encoder cables (MR-EKCBL30M-L, MR-EKCBL30M-H, MR-EKCBL40M-H, and MR-EKCBL50M-H) cannot be used. When an encoder cable of 30 m to 50 m is needed, fabricate a two-wire type encoder cable according to app. 8.
- ■The MR-J4-03A6(-RJ) servo amplifier is not compatible with the fully closed loop system.

17.1 Functions and configuration

17.1.1 Function block diagram

A fully closed loop control block diagram is shown below. The fully closed loop system is controlled in the load-side encoder unit.



Note 1. Switching between semi closed loop control and fully closed loop control can be performed by changing the setting of [Pr. PE01].

- When semi closed loop control is selected, a control is always performed on the bases of the position data of the servo motor encoder independently of whether the servo motor is at a stop or running.
- 2. When the fully closed loop system is enabled in [Pr. PE01], dual feedback control in which the servo motor feedback signal and load-side encoder feedback signal are combined by the dual feedback filter in [Pr. PE08] is performed. In this case, fully closed loop control is performed when the servo motor is at a stop, and semi closed loop control is performed when the servo motor is operating to improve control performance. When "4500" is set as the filter value of [Pr. PE08 Fully closed loop dual feedback filter], fully closed loop control is always performed.

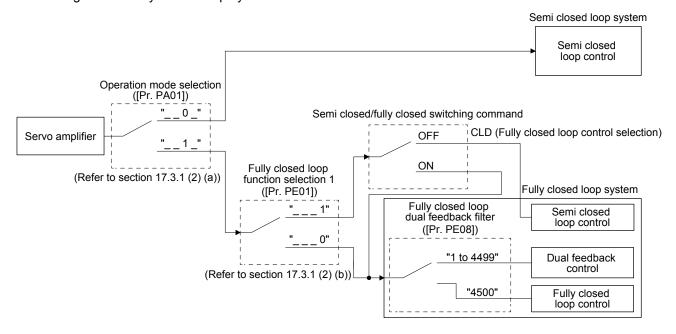
The following table shows the functions of each control mode.

Control	Description		
	Feature	Position is controlled according to the servo motor-side data.	
Semi closed loop control	Advantage	Since this control is insusceptible to machine influence (such as machine resonance), the gains of the servo amplifier can be raised and the settling time shortened.	
	Disadvantage	If the servo motor side is at a stop, the side may be vibrating or the load-side accuracy not obtained.	
	Feature	Position is controlled according to the servo motor-side data and load-side data.	
Dual feedback control	Advantage	Control is performed according to the servo motor-side data during operation, and according to the load side-data at a stop in sequence to raise the gains during operation and shorten the settling time. A stop is made with the load-side accuracy.	
	Feature	Position is controlled according to the load-side data.	
Fully closed loop control	Advantage	The load-side accuracy is obtained not only at a stop but also during operation.	
'	Disadvantage	Since this control is susceptible to machine resonance or other influences, the gains of the servo amplifier may not rise.	

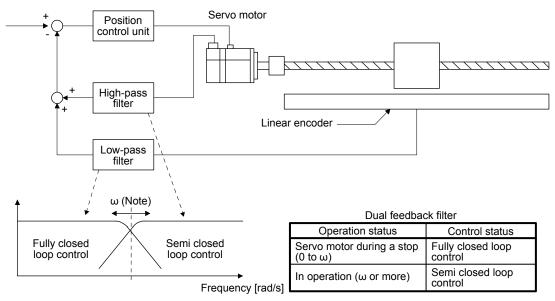
17.1.2 Selecting procedure of control mode

(1) Control mode configuration

In this servo, a semi closed loop system or fully closed loop system can be selected as a control system. In addition, the fully closed loop control and dual feedback control can be selected by the [Pr. PE08] settings on the fully closed loop system.



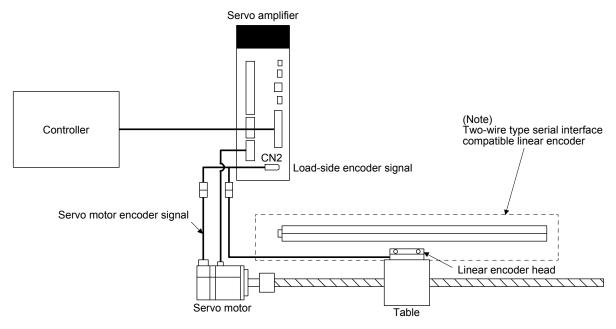
(2) Dual feedback filter equivalent block diagram A dual feedback filter equivalent block diagram on the dual feedback control is shown below.



Note. " ω " (a dual feedback filter band) is set by [Pr. PE08].

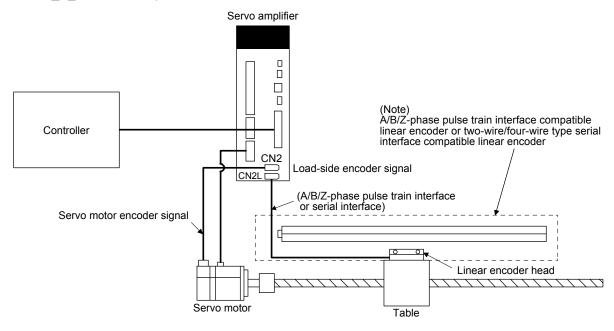
17.1.3 System configuration

- (1) For a linear encoder
 - (a) MR-J4-_A_ servo amplifier



Note. Applicable for the absolute position detection system when an absolute position linear encoder is used. In that case, a battery is not required.

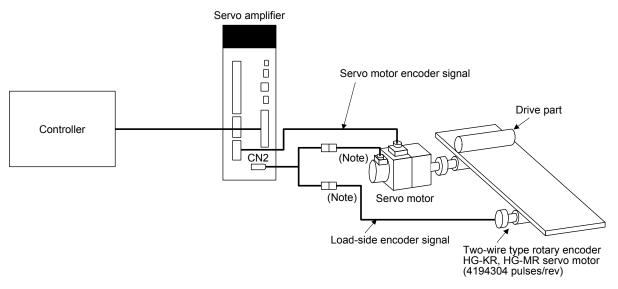
(b) MR-J4-_A_-RJ servo amplifier



Note. Applicable for the absolute position detection system when an absolute position linear encoder is used. In that case, a battery is not required.

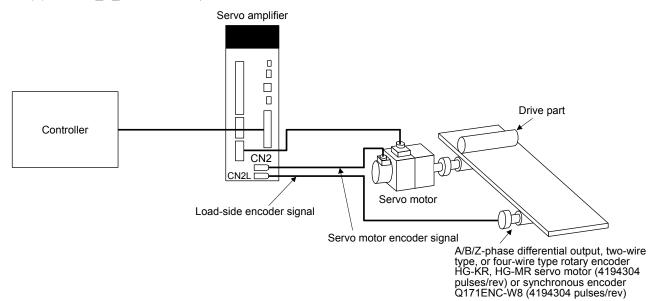
(2) For a rotary encoder

(a) MR-J4-_A_ servo amplifier



Note. Use a two-wire type encoder cable. A four-wire type linear encoder cable cannot be used.

(b) MR-J4-_A_-RJ servo amplifier



17.2 Load-side encoder

POINT

- ●Always use the load-side encoder cable introduced in this section. Using other products may cause a malfunction.
- For details of the load-side encoder specifications, performance and assurance, contact each encoder manufacturer.

17.2.1 Linear encoder

Refer to "Linear Encoder Instruction Manual" for usable linear encoders.

17.2.2 Rotary encoder

When a rotary encoder is used for the load-side encoder, use HG-KR or HG-MR servo motor as an encoder. Use a two-wire type encoder cable for MR-J4-_A_ servo amplifiers. Do not use MR-EKCBL30M-L, MR-EKCBL30M-H, or MR-EKCBL50M-H as they are four-wire type.

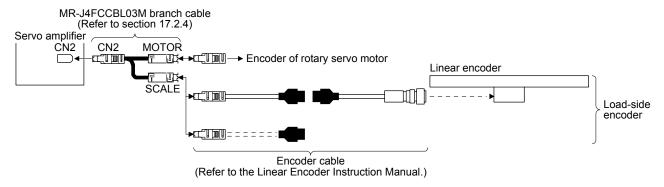
17.2.3 Configuration diagram of encoder cable

Configuration diagram for servo amplifier and load-side encoder is shown below. Cables used vary, depending on the load-side encoder.

(1) Linear encoder

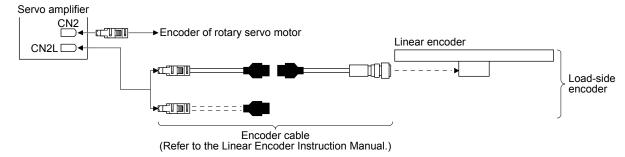
Refer to Linear Encoder Instruction Manual for encoder cables for linear encoder.

(a) MR-J4- A servo amplifier



(b) MR-J4-_A_-RJ servo amplifier

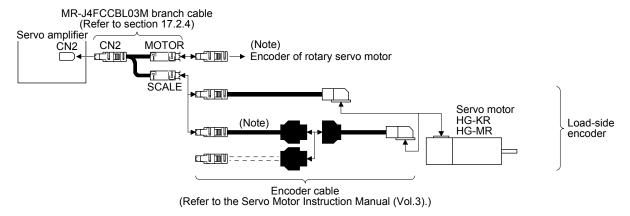
You can connect the linear encoder without using a branch cable shown in (a) for MR-J4-_A_-RJ servo amplifier. You can also use a four-wire type linear encoder.



(2) Rotary encoder

Refer to "Servo Motor Instruction Manual (Vol. 3)" for encoder cables for rotary encoders.

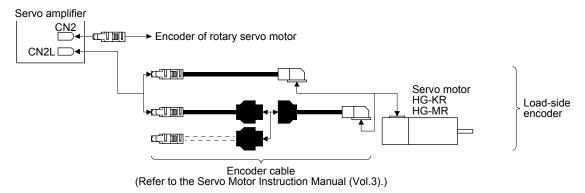
(a) MR-J4-_A_ servo amplifier



Note. Use a two-wire type encoder cable. A four-wire type linear encoder cable cannot be used.

(b) MR-J4-_A_-RJ servo amplifier

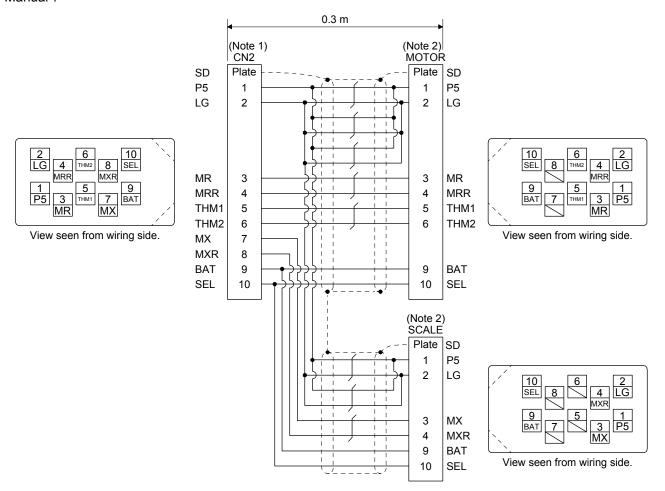
You can connect the linear encoder without using a branch cable shown in (a) for MR-J4-_A_-RJ servo amplifier. You can also use a four-wire type linear encoder.



17.2.4 MR-J4FCCBL03M branch cable

Use MR-J4FCCBL03M branch cable to connect the rotary encoder and the load-side encoder to CN2 connector.

When fabricating the branch cable using MR-J3THMCN2 connector set, refer to "Linear Encoder Instruction Manual".



Note 1. Receptacle: 36210-0100PL, shell kit: 36310-3200-008 (3M)

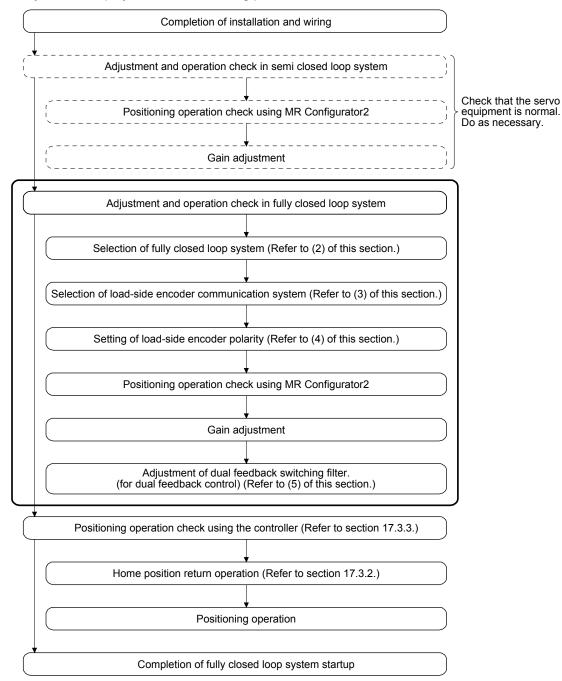
2. Plug: 36110-3000FD, shell kit: 36310-F200-008 (3M)

17.3 Operation and functions

17.3.1 Startup

(1) Startup procedure

Start up the fully closed loop system in the following procedure.

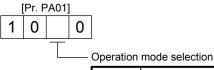


(2) Selection of fully closed loop system By setting [Pr. PA01], [Pr. PE01] and the control command of controller, the control method can be selected as shown in the following table.

[Pr. PA01]	[Pr. PE01]	Semi closed loop control/fully closed loop control switching signal	Command unit	Control method	Absolute position detection system
"0_" Semi closed loop system (standard control mode)			Servo motor encoder unit	Semi closed loop control	0
" 1 _ " Fully closed	"0"		Load-side encoder unit	Dual feedback control (fully closed loop control)	○ (Note)
loop system	" 1"	Off		Semi closed loop control	×
(fully closed loop control mode)		On		Dual feedback control (fully closed loop control)	×

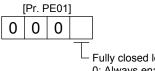
Note. Applicable when the load-side encoder is set as the absolute position encoder.

(1) Operation mode selection Select a operation mode.



Set value	Operation mode	Control unit	
0	Semi closed loop system (Standard control mode)	Servo motor-side resolution unit	
1	Fully closed loop system (Fully closed loop control mode)	Load-side encoder resolution unit	

(b) Semi closed loop control/fully closed loop control selection Select the semi closed loop control/fully closed loop control.



Fully closed loop control selection

- 0: Always enabled
- 1: Switching using the control command of controller (switching between semi closed/fully closed)

Selection using the control command of controller	Control method	
OFF	Semi closed loop control	
ON	Fully closed loop control	

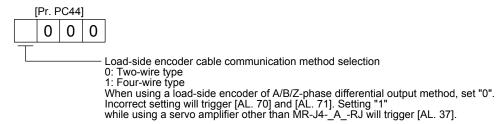
When the operation mode selection in [Pr. PA01] is set to "__1_" (fully closed loop system), this setting is enabled.

(3) Selection of load-side encoder communication method

The communication method changes depending on the load-side encoder type.

Refer to table 1.1 and "Linear Encoder Instruction Manual" for the communication method for each loadside encoder.

Select the cable to be connected to CN2L connector in [Pr. PC44].



(4) Setting of load-side encoder polarity



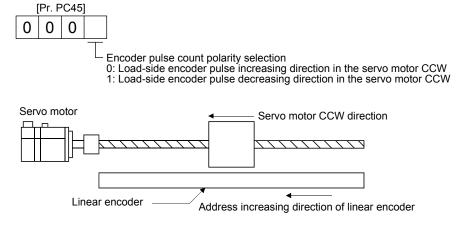
Do not set an incorrect direction to "Encoder pulse count polarity selection" in [Pr. PC45]. An abnormal operation and a machine collision may occur if an incorrect direction is set, which cause a fault and parts damaged.

POINT

- "Encoder pulse count polarity selection" in [Pr. PC45] is not related to [Pr. PA14 Rotation direction selection]. Make sure to set the parameter according to the relationships between servo motor and linear encoder/rotary encoder.
- Do not set an incorrect direction to "Encoder pulse count polarity selection" in [Pr. PC45]. Doing so may cause [AL. 42 Fully closed loop control error] during the positioning operation.

(a) Parameter setting method

Set the load-side encoder polarity to be connected to CN2L connector in order to match the CCW direction of servo motor and the increasing direction of load-side encoder feedback.



(b) How to confirm the load-side encoder feedback direction

For the way of confirming the load-side encoder feedback direction, refer to (6) in this section.

(5) Setting of feedback pulse electronic gear

POINT

●If an incorrect value is set in the feedback pulse electronic gear ([Pr. PE04], [Pr. PE05], [Pr. PE34], and [Pr. PE35]), [AL. 37 Parameter error] and an abnormal operation may occur. Also, it may cause [AL. 42.8 Fully closed loop control error by position deviation] during the positioning operation.

The numerator ([Pr. PE04] and [Pr. PE34]) and denominator ([Pr. PE05] and [Pr. PE35]) of the electronic gear are set to the servo motor-side encoder pulse. Set the electronic gear so that the number of servo motor encoder pulses per servo motor revolution is converted to the number of load-side encoder pulses. The relational expression is shown below.

[Pr. PE04] × [Pr. PE34] = Number of load-side encoder pulses per servo motor revolution Number of motor encoder pulses per servo motor revolution

Select the load-side encoder so that the number of load-side encoder pulses per servo motor revolution is within the following range.

 $4096 (2^{12}) \le \text{Number of load-side encoder pulses per servo motor revolution} \le 67108864 (2^{26})$

(a) When the servo motor is directly coupled with a ball screw and the linear encoder resolution is 0.05 μm

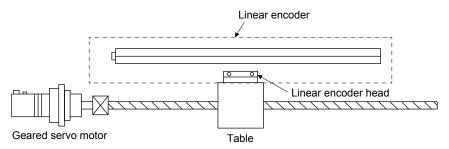
Conditions

Servo motor resolution: 4194304 pulses/rev

Servo motor reduction ratio: 1/11

Ball screw lead: 20 mm

Linear encoder resolution: 0.05 µm



Calculate the number of linear encoder pulses per ball screw revolution.

Number of linear encoder pulses per ball screw revolution

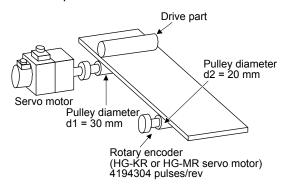
- = Ball screw lead/linear encoder resolution
- $= 20 \text{ mm}/0.05 \mu\text{m} = 400000 \text{ pulses}$

$$\frac{[\text{Pr. PE04}] \times [\text{Pr. PE34}]}{[\text{Pr. PE05}] \times [\text{Pr. PE35}]} = \frac{400000}{4194304} \times \frac{1}{11} = \frac{3125}{32768} \times \frac{1}{11}$$

(b) Setting example when using the rotary encoder for the load-side encoder of roll feeder

Conditions

Servo motor resolution: 4194304 pulses/rev Pulley diameter on the servo motor side: 30 mm Pulley diameter on the rotary encoder side: 20 mm Rotary encoder resolution: 4194304 pulses/rev



When the pulley diameters or reduction ratios differ, consider that in calculation.

$$\frac{[\text{Pr. PE04}] \times [\text{Pr. PE34}]}{[\text{Pr. PE05}] \times [\text{Pr. PE35}]} = \frac{4194304 \times 30}{4194304 \times 20} = \frac{1}{1} \times \frac{3}{2}$$

(6) Confirmation of load-side encoder position data

Check the load-side encoder mounting and parameter settings for any problems.

POINT

● Depending on the check items, MR Configurator2 may be used. Refer to section 17.3.8 for the data displayed on the MR Configurator2.

When checking the following items, the fully closed loop control mode must be set. For the setting of control mode, refer to (2) in this section.

No.	Check item	Confirmation method and description		
1	Read of load-side encoder position data	With the load-side encoder in a normal state (mounting, connection, etc.), the load-side cumulative feedback pulses value is counted normally when the load-side encoder is moved. When it is not counted normally, the following factors can be considered. 1. An alarm occurred. 2. The installation of the load-side encoder was not correct. 3. The encoder cable was not wired correctly.		
2	Read of load-side encoder home position (reference mark, Z-phase)	With the home position (reference mark, or Z-phase) of the load-side encoder in a normal condition (mounting, connection, etc.), the value of load-side encoder information 1 is cleared to 0 when the home position (reference mark, or Z-phase) is passed through by moving the load-side encoder. When it is not cleared, the following factors can be considered. 1. The installation of the load-side encoder was not correct. 2. The encoder cable was not wired correctly.		
3	Confirmation of load-side encoder feedback direction (Setting of load-side encoder polarity)	Confirm that the directions of the cumulative feedback pulses of servo motor encoder (after gear) and the load-side cumulative feedback pulses are matched by moving the device (load-side encoder) manually in the servo-off status. If mismatched, reverse the polarity.		
4	Setting of load-side encoder electronic gear	When the servo motor and load-side encoder operate synchronously, the servo motor-side cumulative feedback pulses (after gear) and load-side cumulative feedback pulses are matched and increased. If mismatched, review the setting of fully closed loop control feedback electronic gear ([Pr. PE04], [Pr. PE05], [Pr. PE34], and [Pr. PE35]) with the following method. 1) Check the servo motor-side cumulative feedback pulses (before gear). 2) Check the load-side cumulative feedback pulses. 3) Check that the ratio of above 1) and 2) has been that of the feedback electronic gear. Command Servo motor-side cumulative feedback pulses (before gear) 1) Servo motor-side cumulative feedback pulses (before gear)		

(7) Setting of fully closed loop dual feedback filter

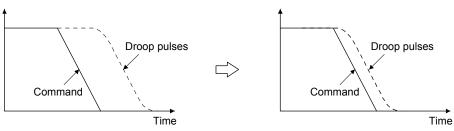
With the initial value (setting = 10) set in [Pr. PE08 Fully closed loop dual feedback filter the dual feedback filter], make gain adjustment by auto tuning, etc. as in semi closed loop control. While observing the servo operation waveform with the graph function, etc. of MR Configurator2, adjust the dual feedback filter.

The dual feedback filter operates as described below depending on the setting.

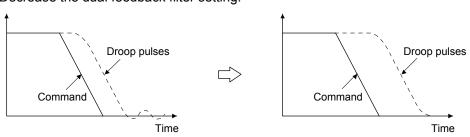
[Pr. PE08] setting	Control mode	Vibration	Settling time
1		Seldom occurs	Long time
to	Dual feedback	to	to
4499		Frequently occurs	Short time
4500	Fully closed loop		

Increasing the dual feedback filter setting shortens the settling time, but increases servo motor vibration since the motor is more likely to be influenced by the load-side encoder vibration. The maximum setting of the dual feedback filter should be less than half of the PG2 setting.

Reduction of settling time: Increase the dual feedback filter setting.



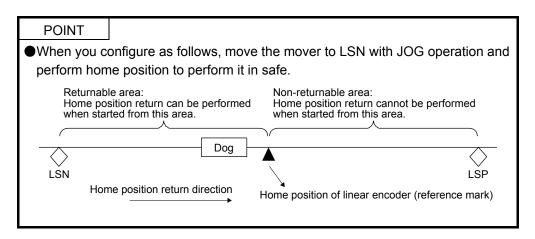
Suppression of vibration: Decrease the dual feedback filter setting.



17.3.2 Home position return

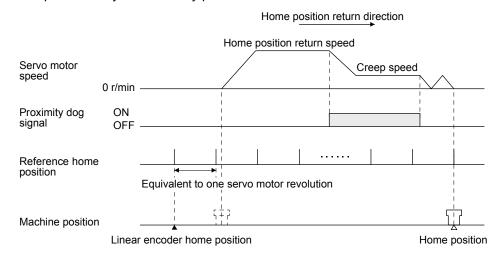
(1) General instruction

Home position return is all performed according to the load-side encoder feedback data, independently of the load-side encoder type. It is irrelevant to the Z-phase position of the servo motor encoder. In the case of a home position return using a dog signal, the home position (reference mark) must be passed through when an incremental type linear encoder is used, or the Z-phase be passed through when a rotary encoder is used, during a period from a home position return start until the dog signal turns off. For the linear encoder, a home position (reference mark) of the linear encoder is necessary in the home position return direction. In addition, set the position of the dog 1/2 rotation or more short of the reference mark.

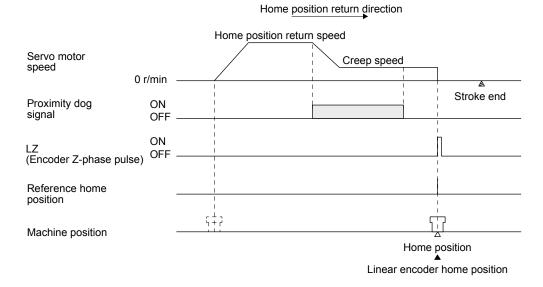


- (2) Load-side encoder types and home position return methods
 - (a) About proximity dog type home position return using absolute type linear encoder When an absolute type linear encoder is used, the home position standard position is the position per servo motor revolution to the linear encoder home position (absolute position data = 0). In the case of a proximity dog type home position return, the nearest position after proximity dog off is the home position.

The linear encoder home position may be set in any position.

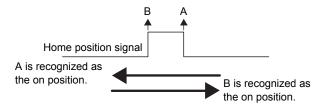


(b) Home position return using incremental linear encoder When you use an incremental linear encoder, LZ (Encoder Z-phase pulse) from the servo amplifier will be the home position (reference mark) of the linear encoder. Two or more home positions (reference marks) should not be set. In addition, the home position return cannot be executed without home position (reference mark).



 Caution for passing the home position (reference mark)
 An interval for turning on home position (reference mark) signal of the linear encoder has a certain width. (Specifications differ depending on the linear encoders. For details, refer to "Linear Encoder Instruction Manual".)

Example: When Z-phase is recognized at startup



The position which turns on a signal differs depending on the directions of home position passing. When you need to set the home position return completion to the same position each time such as dog type home position return, always start home position return with the same direction.

2) Caution for linear encoder which does not have the home position (Z-phase) The linear encoder which does not have the home position (Z-phase), LZ (Encoder Z-phase pulse) of the servo amplifier does not be outputted. The home position return can be performed depending on specifications of controllers even if LZ (Encoder Z-phase pulse) is not outputted. Check the controller specifications of the home position return.

17.3.3 Fully closed loop control error detection functions

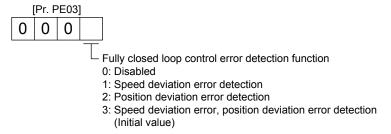
If fully closed loop control becomes unstable for some reason, the speed at servo motor side may increase abnormally. The fully closed loop control error detection function is a protective function designed to predetect it and stop operation.

The fully closed loop control error detection function has two different detection methods, speed deviation and position deviation, and errors are detected only when the corresponding functions are enabled by setting [Pr. PE03 Fully closed loop function selection 2].

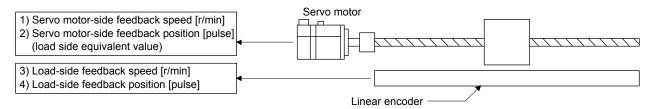
The detection level setting can be changed using [Pr. PE06] and [Pr. PE07].

(1) Parameter

The fully closed loop control error detection function is selected.

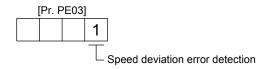


(2) Fully closed loop control error detection functions



(a) Speed deviation error detection

Set [Pr. PE03] to "___ 1" to enable the speed deviation error detection.



The function compares the servo motor-side feedback speed (1)) and load-side feedback speed (3)). If the deviation is not less than the set value (1 r/min to the permissible speed) of [Pr. PE06 Fully closed loop control speed deviation error detection level], the function generates [AL. 42.2 Servo control error by speed deviation] and stops the motor. The initial value of [Pr. PE06] is 400 r/min. Change the set value as necessary.

(b) Position deviation error detection

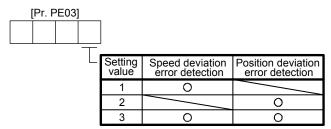
Set [Pr. PE03] to "___2" to enable the position deviation error detection.



Comparing the servo motor-side feedback position (2)) and load-side feedback position (4)), if the deviation is not less than the set value (1 kpulses to 20000 kpulses) of [Pr. PE07 Fully closed loop control position deviation error detection level], the function generates [AL. 42.1 Servo control error by position deviation] and stops the motor. The initial value of [Pr. PE07] is 100 kpulses. Change the set value as necessary.

(c) Detecting multiple deviation errors

When setting [Pr. PE03] as shown below, multiple deviation errors can be detected. For the error detection method, refer to (2) (a), (b) in this section.



17.3.4 Auto tuning function

Refer to section 6.3 for the auto tuning function.

17.3.5 Machine analyzer function

Refer to Help of MR Configurator2 for the machine analyzer function of MR Configurator2.

17.3.6 Test operation mode

Test operation mode is enabled by MR Configurator2.

For details on the test operation, refer to section 4.5.9.

Function	Item	Usability	Remark
	JOG operation	0	It drives in the load-side encoder resolution unit
	Positioning operation	0	The fully closed loop system is operated in the load-side encoder resolution
Test operation	Program operation	0	unit. For details, refer to section 4.5.9 (5).
mode	Output signal (DO) forced output	0	Refer to section 4.5.9 (6).
	Motor-less operation		

17.3.7 Absolute position detection system under fully closed loop system

An absolute type linear encoder is necessary to configure an absolute position detection system under fully closed loop control using a linear encoder. In this case, the encoder battery (MR-BAT6V1SET) need not be installed to the servo amplifier. When an rotary encoder is used, an absolute position detection system can be configured by installing the encoder battery (MR-BAT6V1SET) to the servo amplifier. In this case, the battery life will be shorter because the power consumption is increased as the power is supplied to the two encoders of motor side and load side.

For the absolute position detection system with linear encoder, the restrictions mentioned in this section apply. Enable the absolute position detection system with [Pr. PA03 Absolute position detection system] and use this servo within the following restrictions.

(1) Using conditions

- (a) Use an absolute type linear encoder with the load-side encoder.
- (b) Select Always fully closed loop ([Pr. PA01] = _ 1 _ and [Pr. PE01] = _ _ 0).
- (2) Absolute position detection range using encoder

Encoder type	Absolute position detection enabled range
Linear encoder (serial interface)	Movable distance range of linear encoder (within 32-bit absolute position data)

(3) Alarm detection

The absolute position-related alarm ([AL. 25]) and warnings (AL. 92] and [AL. 9F]) are not detected.

(4) Absolute position data transfer to controller

It is the same process as rotary servo motors. (Refer to section 12.8.)

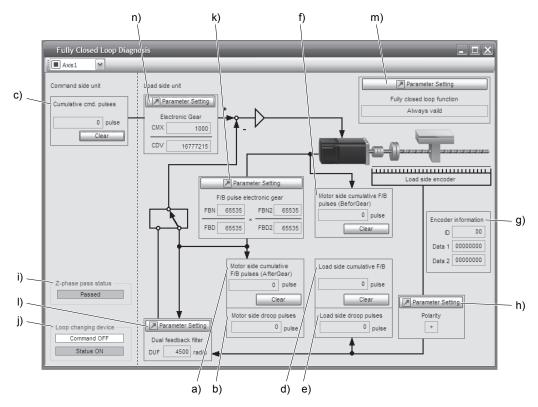
17.3.8 About MR Configurator2

Using MR Configurator2 can confirm if the parameter setting is normal or if the servo motor and the load-side encoder operate properly.

This section explains the fully closed diagnosis screen.

Click "Monitor start" to constantly read the monitor display items from the servo amplifier.

Then, click "Monitor stop" to stop reading. Click "Parameter read" to read the parameter items from the servo amplifier, and then click "Parameter write" to write them.



Symbol	Name	Explanation	Unit
a)	Motor-side cumu. feedback pulses	Feedback pulses from the servo motor encoder are counted and displayed. (load-side encoder unit)	pulse
	(after gear)	When the set value exceeds 99999999, it starts with 0.	
	,	Click "Clear" to reset the value to 0.	
		The "-" symbol is indicated for reverse.	
b)	Motor-side droop pulses	Droop pulses of the deviation counter between a servo motor-side position and a command are displayed.	pulse
		The "-" symbol is indicated for reverse.	
c)	Cumulative command	Position command input pulses are counted and displayed.	pulse
	pulses	Click "Clear" to reset the value to 0.	
		The "-" symbol is indicated for reverse command.	
d)	Load-side cumulative	Feedback pulses from the load-side encoder are counted and displayed.	pulse
	feedback pulses	When the set value exceeds 999999999, it starts with 0.	
		Click "Clear" to reset the value to 0.	
		The "-" symbol is indicated for reverse.	
e)	Load-side droop pulses	Droop pulses of the deviation counter between a load-side position and a command are displayed.	pulse
		The "-" symbol is indicated for reverse.	
f)	Motor-side cumu. feedback	Feedback pulses from the servo motor encoder are counted and displayed. (Servo	pulse
	pulses	motor encoder unit)	
	(Before Gear)	When the set value exceeds 999999999, it starts with 0.	
		Click "Clear" to reset the value to 0.	
		The "-" symbol is indicated for reverse.	1

The load-side encoder information is displayed. The display contents differ depending on the load-side encoder type. - ID: The ID No. of the load-side encoder is displayed. - Data 1: For the incremental type linear encoder, the counter from pow displayed. For the absolute position type linear encoder, the a position data is displayed. - Data 2: For the incremental type linear encoder, the distance (number from the reference mark (2-phase) is displayed. For the absolute position from the reference mark (2-phase) is displayed. For the absolute type linear encoder, "00000000" is displayed. For the absolute position in the servo motor CCW, at: in indicated a address decreasing direction in the servo motor CCW, at: indicated a address decreasing direction in the servo motor CCW, at: indicated a address decreasing direction in the servo motor CCW, at: indicated a address decreasing direction in the servo motor CCW, at: indicated a address decreasing direction in the servo motor CCW, at: indicated a address decreasing direction in the servo motor CCW, at: indicated a address decreasing direction in the servo motor CCW, at: indicated a address decreasing direction in the servo motor CCW, at: indicated a address decreasing direction in the servo motor CCW, at: "Enabled" or "Semi closed loop control/fully closed loop control switching the encoder is displayed. The state of the semi closed loop control/fully closed loop control switching the inside state during selection are displayed. The state of the semi closed loop control/fully closed loop control switching the inside state during selection are displayed. The feedback pulse electronic gears (IPr. PE04], IPr. PE05], IPr. PE34], are displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) IPresident feedback pulse electronic gears (IPr. PE04], IPr. PE05], IPr. PE34], are displayed/s	bsolute of pulses) ute position			
ID: The ID No. of the load-side encoder is displayed. Data 1: For the incremental type linear encoder, the counter from pow displayed. For the absolute position type linear encoder, the distance (number from the reference mark (Z-phase) is displayed. For the absolute position type linear encoder, the distance (number from the reference mark (Z-phase) is displayed. For the absolute type linear encoder, "00000000" is displayed. For the absolute type linear encoder, "00000000" is displayed. For the absolute type linear encoder, "00000000" is displayed. For the absolute type linear encoder, "00000000" is displayed. For the absolute type linear encoder, "00000000" is displayed. For the absolute address decreasing direction in the servo motor CCW, as "-". If the fully closed loop system is "disabled", the Z-phase pass status of the encoder is displayed. If the fully closed loop system is "Enabled" or "Semi closed loop system is "Enabled" or "Semi closed loop control/fully closed is displayed. Ji	bsolute of pulses) ute position	\		
Data 1: For the incremental type linear encoder, the counter from pow displayed. For the absolute position type linear encoder, the a position data is displayed. Data 2: For the incremental type linear encoder, the distance (number from the reference mark (Z-phase) is displayed. For the absolute position data is displayed. In Polarity For address increasing direction in the servo motor CCW, as "-". I) Z-phase pass status If the fully closed loop system is "disabled", the Z-phase pass status of the encoder is displayed. If the fully closed loop system is "Enabled" or "Semi control/fully closed loop control switching", the Z-phase pass status of the encoder is displayed. J) Fully closed loop changing device s displayed. K) Parameter (Feedback pulse electronic gear) The state of the semi closed loop control/fully closed loop control switching", the device is displayed. The state of the semi closed loop control/fully closed loop control switching the inside state during selection are displayed. The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], are displayed/set for servo motor encoder pulses in this parameter. (Refer 17.3.1 (5).) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/parameter. The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-England and the second passes in the secon	bsolute of pulses) ute position			
displayed. For the absolute position type linear encoder, the a position data is displayed. • Data 2: For the incremental type linear encoder, the distance (number from the reference mark (Z-phase) is displayed. For the absolutype linear encoder, "0000000" is displayed. For the absolutype linear encoder, "00000000" is displayed. For address increasing direction in the servo motor CCW, it is indicated a address decreasing direction in the servo motor CCW, as "-". i) Z-phase pass status If the fully closed loop system is "disabled", the Z-phase pass status of the encoder is displayed. If the fully closed loop system is "Enabled" or "Semi controllfully closed loop control switching", the Z-phase pass status of the encoder is displayed. j) Fully closed loop changing device i) Fully closed loop control switching the inside state during selection are displayed. The state of the semi closed loop control/fully closed loop control switching the inside state during selection are displayed. The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], are displayed/set for servo motor encoder pulses in this parameter. (Reference filter) The parameter (fully closed loop function) Parameter (fully closed loop function) The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control Englated and the section of t	bsolute of pulses) ute position			
displayed. For the absolute position type linear encoder, the a position data is displayed. Data 2: For the incremental type linear encoder, the distance (number from the reference mark (Z-phase) is displayed. For the absolutype linear encoder, "00000000" is displayed. For the absolutype linear encoder, "00000000" is displayed. For the absolutype linear encoder, "00000000" is displayed. For address increasing direction in the servo motor CCW, it is indicated a address decreasing direction in the servo motor CCW, as "-". If the fully closed loop system is "disabled", the Z-phase pass status of the encoder is displayed. If the fully closed loop system is "Enabled" or "Semi controll/fully closed loop control switching", the Z-phase pass status of the encoder is displayed. Ji) Fully closed loop changing device Ji) Fully closed loop changing device Ji) Fully closed loop changing device Jii) Fully closed loop changing device Jiii) Fully closed loop changing device Jiii) Fully closed loop control switching selection are displayed. The state of the semi closed loop control/fully closed loop control switching the inside state during selection are displayed. Jiii) Parameter (Feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], are displayed/set for servo motor encoder pulses in this parameter. (Reference filter) Jiii) Parameter (fully closed loop function) Jiii) Parameter (fully closed loop function) Jiii) Parameter (fully closed loop function) Jiii) Parameter (fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control is displayed or set. Click "Param	bsolute of pulses) ute position			
position data is displayed. Data 2: For the incremental type linear encoder, the distance (number from the reference mark (Z-phase) is displayed. For the absol type linear encoder, "0000000" is displayed. Polarity For address increasing direction in the servo motor CCW, it is indicated a address decreasing direction in the servo motor CCW, as "-". If the fully closed loop system is "disabled", the Z-phase pass status of the encoder is displayed. If the fully closed loop system is "Enabled" or "Semi control/fully closed loop control switching", the Z-phase pass status of the encoder is displayed. The state of the semi closed loop control/fully closed loop control/fully closed switching", the device is displayed. The state of the semi closed loop control/fully closed loop control/fully closed switching selection are displayed. The state of the semi closed loop control/fully closed loop control switchin the inside state during selection are displayed. The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], a are displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) Parameter (Dual feedback filter) Parameter (fully closed loop function) Parameter (fully closed loop function) The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Engagement and the section of the secti	of pulses) ute position			
Data 2: For the incremental type linear encoder, the distance (number from the reference mark (Z-phase) is displayed. For the absolity per linear encoder, "00000000" is displayed. I) Polarity For address increasing direction in the servo motor CCW, it is indicated a address decreasing direction in the servo motor CCW, as "-". I) Z-phase pass status If the fully closed loop system is "disabled", the Z-phase pass status of the encoder is displayed. If the fully closed loop system is "Enabled" or "Semi control/fully closed loop control/fully closed loop control/fully closed loop control/fully closed device switching", the device is displayed. The state of the semi closed loop control/fully closed loop control switching the inside state during selection are displayed. The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], are displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) I) Parameter (Dual feedback filter) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/ parameter. The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-English and section parameter and section parameter is the second control	ute position	\		
from the reference mark (Z-phase) is displayed. For the absolitype linear encoder, "00000000" is displayed. h) Polarity For address increasing direction in the servo motor CCW, is is indicated a address decreasing direction in the servo motor CCW, as "-". i) Z-phase pass status If the fully closed loop system is "disabled", the Z-phase pass status of the encoder is displayed. If the fully closed loop system is "Enabled" or "Semi control/fully closed loop control switching", the Z-phase pass status of the encoder is displayed. j) Fully closed loop changing device The fully closed loop control switching", the device is displayed. k) Parameter (Feedback pulse electronic gear is "Semi closed loop control/fully closed switching", the device is displayed. The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], a are displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) I) Parameter (Dual feedback filter) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-E leave and the latest seeding and the latest seedin	ute position	١ ١		
h) Polarity For address increasing direction in the servo motor CCW, it is indicated a address decreasing direction in the servo motor CCW, as "-". If the fully closed loop system is "disabled", the Z-phase pass status of the encoder is displayed. If the fully closed loop system is "Enabled" or "Semi control/fully closed loop control switching", the Z-phase pass status of the encoder is displayed. Only if the fully closed loop control switching", the Z-phase pass status of the encoder is displayed. Only if the fully closed loop system is "Semi closed loop control/fully close displayed. The state of the semi closed loop control/fully closed loop control/fully closed switching", the device is displayed. The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], a are displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) The parameter (Dual feedback filter) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/parameter. The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Englave and the parameter setting" button to display the "Fully closed loop control-Englave and the control of the second cont	s "+" and for	\		
address decreasing direction in the servo motor CCW, as "-". If the fully closed loop system is "disabled", the Z-phase pass status of the encoder is displayed. If the fully closed loop system is "Enabled" or "Semi control/fully closed loop control switching", the Z-phase pass status of the encoder is displayed. Ji Fully closed loop changing device s displayed. The fully closed loop control/fully closed loop control/fully closed loop control/fully closed loop control/fully closed loop control switching the inside state during selection are displayed. The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], are displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) The parameter (Dual feedback filter) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/parameter. The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Englance and selection and selection are displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Englance and selection are displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Englance and selection are displayed and s	s "+" and for	\		
address decreasing direction in the servo motor CCW, as "-". If the fully closed loop system is "disabled", the Z-phase pass status of the encoder is displayed. If the fully closed loop system is "Enabled" or "Semi control/fully closed loop control switching", the Z-phase pass status of the encoder is displayed. Ji Fully closed loop changing device s displayed. The fully closed loop control/fully closed loop control/fully closed loop control/fully closed loop control/fully closed loop control switching the inside state during selection are displayed. The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], are displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) The parameter (Dual feedback filter) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/parameter. The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Englance and selection and selection are displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Englance and selection are displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Englance and selection are displayed and s	,			
If the fully closed loop system is "disabled", the Z-phase pass status of the encoder is displayed. If the fully closed loop system is "Enabled" or "Semi control/fully closed loop control switching", the Z-phase pass status of the encoder is displayed. j) Fully closed loop changing device				
encoder is displayed. If the fully closed loop system is "Enabled" or "Semi control/fully closed loop control switching", the Z-phase pass status of the encoder is displayed. John	e servo motor			
control/fully closed loop control switching", the Z-phase pass status of the encoder is displayed. j) Fully closed loop changing device Only if the fully closed loop system is "Semi closed loop control/fully closed switching", the device is displayed. The state of the semi closed loop control/fully closed loop control switching the inside state during selection are displayed. K) Parameter (Feedback pulse electronic gear) The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], a red displayed/set for servo motor encoder pulses in this parameter. (Reference filter) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/parameter. The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Englance in the parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Englance in the parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Englance in the parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Englance in the parameter for the set of the control of the parameter for the set of the control of the parameter for the set of the control of the parameter for the set of the control of the parameter for the set of the control of the parameter for the set of the control of the parameter for the set of the control of the parameter for the set of the control of the parameter for the set of the control of the parameter for the set of the control of the parameter for the set of the control of the parameter for the set of the control of the parameter for the set of the control of the parameter for the parameter for the full of the parameter for the parameter for the full of the parameter for the full of the parameter for the full of the parameter	, , , , , , , , , , , , , , , , , , , ,			
encoder is displayed. Only if the fully closed loop system is "Semi closed loop control/fully closed switching", the device is displayed. The state of the semi closed loop control/fully closed loop control switching the inside state during selection are displayed. I) Parameter (Feedback pulse electronic gears) The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], are displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/parameter. m) Parameter (fully closed loop function) The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-Eigen Parameter setting" button to display the "Fully closed loop control-Eigen Parameter flat site encoder place in the condensate button is exceeding the encoder place in the condensate button is exceeding the encoder place in the condensate button is exceeding the encoder place in the condensate button is exceeding the encoder place in the condensate button is exceeding the encoder place is encoder place. 1) Parameter of encoder place is a place in encoder place is encoder place. 1) Parameter of encoder place is a place in encoder place is a place in encoder place in encoder place. 1) Parameter of encoder place is a place in encoder place is a place in encoder place in encoder place in encoder place. 1) Parameter of encoder place in e	ontrol/fully closed loop control switching", the Z-phase pass status of the load-side			
device switching", the device is displayed. The state of the semi closed loop control/fully closed loop control switching the inside state during selection are displayed. The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], a re displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) Parameter (Dual feedback filter) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/ parameter. The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-E Description Pulse Description Pulse Description Pulse Description D				
device switching", the device is displayed. The state of the semi closed loop control/fully closed loop control switching the inside state during selection are displayed. The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], a re displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) Parameter (Dual feedback filter) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/ parameter. The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-E Description Pulse Description Pulse Description Pulse Description D	d loop control			
The state of the semi closed loop control/fully closed loop control switching the inside state during selection are displayed. Parameter (Feedback pulse electronic gears) The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], a red displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).)	a 1996 30111191			
the inside state during selection are displayed. k) Parameter (Feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], a are displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) I) Parameter (Dual feedback filter) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/ parameter. The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-E (Click "Parameter setting" button to display the "Fully closed loop control-E (Click "Parameter setting" button to display the "Fully closed loop control-E (Click "Parameter setting" button to display the "Fully closed loop control-E (Click "Parameter setting" button to display the "Fully closed loop control-E (Click "Parameter setting" button to display the "Fully closed loop control-E (Click "Parameter setting" button selection (FCT) Fully closed loop function sel	g signal and			
Red Parameter (Feedback pulse electronic gears) The feedback pulse electronic gears ([Pr. PE04], [Pr. PE05], [Pr. PE34], a are displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).)	5 / 5	/		
pulse electronic gear) are displayed/set for servo motor encoder pulses in this parameter. (Refe 17.3.1 (5).) Parameter (Dual feedback filter) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/parameter. The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-E Parameter (fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-E Parameter setting" button to display the "Fully closed loop control-E Parameter setting" button to display the "Fully closed loop control-E Parameter setting" button to display the "Fully closed loop function setcion (Fully loops and but in the increase of the control	nd [Pr. PE351)			
17.3.1 (5).) I) Parameter (Dual feedback filter) The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/parameter. The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-E **Parameter setting** button to display the "Fully closed loop control-E **Parameter setting** **Param				
The band of [Pr. PE08 Fully closed loop dual feedback filter] is displayed/parameter. The parameter (fully closed loop function) The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-E Parameter Setting" button to display the "Fully closed loop control-E Parameter Setting" button to display the "Fully closed loop control-E Parameter Setting" button to display the "Fully closed loop control-E Parameter Setting" button to display the "Fully closed loop function selection (FCT1) Parameter closed setting looped control Septembal Setting (Seet Set Set Set Set Set Set Set Set Set		/		
filter) Parameter (fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-E Parameter Setting	set in this			
The parameter for the fully closed loop control is displayed or set. Click "Parameter setting" button to display the "Fully closed loop control-E Parameter Setting Asst Asst Asst Asst Asst Asst Asst Ass				
Click "Parameter setting" button to display the "Fully closed loop control-E Parameter Setting Fully closed control Basic Fully closed loop function selection Always valid Fully closed control Basic Fully closed				
Parameter Setting	Rasic" window			
Parameter Book Para	dolo willdow.			
1) Fully closed loop function selection ([Pr.PE01])				
1) Fully closed loop function selection ([Pr.PE01]) Fully closed loop function selection ([Pr.PE01])				
Folly closed loop function selection (**CT1) Feedback puise electronic gear(**BN, *FBD, *				
Postlon control Speed control Speed control Speed setting (Speed setting (Spee				
Always valid Seed esting (Seek Serve adjustments - Gan changing - Pully closed control - Pully closed loop function selection ([Pr.PE01])	2)			
(a) Serve adjustments (b) Gan changing (c) Digital (1/0) (c) Analog input (c) Analog input (c) Fully closed control (c) Analog input (c) Analo				
3) Analog roput C.Load side encoder ("CDP9" ("CDPA) Selection of Load side encoder cable communication method 2. w/re M Selection of Load side encoder cable communication method 2. w/re M Selection of encoder pulse is in the horeasing direction by the serve meter CCW Selection of ABZ-phase input interface encoder Z-phase connection judgment function Z-phase side no-signal alarm detection valid M M M M M M M M M				
3) Charly doed control Selection of Load side encoder cable communication method 2-wire M				
4) Selection of encoder pulse count polarity Encoder pulse is in the increasing direction by the serve motor CCW Selection of ABZ-phase input interface encoder Z-phase connection judgment function Z-phase side no-signal alarm detection valid 1) Fully closed loop function selection ([Pr.PE01])				
Encoder julies is in the increasing direction by the serve motor CCW Selection of ABZ-phase input interface encoder Z-phase connection judgment function Z-phase side no-signal alarm detection valid The phase side no-signal alarm detection ([Pr.PE01])		i		
2-shase side no-signal alarm detection valid 1) Fully closed loop function selection ([Pr.PE01])		ĺ		
Fully closed loop function selection ([Pr.PE01])				
, , , , , , , , , , , , , , , , , , , ,				
, , , , , , , , , , , , , , , , , , , ,				
The state of the s		1		
■ 1		1		
2) Setting of feedback pulse electronic gear ([Pr. PE04], [Pr. PE05], [Pr. F	PE34], [Pr.	1		
PE35])		1		
Setting of feedback pulse electronic gear				
0) 1 2 2 2 2 2 2 2 2 2	,			
3) Load-side encoder cable communication method selection ([Pr. PC44]	* I			
This is used to select a load-side encoder cable to be connected to the	: CN2L			
connector.				
4) Encoder pulse count polarity selection ([Pr. PC45])				
Polarity of the load-side encoder cable information is selected.				
Folanty of the load-side encoder capie information is selected.				
5) Selection of A/B/Z-phase input interface encoder Z-phase connection	udgement	1		
function ([Pr. PC45])		- 1		
Select the non-signal detection status for the pulse train signal from the				
input interface encoder used as a linear encoder or load-side encoder.	e A/B/Z-phase			
This function is enabled only when you use an A/B/Z-phase input inter				
n) Parameter (electronic gear) Electronic gear ([Pr. PA05], [Pr. PA06], [Pr. PA07], [Pr. PA13], [Pr. PA21]				
This is used to set parameters for the electronic gear.	face encoder.			

17. FULLY CLOSED LOOP SYSTEM

MEMO		

18. MR-J4-03A6(-RJ) SERVO AMPLIFIER

The following item is the same as 100 W or more MR-J4-_A_(-RJ) servo amplifiers. Refer to the section of the detailed explanation field for details.

Item	Detailed explanation	
Parameter	Chapter 5	
Normal gain adjustment	Chapter 6	
Special adjustment function	Chapter 7	
Troubleshooting	Chapter 8	
Absolute position detection system	Chapter 12	

Note. Refer to section 18.5.4 when operating one-touch tuning by using push button switch.

18.1 Functions and configuration

18.1.1 Summary

MR-J4-03A6(-RJ) servo amplifier is MELSERVO-J4 series 48 V DC and 24 V DC power compatible ultrasmall capacity servo amplifier.

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.

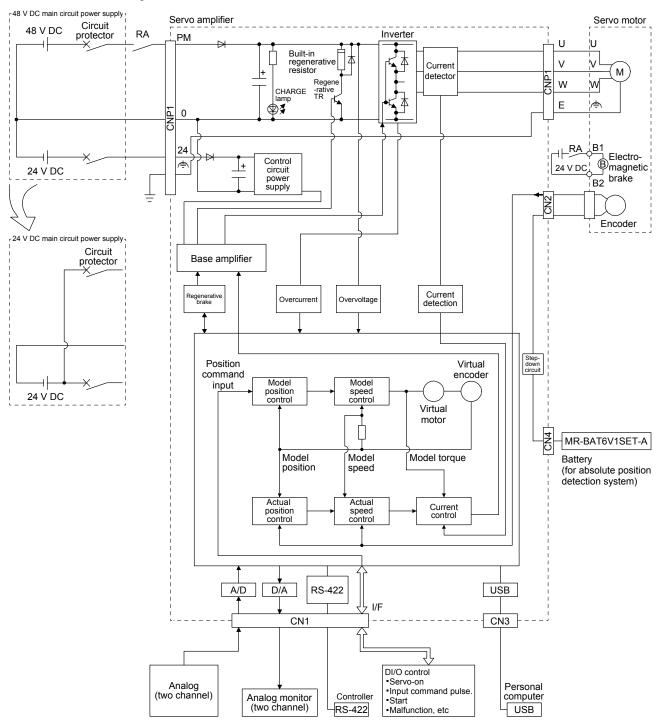
With one-touch tuning and real-time auto tuning, you can automatically adjust the servo gains according to the machine.

The following shows the differences with 100 W or more MR-J4-_A_(-RJ) servo amplifier.

		Differ			
Category	Item	MR-J4A_(-RJ) 100 W or more	MR-J4-03A6(-RJ)	Related parameter	
Power supply	Main circuit power supply	200 V AC/400 V AC/ 100 V AC	48 V DC/24 V DC	[Pr. PC27]	
	Control circuit power supply	200 V AC/400 V AC/ 100 V AC	24 V DC		
Functional safety	STO function	Compatible			
Encoder	Encoder resolution	4194304 pulses/rev	262144 pulses/rev		
Status display	7-segment LED display digits	5-digits	3-digits	[Pr. PC36]	
Analog monitor output	Output voltage range	± 10 V	5 V ± 4 V	[Pr. PC14]/[Pr. PC15]	
Dynamic brake	Stop system	Stop with dynamic brake	Stop with electronic dynamic brake	[Pr. PF09]/[Pr. PF15]	
Regenerative option Regenerative option selection		Compatible		[Pr. PA02]	
Operation mode	Fully closed loop control mode	Compatible		[Pr. PA01]	
	Linear servo motor control mode	Compatible			
	DD motor control mode	Compatible			
Function	SEMI-F47 function	Compatible		[Pr. PA20]/[Pr. PF25]	
	J3A electronic gear setting value compatibility mode	Compatible		[Pr. PA21]	
	Instantaneous power failure tough drive	Compatible		[Pr. PA20]/[Pr. PF25]	
	Parameter unit	Compatible		[Pr. PF34]	

18.1.2 Function block diagram

The function block diagram of this servo is shown below.



18.1 3 Servo amplifier standard specifications

Model		MR-J4-03A6(-RJ)		
Rated output		30 W		
Output Rated voltage		3-phase 13 V AC		
Output	Rated current [A]	2.4		
	Voltage	48 V DC/24 V DC (Note 5)		
	Dated aurrent	For 48 V DC: 1.2 A		
Main circuit	Rated current	For 24 V DC: 2.4 A		
power supply input	Permissible voltage	For 48 V DC: 40.8 V DC to 55.2 V DC		
	fluctuation	For 24 V DC: 21.6 V DC to 26.4 V DC		
	Power supply capacity	Refer to section 18.7.2.		
	Inrush current	Refer to section 18.7.4.		
	Voltage	24 V DC		
Control circuit	Rated current [A]	0.2		
power supply input	Permissible voltage fluctuation	21.6 V DC to 26.4 V DC		
input	Power consumption [W]	5.0		
	Inrush current [A]	Refer to section 18.7.4.		
Interface	Voltage	24 V DC ± 10%		
power supply	Current capacity [A]	0.3 (Note 1)		
Control method	1	Sine-wave PWM control, current control method		
Permissible regenerative power of servo amplifier built-in regenerative resistor [W]		0.7		
Dynamic brake (Note 4)		Built-in (electronic dynamic brake)		
Communication function		USB: connection to a personal computer or others (MR Configurator2-compatible)		
		RS-422: 1: n communication (up to 32 axes)		
Encoder output pulses		Compatible (A/B/Z-phase pulse)		
Analog monitor		Two channels		
	Max. input pulse frequency	4 Mpulses/s (for differential receiver) (Note 3), 200 kpulses/s (for open collector)		
Danition	Positioning feedback pulse	Encoder resolution (resolution per servo motor revolution): 18 bits		
Position control mode	Command pulse multiplying factor	Electronic gear 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 rotation (this can be changed from parameter setting)		
	Torque limit	Set by parameter setting or external analog input (0 V DC to +10 V DC/maximum torque)		
	Speed control range	Analog speed command 1: 2000, internal speed command 1: 5000		
Speed control	Analog speed command input	0 to ±10 V DC/rated speed (The speed at 10 V is changeable with [Pr. PC12].)		
mode	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 by parameter setting or external analog input (0 V DC to +10 V DC/maximum torque)		
Torque	Analog torque command input	0 V DC to ±8 V DC/maximum torque (input impedance 10 k Ω to 12 k Ω)		
control mode	Speed limit	Set by parameter setting or external analog input (0 V DC to 10 V DC/rated speed)		
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		

Model			MR-J4-03A6(-RJ)		
Compliance to global CE marking			LVD: EN 61800-5-1/EN 60950-1 EMC: EN 61800-3		
standards	UL standard		UL 508C (NMMS2)		
Structure (IP r	ating)		Natural cooling, open (IP20)		
Close mounting			Possible (Note 2)		
DIN rail mounting (width: 35 mm)		nm)	Possible		
	Ambient	Operation	0 °C to 55 °C (non-freezing)		
	temperature	Storage	-20 °C to 65 °C (non-freezing)		
Environment	Ambient humidity	Operation Storage	90 %RH or less (non-condensing)		
	Ambience		Indoors (no direct sunlight); no corrosive gas, inflammable gas, oil mist or dust		
	Altitude		1000 m or less above sea level		
	Vibration resistance		5.9 m/s ² , at 10 Hz to 55 Hz (directions of X, Y and Z axes)		
Mass	Mass [kg]		0.2		

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 amplifiers, operate them at the ambient temperatures 45 °C or lower.
- 3. 1 Mpulse/s or lower commands are supported in the initial setting. When inputting commands over 1 Mpulse/s to 4 Mpulses/s or lower, change the setting in [Pr. PA13].
- 4. This is an electronic dynamic brake. This will not operate during control circuit power supply off. In addition, It may not operate depending on alarms and warnings. Refer to chapter 8 for details.
- 5. Initial value is the 48 V DC setting. To use with 24 V DC, set [Pr. PC27] to "_ 1 _ _". The characteristics of the servo motor vary depending on whether 48 V DC or 24 V DC is used. For details, refer to "Servo Motor Instruction Manual (Vol. 3)".

18.1.4 Combinations of servo amplifiers and servo motors

Servo amplifier	Servo motor
MR-J4-03A6(-RJ)	HG-AK0136
	HG-AK0236
	HG-AK0336

18.1.5 Function list

The following table lists the functions of MR-J4-03A6(-RJ) servo amplifier. For details of the functions, refer to each section indicated in the detailed explanation field.

Function	Description	Detailed explanation
Model adaptive control	This realizes a high response and stable control following the ideal model. The two-degree-of-freedom-model model adaptive control enables you to set a response to the command and response to the disturbance separately. Additionally, this function can be disabled. Refer to section 7.5 for disabling this function.	explanation
Position control mode	This servo amplifier is used as a position control servo.	Section 18.3.5 (1) Section 3.6.1 Section 4.2
Speed control mode	This servo amplifier is used as a speed control servo.	Section 18.3.5 (2) Section 3.6.2 Section 4.3
Torque control mode	This servo amplifier is used as a torque control servo.	Section 18.3.5 (3) Section 3.6.3 Section 4.4
Position/speed control switch mode	Using an input device, control can be switched between position control and speed control.	Section 3.6.4
Speed/torque control switch mode	Using an input device, control can be switched between speed control and torque control.	Section 3.6.5
Torque/position control switch mode	Using an input device, control can be switched between torque control and position control.	Section 3.6.6
Positioning mode	Positioning mode is compatible with MR-J4-03A6-RJ servo amplifier. For details, refer to "MR-J4ARJ Servo Amplifier Instruction Manual (Positioning Mode).	
High-resolution encoder	High-resolution encoder of 262144 pluses/rev is used for the encoder of the rotary servo motor compatible with the MR-J4-03A6(-RJ) servo amplifier.	
Absolute position detection system	Setting a home position once makes home position return unnecessary at every power-on.	Chapter 12
Gain switching function	You can switch gains during rotation/stop, and can use input devices to switch gains during operation.	Section 7.2
Advanced vibration suppression control II	This function suppresses vibration at the arm end or residual vibration.	Section 7.1.5
Machine resonance suppression filter	This is a filter function (notch filter) which 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 at high frequency. The shaft resonance suppression filter suppresses the vibration.	Section 7.1.3
Adaptive filter II	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 servo system response is increased.	Section 7.1.4
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system by simply connecting an MR Configurator2 installed personal computer and servo amplifier. MR Configurator2 is necessary for this function.	
Robust filter	This function provides better disturbance response in case low response level that load to motor inertia ratio is high for such as roll send axes.	[Pr. PE41]
Slight vibration suppression control	Suppresses vibration of ±1 pulse generated at a servo motor stop.	[Pr. PB24]
Electronic gear	Input pulses can be multiplied by 1/10 to 4000.	[Pr. PA06] [Pr. PA07]
S-pattern acceleration/ deceleration time constant	Speed can be increased and decreased smoothly.	[Pr. PC03]

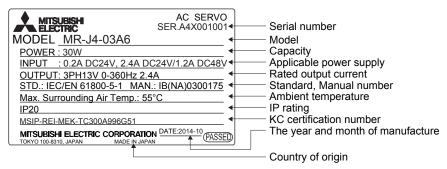
Function	Description	Detailed explanation
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor	Section 6.3
	shaft varies.	
Brake unit	This is not available with MR-J4-03A6(-RJ) servo amplifier. This is not available with MR-J4-03A6(-RJ) servo amplifier.	
Power regeneration converter Regenerative option	This is not available with MR-J4-03A6(-RJ) servo amplifier.	
Alarm history clear	Alarm history is cleared.	[Pr. PC18]
Input signal selection	ST1 (Forward rotation start), ST2 (Reverse rotation start), and SON (Servo-on) and	[Pr. PD03] to
(device settings)	other input device can be assigned to specified pins.	[Pr. PD22]
Output signal selection (device settings)	The output devices including MBR (Electromagnetic brake interlock) can be assigned to certain pins of the CN1 connector.	[Pr. PD23] to [Pr. PD26] [Pr. PD28]
Output signal (DO) forced output	Output signal can be forced on/off independently of the servo status. Use this function for checking output signal wiring, etc.	Section 18.5.9
Restart after instantaneous power failure	This is not available with MR-J4-03A6(-RJ) servo amplifier.	
Command pulse selection	Command pulse train form can be selected from among three different types.	[Pr. PA13]
Torque limit	Servo motor torque can be limited to any value.	Section 3.6.1 (5) [Pr. PA11] [Pr. PA12]
Speed limit	Servo motor speed can be limited to any value.	Section 3.6.3 (3) [Pr. PC05] to [Pr. PC11]
Status display	Servo status is shown on the 3-digit, 7-segment LED display	Section 18.5.3
External I/O signal display	On/off statuses of external I/O signals are shown on the display.	Section 18.5.8
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) or VLA (Analog speed limit is 0 V.	Section 18.5.5
Alarm code output	If an alarm has occurred, the corresponding alarm number is outputted in 3-bit code.	Chapter 8
Test operation mode	Jog operation, positioning operation, motor-less operation, DO forced output, and program operation MR Configurator2 is required for the positioning operation and program operation.	Section 18.5.10
Analog monitor output	Servo status is outputted in terms of voltage in real time.	Section 18.6 (3)
MR Configurator2	Using a personal computer, you can perform the parameter setting, test operation, monitoring, and others.	Section 11.7
Linear servo system	This is not available with MR-J4-03A6(-RJ) servo amplifier.	
Direct drive servo system	This is not available with MR-J4-03A6(-RJ) servo amplifier.	
Fully closed loop system	This is not available with MR-J4-03A6(-RJ) servo amplifier.	
One-touch tuning	Gain adjustment is performed just by one click on a certain button on MR Configurator2 or operation section.	Section 6.2 Section 18.5.4
SEMI-F47 function	This is not available with MR-J4-03A6(-RJ) servo amplifier.	
Tough drive function	This function makes the equipment to continue operating even under the condition that an alarm occurs. MR-J4-03A6(-RJ) servo amplifier is compatible with vibration tough drive. This is not compatible with instantaneous power failure tough drive.	Section 7.3.1
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 on the drive recorder window on MR Configurator2 by clicking the "Graph" button. However, the drive recorder will not operate on the following conditions. 1. You are using the graph function of MR Configurator2. 2. You are using the machine analyzer function. 3. [Pr. PF21] is set to "-1".	[Pr. PA23]
STO function	This is not available with MR-J4-03A6(-RJ) servo amplifier.	

Function	Description	Detailed explanation
Servo amplifier life diagnosis function	Cumulative operation time can be checked. This function gives an indication of the replacement time for parts of the servo amplifier including a capacitor before they malfunction. MR Configurator2 is necessary for this function.	
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.	
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. MR Configurator2 is necessary for this function.	
Lost motion compensation function	This function improves the response delay occurred when the machine moving direction is reversed.	Section 7.6
Super trace control	This function sets constant and uniform acceleration/deceleration droop pulses to almost 0.	Section 7.7
High-resolution analog input	This is not available with MR-J4-03A6(-RJ) servo amplifier.	

18.1.6 Model definition

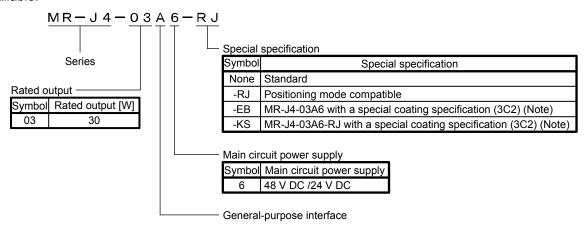
(1) Rating plate

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



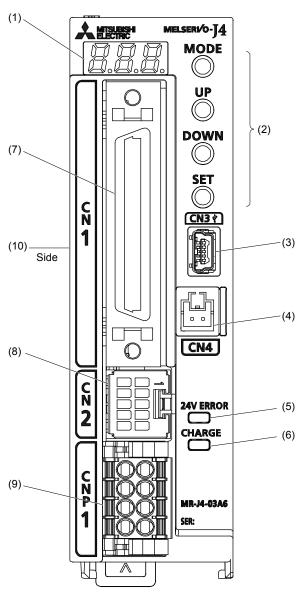
(2) Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.



Note. Type with a specially-coated servo amplifier board (IEC 60721-3-3 Class 3C2). Refer to app. 11.3 for details.

18.1.7 Parts identification



No.	Name/Application	Detailed
	··	explanation
(1)	Display The 3-digit, 7-segment LED shows the servo status and the alarm number.	Section 18.5
(2)	Operation section Used to perform status display, diagnostic, alarm, and parameter setting operations. Push the "MODE" and "SET" buttons at the same time for 3 s or more to switch to the one-touch tuning mode. MODE	Section 18.5
	with the "MODE" button for 3 s or more to switch to the one-touch tuning mode.	
(3)	USB communication connector (CN3) Connect the personal computer.	Section 11.7
(4)	Battery connector (CN4) Connect the battery for absolute position data backup.	Section 18.9
(5)	Control circuit power voltage error lamp (24 V ERROR) When a voltage value of the control circuit power voltage (24 V DC) is out of permissible range, this will light in yellow.	Section 18.4.3
(6)	Charge lamp (CHARGE) When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(7)	I/O signal connector (CN1) Connect digital I/O signal, analog input signal, analog monitor output signal, and RS-422 communication controller.	Section 18.3.5 Section 18.3.6
(8)	Encoder connector (CN2) Connect the servo motor encoder.	Section 18.3.6
(9)	Power and servo motor power output connector (CNP1) Connect input power and servo motor.	Section 18.3.1 Section 18.3.2
(10)	Rating plate	Section 18.1.6 (1)

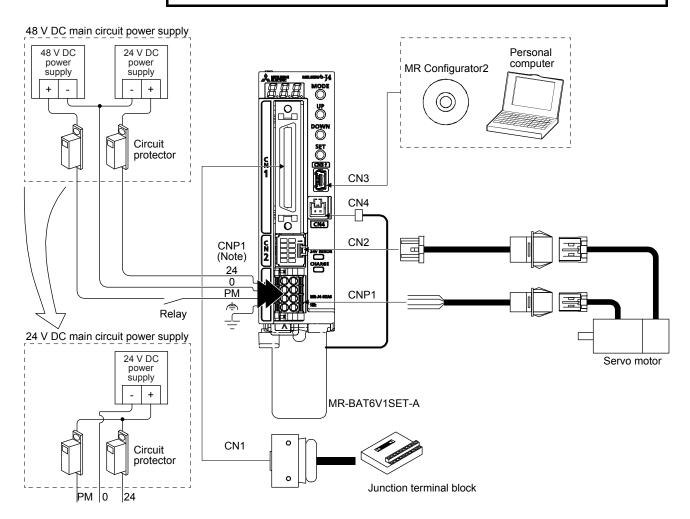
18.1.8 Configuration including peripheral equipment

⚠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.



Note. Refer to section 18.3.2 for details.

18.2 Installation

NARNING ●To prevent electric shock, ground equipment securely.

- Stacking in excess of the specified number of product packages is not allowed.
- ●Install the equipment on incombustible material. Installing them directly or close to combustibles will lead to 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 equipment. Otherwise, it may cause injury.
- •Use the equipment within the specified environment. For the environment, refer to section 18.1.3.
- 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 strike the servo amplifier. Isolate it from all impact loads.
- ●Do not install or operate the servo amplifier which has been damaged or has any parts missing.



- ↑ CAUTION When the equipment 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.
 - ●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.
 - 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, such as heat treatment. Additionally, disinfect and protect wood from insects before packing the products.

The following item is the same as 100 W or more MR-J4-_A_(-RJ) servo amplifiers. Refer to the section of the detailed explanation field for details.

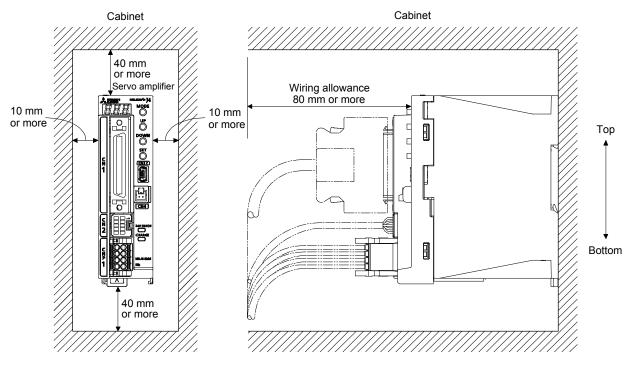
Item	Detailed explanation
Keep out foreign materials	Section 2.2
Encoder cable stress	Section 2.3
Inspection items	Section 2.4
Parts having service life	Section 2.5

18.2.1 Installation direction and clearances

When using heat generating equipment, 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.

(1) Installation of one servo amplifier

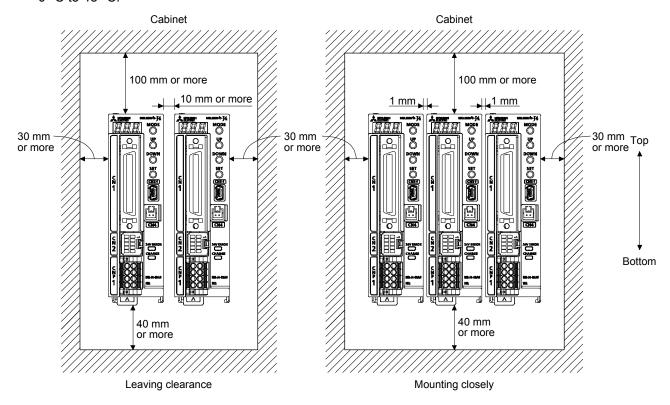


(2) Installation of two or more servo amplifiers

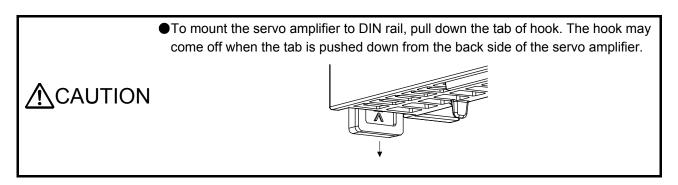
POINT

●You can install MR-J4-03A6(-RJ) servo amplifiers without clearances between them. When closely mounting the servo amplifiers, operate them at the ambient temperatures of 0 °C to 45 °C.

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, operate at the ambient temperatures 0 $^{\circ}$ C to 45 $^{\circ}$ C.

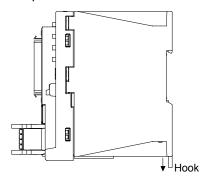


18.2.2 Installation by DIN rail

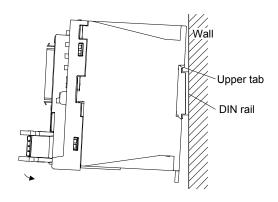


The following explains mounting and removing procedure of servo amplifier using DIN rail.

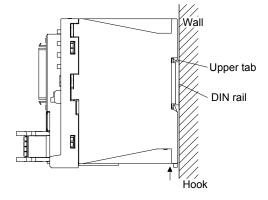
Mounting servo amplifier to DIN rail



1) Pull down the hook.

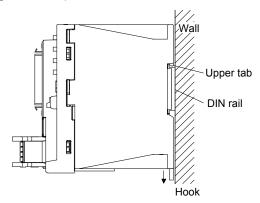


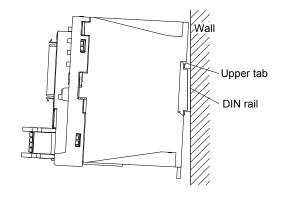
Hang the upper tab on the back of the servo amplifier to the upper tab of DIN rail, and push toward to the wall.



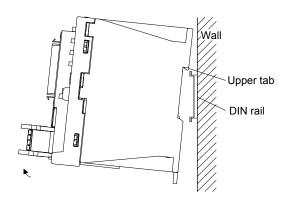
3) Push up the hook, and fix the servo amplifier.

Removing servo amplifier from DIN rail





1) Pull down the hook.



3) Lift up and remove the servo amplifier.

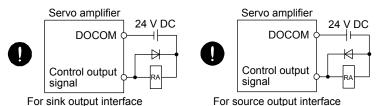
2) Pull the servo amplifier forward.

18.3 Signals and wiring

- A person who is involved in wiring should be fully competent to do the work.
- Before wiring, turn off the power and check to see if the charge lamp turned 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.

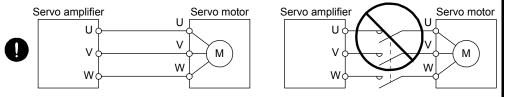


- MARNING ●Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, it may cause an electric shock.
 - ●The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
 - ■To avoid an electric shock, insulate the connections of the power supply terminals.
 - ■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.



ACAUTION

- ●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.
- 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.

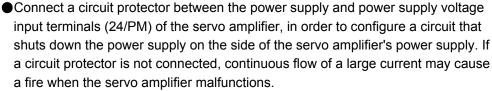


● Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

The items in the following table are the same as those for MR-J4-_A_(-RJ) servo amplifiers of 100 W or more. Refer to the section of the detailed explanation field for details.

Item	Detailed explanation
Detailed explanation of signals	Section 3.6
Forced stop deceleration function	Section 3.7
Servo motor with an electromagnetic brake	Section 3.10

18.3.1 Input power supply circuit



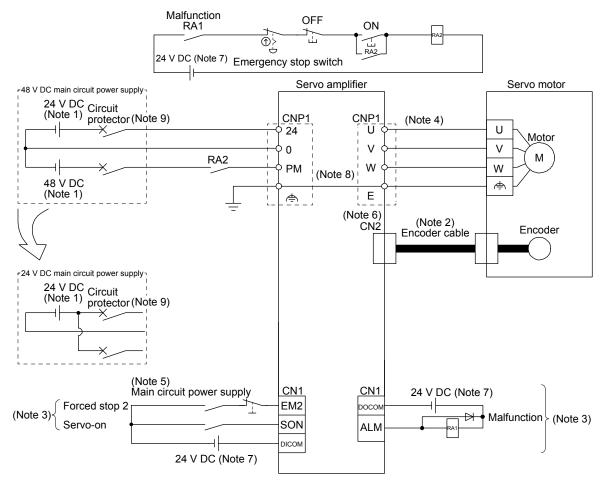


- ■Use ALM (Malfunction) to switch main circuit power supply off. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the built-in regenerative resistor.
- Check the servo amplifier model, and then input proper voltage to the servo amplifier power supply. If input voltage exceeds the upper limit of the specification, the servo amplifier will break down.
- 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.

Configure the wirings so that the main circuit 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.

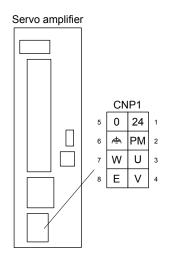


Note $\,$ 1. Use reinforced insulating type for 24 V DC and 48 V DC power supply.

- 2. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
- 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 "Servo Motor Instruction Manual (Vol. 3)".
- 5. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 6. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
- 7. The illustration of the 24 V DC power supply is divided between input signal, output signal, and external emergency stop circuit for convenience. However, they can be configured by one. For 24 V DC power for I/O signal, use power other than 24 V DC power of servo amplifier control circuit power supply.
- 8. The noiseless grounding (♠) terminals and E terminals are connected in the servo amplifier. Be sure to ground from the noiseless grounding (♠) terminal of CNP1 to the grounding terminal of the cabinet.
- 9. Circuit protectors are required for protection of power supplies, wires, servo amplifiers and others. When not using a circuit protector, configure an external protective circuit such as a power supply with protection function.

18.3.2 Explanation of power supply system

(1) Pin assignment



(2) Detailed explanation

Symbol	Connection target (application)	Description				
24		Used to connect + of the control circuit power	supply (24 V DC).			
РМ	Control circuit power supply/main circuit power supply	Used to connect + of the main circuit power's Set [Pr. PC27] according to the specification of Parameter Main circuit power supply 48 V DC 24 V DC	of main circuit power supply.			
0		Switch off - of the control circuit power supply	and main circuit power supply.			
♠	Noiseless grounding	Connect to the grounding terminal of the cabinet to ground.				
U/V/W/E	Servo motor power output		V/W/E) to the servo motor power input (U/V/W/♠) intervene. Otherwise, it may cause a malfunction.			

(3) Wiring CNP1

POINT

●For the wire sizes used for wiring, refer to section18.8.3.

Use the servo amplifier power connector for wiring CNP1.

(a) Connector

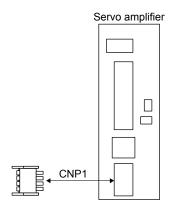


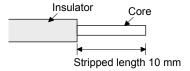
Table 18.1 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire size	Stripped length [mm]	Manufacturer
CNP1	DFMC 1,5/ 4-ST-3,5-LR or equivalent	AWG 24 to 16	10	Phoenix Contact

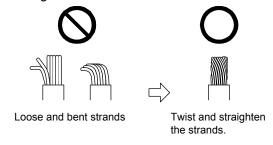
(b) Cable connection procedure

1) Fabrication on cable insulator

Refer to table 18.1 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.



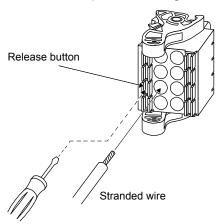
You can also use a ferrule to connect with the connectors. When you use a ferrule, use the following ferrules and crimp terminal.

Servo amplifier	Wire size	Ferrule model (Phoenix Contact)	Crimp terminal (Phoenix Contact)
MR-J4-03A6(-RJ)	AWG 20	AI0.25-10YE	
	AWG 18	AI0.34-10TQ	CRIMPFOX6
	AWG 18	AI0.5-10WH	CRIIVIPFOXO
	AWG 16	AI0.75-10GY	

2) Inserting wire

When using solid wire, insert the wire to the end. When using stranded wire, insert the wire to the end with pushing down the release button with a small flat head screwdriver, etc.

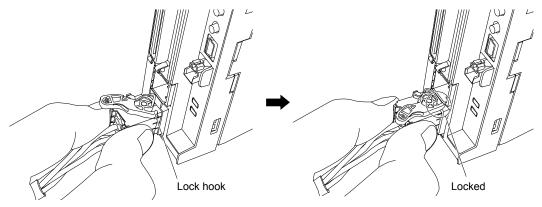
The following show a connection example when using stranded wire to the CNP 1 connector.



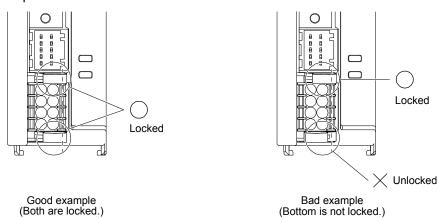
(c) Mounting connector

1) Mounting

Fit the CNP1 connector when the servo amplifier is fixed. While pushing the connector, make sure that the connector is locked to the top and bottom of the socket. After that, check that the connector cannot be pulled out.



Refer to the following example for a status of lock.



2) Disconnection

Pull out the CNP1 connector after unlocking the top and bottom of the connector.

18.3.3 Selection of main circuit power supply/control circuit power supply

The inrush current at power on will be large because a resistance for protecting inrush current is not built-in in the main circuit power supply of the servo amplifier. The main circuit capacitor capacity of the servo amplifier is approximately 270 μ F. When the load characteristic (overcurrent protection criteria) of the power unit is current fold back method, the power cannot be started. Be careful when selecting a power. Especially when the power is turned ON/OFF on the power unit output side, approximately 100 μ s to 300 μ s instantaneous current will flowed at power on due to capacitor charge. Therefore, a power unit such as one which operates overcurrent at 1ms or less cannot be used.

A circuit to protect inrush current at power on is built-in in the control circuit power supply of servo amplifier. In addition, when using main circuit power supply and control circuit power supply, use a reinforced insulating type.

18.3.4 Power-on sequence

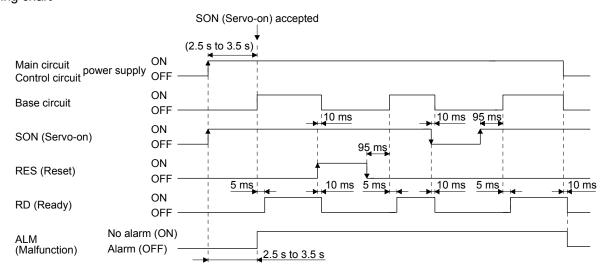
POINT

The voltage of analog monitor output, output signal, etc. may be unstable at power-on.

(1) Power-on procedure

- 1) When wiring the power supply, use a circuit protector for the power supply (24/PM). Configure up an external sequence so that the relay connected to PM turns off when an alarm occurs.
- 2) Switch on the control circuit power supply (24/0) simultaneously with the main circuit power supply (PM/0) or before switching on the main circuit power supply. If the main circuit power supply is not on, the display shows the corresponding warning. However, by switching on the main circuit power supply, the warning disappears and the servo amplifier will operate properly.
- 3) The servo amplifier receives the SON (Servo-on) within 2.5 s to 3.5 s after the main circuit power supply is switched on. Therefore, when SON (Servo-on) is switched on simultaneously with the main circuit 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) of this section.)
- 4) When RES (Reset) is switched on, the base circuit is shut off and the servo motor shaft coasts.

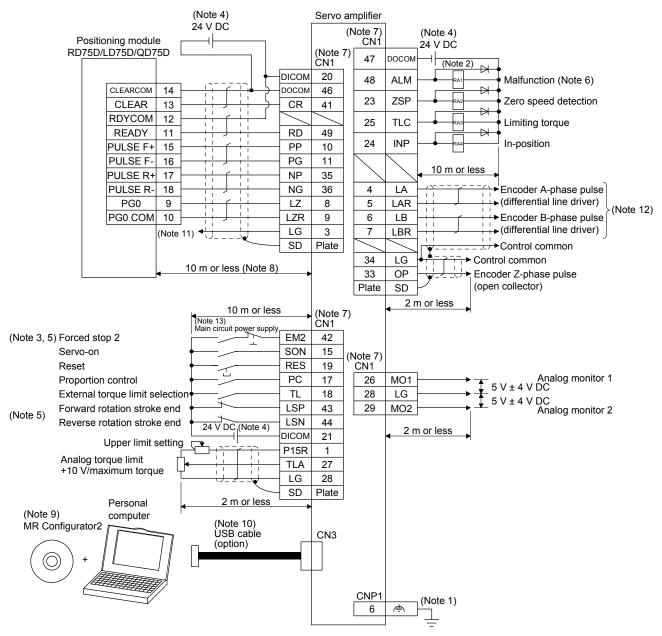
(2) Timing chart



18.3.5 I/O signal connection example

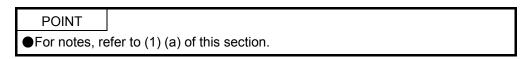
(1) Position control mode

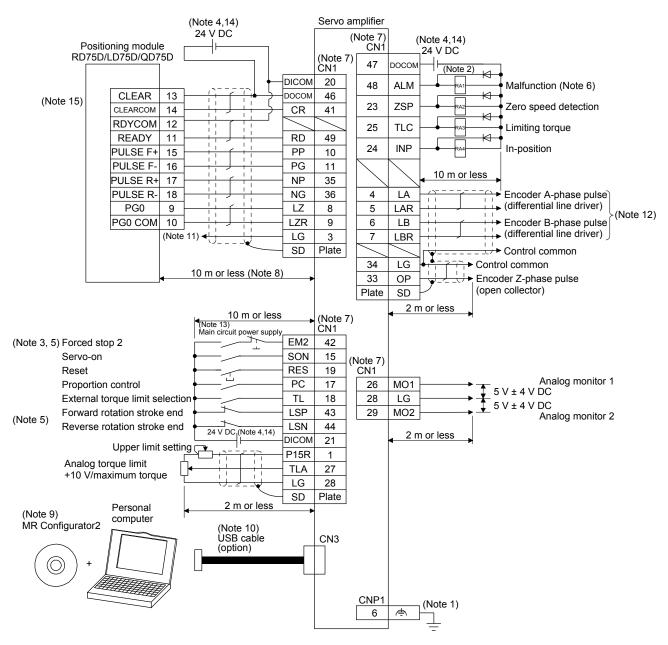
(a) For sink I/O interface



- Note 1. To prevent an electric shock, always connect the CNP1 noiseless grounding terminal (remarked) of the servo amplifier to the grounding terminal (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. For 24 V DC power for I/O signal, use power other than 24 V DC power of servo amplifier control circuit power supply.
 - 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. When this signal (normally closed contact) 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 11.7.)
 - 10. The USB communication function and RS-422 communication function are mutually exclusive. They cannot be used together.
 - 11. This connection is not necessary for RD75D, LD75D and QD75D. However, to enhance noise tolerance, it is recommended to connect LG of servo amplifier and control common depending on the positioning module.
 - 12. When a command cable for connection with the controller side malfunctions due to disconnection or noise, a position mismatch can occur. To avoid the position mismatch, check Encoder A-phase pulse and Encoder B-phase pulse on the controller side.
 - 13. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
 - 14. Plus and minus of the power of source interface are the opposite of those of sink interface.
 - 15. CLER and CLEARCOM of source interface are interchanged to sink interface.

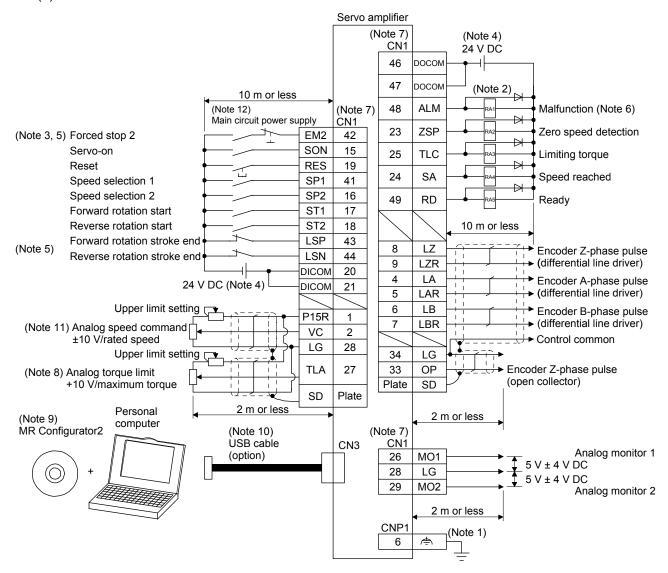
(b) For source I/O interface





(2) Speed control mode

(a) For sink I/O interface

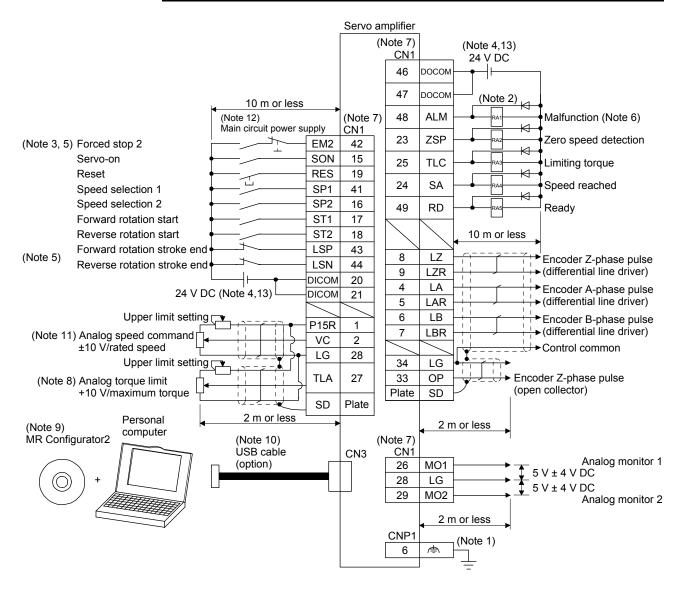


- Note 1. To prevent an electric shock, always connect the CNP1 noiseless grounding terminal (random marked) of the servo amplifier to the grounding terminal (PE) of the cabinet.
 - 2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will malfunction and will 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. A 24 V DC power supply can be used for both input signal and output signal.
 - 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. PD03] to [Pr. PD22]. (Refer to section 3.6.1 (5).)
 - 9. Use SW1DNC-MRC2-_. (Refer to section 11.7.)
 - 10. The USB communication function and RS-422 communication function are mutually exclusive. They cannot be used together.
 - 11. Use an external power supply when inputting a negative voltage.
 - 12. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
 - 13. Plus and minus of the power of source interface are the opposite of those of sink interface.

(b) For source I/O interface

POINT

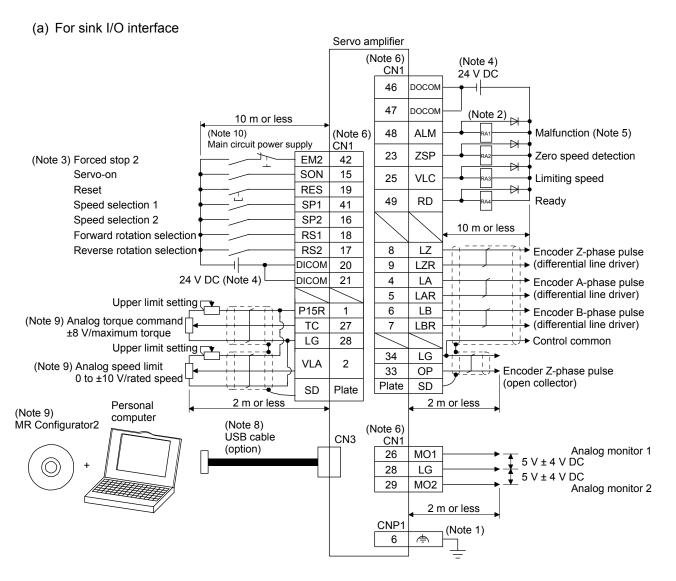
●For notes, refer to (2) (a) of this section.



(3) Torque control mode

POINT

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



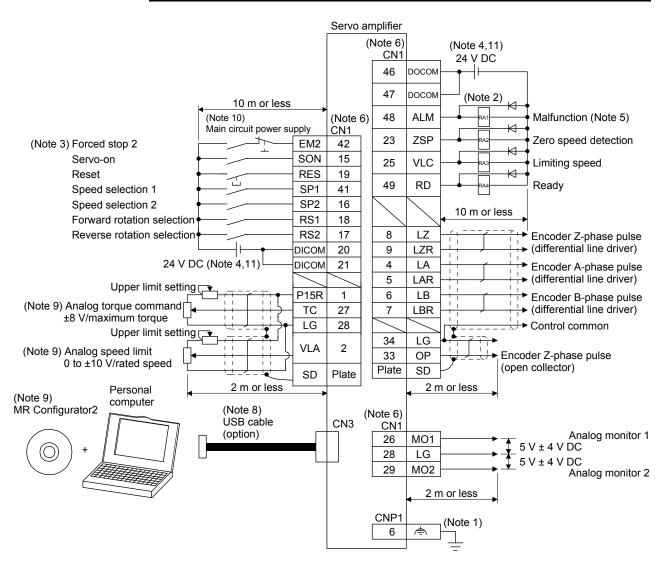
Note 1. To prevent an electric shock, always connect the CNP1 noiseless grounding terminal (remarked) of the servo amplifier to the grounding terminal (PE) of the cabinet.

- 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. A 24 V DC power supply can be used for both input signal and output signal.
- 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 11.7.)
- 8. The USB communication function and RS-422 communication function are mutually exclusive. They cannot be used together.
- 9. Use an external power supply when inputting a negative voltage.
- 10. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo
- 11. Plus and minus of the power of source interface are the opposite of those of sink interface.

(b) For source I/O interface

POINT

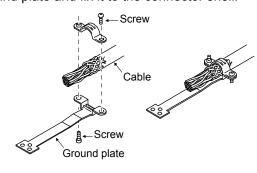
●For notes, refer to (3) (a) of this section.

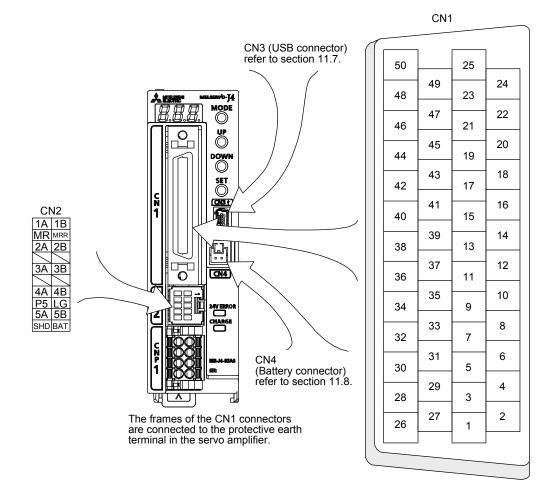


18.3.6 Connectors and pin assignment

POINT

- ●The pin assignment of the connectors is as viewed from the cable connector wiring section.
- For the CN1 connector, securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.





The device assignment of CN1 connector pins changes depending on the control mode. For the pins which are given parameters in the related parameter column, their devices will be changed using those parameters.

	(Note 1)		(Note 2	2) I/O signal	s in control	modes		
Pin No.	I/O	Р	P/S	S	S/T	T	T/P	Related parameter
1		P15R	P15R	P15R	P15R	P15R	P15R	
2			-/VC	VC	VC/VLA	VLA	VLA/-	
3		LG	LG	LG	LG	LG	LG	
4	0	LA	LA	LA	LA	LA	LA	
5	0	LAR	LAR	LAR	LAR	LAR	LAR	
6	0	LB	LB	LB	LB	LB	LB	
7	0	LBR	LBR	LBR	LBR	LBR	LBR	
8	0	LZ	LZ	LZ	LZ	LZ	LZ	
9	0	LZR	LZR	LZR	LZR	LZR	LZR	
10	I	PP	PP/-	(Note 4)	(Note 4)	(Note 4)	-/PP	Pr. PD43/Pr. PD44
11	l	PG	PG/-	(100.7)	(100.7)		-/PG	
12		OPC	OPC/-				-/OPC	
13	0	SDP	SDP	SDP	SDP	SDP	SDP	
14	0	SDN	SDN	SDN	SDN	SDN	SDN	
15	ı	SON	SON	SON	SON	SON	SON	Pr. PD03/Pr. PD04
16	i		-/SP2	SP2	SP2/SP2	SP2	SP2/-	Pr. PD05/Pr. PD06
17	i I	PC	PC/ST1	ST1	ST1/RS2	RS2	RS2/PC	Pr. PD07/Pr. PD08
18	i	TL	TL/ST2	ST2	ST2/RS1	RS1	RS1/TL	Pr. PD09/Pr. PD10
19	i I	RES	RES	RES	RES	RES	RES	Pr. PD11/Pr. PD12
20		DICOM	DICOM	DICOM	DICOM	DICOM	DICOM	
21		DICOM	DICOM	DICOM	DICOM	DICOM	DICOM	
22	0	INP	INP/SA	SA	SA/-		-/INP	Pr. PD23
23	0	ZSP	ZSP	ZSP	ZSP	ZSP	ZSP	Pr. PD24
24	0	INP	INP/SA	SA	SA/-		-/INP	Pr. PD25
25	0	TLC	TLC	TLC	TLC/VLC	VLC	VLC/TLC	Pr. PD26
26	0	MO1	MO1	MO1	MO1	MO1	MO1	Pr. PC14
27	I	TLA	(Note 3) TLA	(Note 3) TLA	(Note 3) TLA/TC	TC	TC/TLA	
28		LG	LG	LG	LG	LG	LG	
29	0	MO2	MO2	MO2	MO2	MO2	MO2	Pr. PC15
30		LG	LG	LG	LG	LG	LG	
31	I	TRE	TRE	TRE	TRE	TRE	TRE	
32								
33	0	OP	OP	OP	OP	OP	OP	
34		LG	LG	LG	LG	LG	LG	
35	I	NP	NP/-	(Note 4)	(Note 4)	(Note 4)	-/NP	Pr. PD45/Pr. PD46
36	I	NG	NG/-				-/NG	
37	I	PP2	PP2/-	(Note 5)	(Note 5)	(Note 5)	-/PP2	Pr. PD43/Pr. PD44
38	I	NP2	NP2/-	(Note 5)	(Note 5)	(Note 5)	-/NP2	Pr. PD45/Pr. PD46
39	I	RDP	RDP	RDP	RDP	RDP	RDP	
40	I	RDN	RDN	RDN	RDN	RDN	RDN	
41	I	CR	CR/SP1	SP1	SP1/SP1	SP1	SP1/CR	Pr. PD13/Pr. PD14
42	I	EM2	EM2	EM2	EM2	EM2	EM2	
43	I	LSP	LSP	LSP	LSP/-		-/LSP	Pr. PD17/Pr. PD18
44	I	LSN	LSN	LSN	LSN/-		-/LSN	Pr. PD19/Pr. PD20
45	I	LOP	LOP	LOP	LOP	LOP	LOP	Pr. PD21/Pr. PD22
46		DOCOM	DOCOM	DOCOM	DOCOM	DOCOM	DOCOM	
47		DOCOM	DOCOM	DOCOM	DOCOM	DOCOM	DOCOM	
48	0	ALM	ALM	ALM	ALM	ALM	ALM	
49	0	RD	RD	RD	RD	RD	RD	Pr. PD28
50								

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. TLA will be available when TL (External torque limit selection) is enabled with [Pr. PD03] to [Pr. PD22].
- 4. This is available as an input device of sink interface. Input devices are not assigned by default. Assign the input devices with [Pr. PD43] to [Pr. PD46] as necessary. When using this pin by DI, supply + of 24 V DC to CN1-12 pin.
- 5. This is available as an input device of source interface. Input devices are not assigned by default. Assign the input devices with [Pr. PD43] to [Pr. PD46] as necessary.

18.3.7 Signal (device) explanations

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

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

P: Position control mode

S: Speed control mode

T: Torque control mode

"O" and " Δ " of the table shows the followings.

O: Usable device by default.

Δ: Usable device by setting the following parameters.

[Pr. PA04], [Pr. PD03] to [Pr. PD26], [Pr. PD28]

(1) I/O device

(a) Input device

Device	Symbol	Connector	Function and application	I/O	Control mode			
Device	Symbol	pin No.	i diletion and application	division	P	S	Т	
Forced stop 2	EM2	CN1-42	For details of device, refer to section 3.5.1 (1) (a).	DI-1	0	0	0	
Forced stop 1	EM1	(CN1-42)		DI-1	Δ	Δ	Δ	
Servo-on	SON	CN1-15		DI-1	0	0	0	
Reset	RES	CN1-19		DI-1	0	0	0	
Forward rotation stroke end	LSP	CN1-43		DI-1	0		Δ	
Reverse rotation stroke end	LSN	CN1-44						
External torque limit selection	TL	CN1-18		DI-1	0	Δ		
Internal torque limit selection	TL1			DI-1	Δ	Δ	Δ	
Forward rotation start	ST1	CN1-17		DI-1	\setminus	0		
Reverse rotation start	ST2	CN1-18			$ \ $		$ \setminus$	
Forward rotation selection	RS1	CN1-18		DI-1	\setminus		0	
Reverse rotation selection	RS2	CN1-17			$ \ $	$ \ $		
Speed selection 1	SP1	CN1-41		DI-1		0	0	
Speed selection 2	SP2	CN1-16		DI-1		0	0	
Speed selection 3	SP3			DI-1		Δ	Δ	
Proportional control	PC	CN1-17		DI-1	0	Δ		
Clear	CR	CN1-41		DI-1	0			
Electronic gear selection 1	CM1			DI-1	Δ			
Electronic gear selection 2	CM2			DI-1	Δ			
Gain switching	CDP			DI-1	Δ	Δ	Δ	
Control switching	LOP	CN1-45		DI-1	fun and app	er to ction d licat umn		

Device	Symbol	Connector	Function and application	I/O division		ol e	
		pin No.		aivision	Р	S	Т
Second acceleration/ deceleration selection	STAB2		For details of device, refer to section 3.5.1 (1) (a).	DI-1		Δ	Δ
ABS transfer mode	ABSM	CN1-17		DI-1	Δ		
ABS request	ABSR	CN1-18		DI-1	Δ		

(b) Output device

Device	Symbol	Connector pin No.	Function and application	I/O division		ontr node S	е
Malfunction	ALM	CN1-48	For details of device, refer to section 3.5.1 (1) (b).	DO-1	0	0	0
Ready	RD	CN1-49		DO-1	0	0	0
In-position	INP	CN1-22		DO-1	0		
Speed reached	SA	CN1-24		DO-1		0	
Limiting speed	VLC	CN1-25		DO-1			0
Limiting torque	TLC			DO-1	0	0	
Zero speed detection	ZSP	CN1-23		DO-1	0	0	0
Electromagnetic brake interlock	MBR			DO-1	Δ	Δ	Δ
Warning	WNG			DO-1	Δ	Δ	Δ
Battery warning	BWNG			DO-1	Δ		Δ
Alarm code	ACD0	(CN1-24)		DI-1	Δ	Δ	Δ
	ACD1	(CN1-23)					
	ACD2	(CN1-22)					
Variable gain selection	CDPS			DO-1	Δ	Δ	Δ
Absolute position undetermined	ABSV			DO-1	Δ		
ABS transmission data bit 0	ABSB0	(CN1-22)		DO-1	Δ		
ABS transmission data bit 1	ABSB1	(CN1-23)		DO-1	Δ		
ABS transmission data ready	ABST	(CN1-25)		DO-1	Δ		

(2) Input signal

Device	Sympol	Connector	Function and application	I/O division	Control mode		
		piii No.			Р	S	Т
Analog torque limit	TLA	CN1-27	Refer to section 3.5 (2) for details of signal.	Analog input	0	Δ	
Analog torque command	TC			Analog input		\setminus	0
Analog speed command	VC	CN1-2		Analog input		0	
Analog speed limit	VLA			Analog input			0
Forward rotation	PP	CN1-10		DI-2	0		\
pulse train	NP	CN1-35				\	\
Reverse rotation	PP2	CN1-37					\
pulse train	NP2	CN1-38				\	\
	PG	CN1-11				\	$ \ $
	NG	CN1-36				\	igsquare

(3) Output signal

Device	Symbol Connecto pin No.	Connector	Function and application	I/O division	Control mode		
		pin ivo.			Р	S	Т
Encoder A-	LA	CN1-4	Refer to section 3.5 (3) for details of signal.	DO-2	0	0	0
phase pulse (differential line driver)	LAR	CN1-5					
Encoder B-	LB	CN1-6					
phase pulse (differential line driver)	LBR	CN1-7					
Encoder Z-	LZ	CN1-8		DO-2	0	0	0
phase pulse (differential line driver)	LZR	CN1-9					
Encoder Z- phase pulse (open-collector)	OP	CN1-33		DO-2	0	0	0
Analog monitor 1	MO1	CN1-26	This is used to output the data set in [Pr. PC14] to between MO1 and LG in terms of voltage. Output voltage:5 V \pm 4 V	Analog output	0	0	0
			Resolution: 10 bits or equivalent				
Analog monitor 2	MO2	CN1-29	This signal outputs the data set in [Pr. PC15] to between MO2 and LG in terms of voltage. Output voltage:5 V ± 4 V Resolution: 10 bits or equivalent	Analog output	0	0	0

(4) Communication

Device	Symbol	Connector pin No.	Function and application	I/O division	Control mode		-
					Р	S	Т
RS-422 I/F	SDP	CN1-13	These are terminals for RS-422 communication.		0	0	0
	SDN	CN1-14					
	RDP	CN1-39					
	RDN	CN1-40					
	TRE	CN1-31		\			

(5) Power supply

Device	Symbol	Connector	Function and application	I/O division	Control mode		
y pin		pin No.			Р	S	Т
Digital I/F power supply input	DICOM	CN1-20 CN1-21	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 the 24 V DC external power supply.		0	0	0
Open-collector sink interface	OPC	CN1-12	When inputting a pulse train in the open-collector type with sink interface, supply this terminal with the positive (+) power of 24 V DC.		0		
power supply input			Supply + of 24 V DC to this terminal when using CN1-10-pin and CN1-35-pin by DI.			0	0
Digital I/F common	DOCOM	CN1-46 CN1-47	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 the 24 V DC external power supply.		0	0	0
15 V DC power supply	P15R	CN1-1	This outputs 15 V DC to between P15R and LG. This is available as power for TC, TLA, VC, or VLA. Permissible current: 30 mA		0	0	0
Control common	LG	CN1-3 CN1-28 CN1-30 CN1-34	Common terminal of TLA/TC/VC/VLA/OP/MO1/MO2/P15R. Pins are connected internally.		0	0	0
Shield	SD	Plate	Connect the external conductor of the shielded wire.		0	0	0

18.3.8 Alarm occurrence timing chart

⚠CAUTION

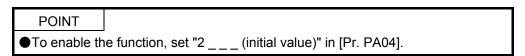
•When an alarm has occurred, remove its cause, make sure that the operation signal is not being input, ensure safety, and reset the alarm before restarting operation.

POINT

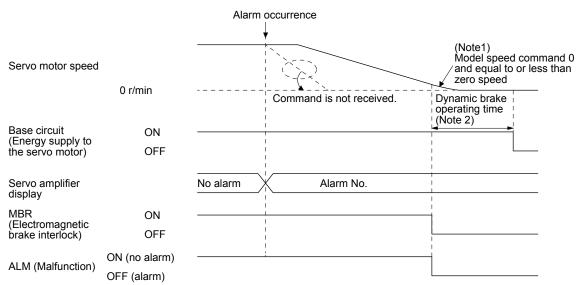
●In the torque control mode, the forced stop deceleration function is not available.

To deactivate an alarm, cycle the control circuit 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.

(1) When you use the forced stop deceleration function



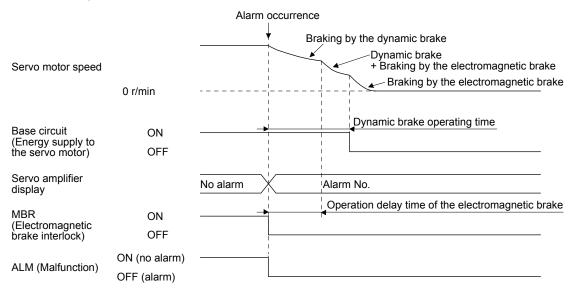
(a) When the forced stop deceleration function is enabled



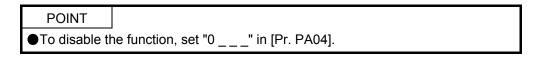
Note 1. The model speed command is a speed command generated in the servo amplifier for forced stop deceleration of the servo motor.

2. If the servo motor speed is 5 r/min or higher, the electric dynamic brake will operate continuously for the time period set by [Pr. PF15].

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



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

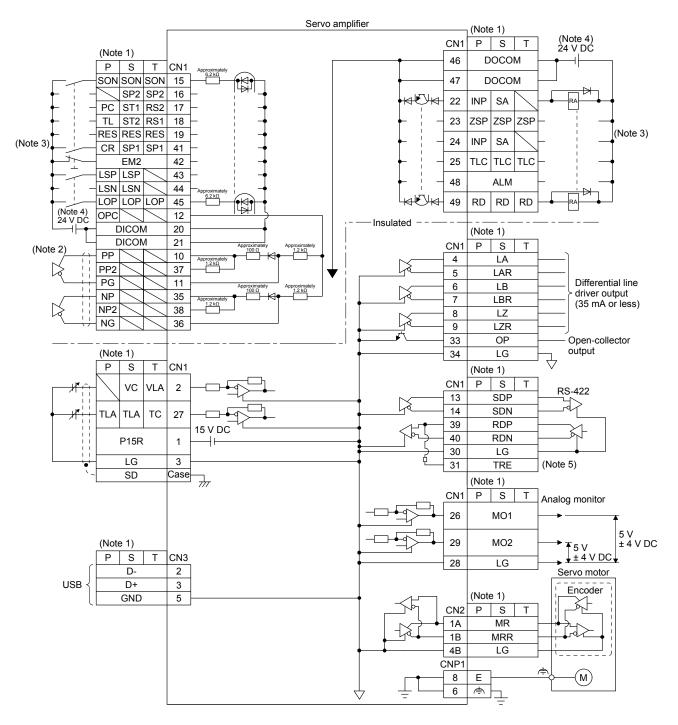


The operation status during an alarm is the same as (1) (b) of this section.

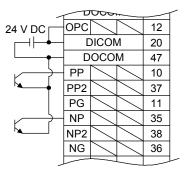
18.3.9 Interfaces (Internal connection diagram)

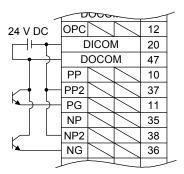
The items in the following table are the same as those for MR-J4-_A_(-RJ) servo amplifiers of 100 W or more. Refer to the section of the detailed explanation field for details.

Item	Detailed explanation				
Detailed explanation of interfaces	Section 3.9.2				
Source I/O interface	Section 3.9.3				



- 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.



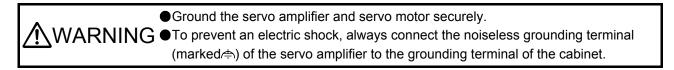


For sink input interface

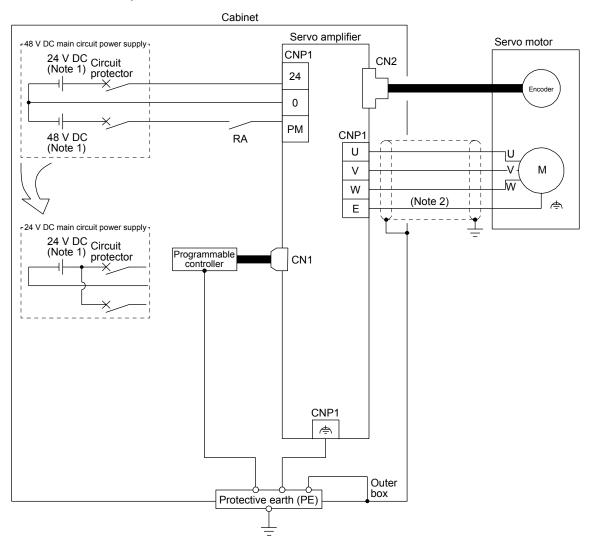
For source input interface

- 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.
 - For 24 V DC power for I/O signal, use power other than 24 V DC power of servo amplifier control circuit power supply.
- 5. To use the RS-422 communication function, connect between TRE and RDN of the final axis servo amplifier. (Refer to section 18.11.)

18.3.10 Grounding



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 1. For power supply specifications, refer to section 18.1.3.

2. Connect 🖨 of servo motor to E of the CNP1 connector. Do not connect the wire directly to the grounding terminal of the cabinet.

18.4 Startup

MARNING ●Do not operate the switches with wet hands. Otherwise, it may cause an electric shock.



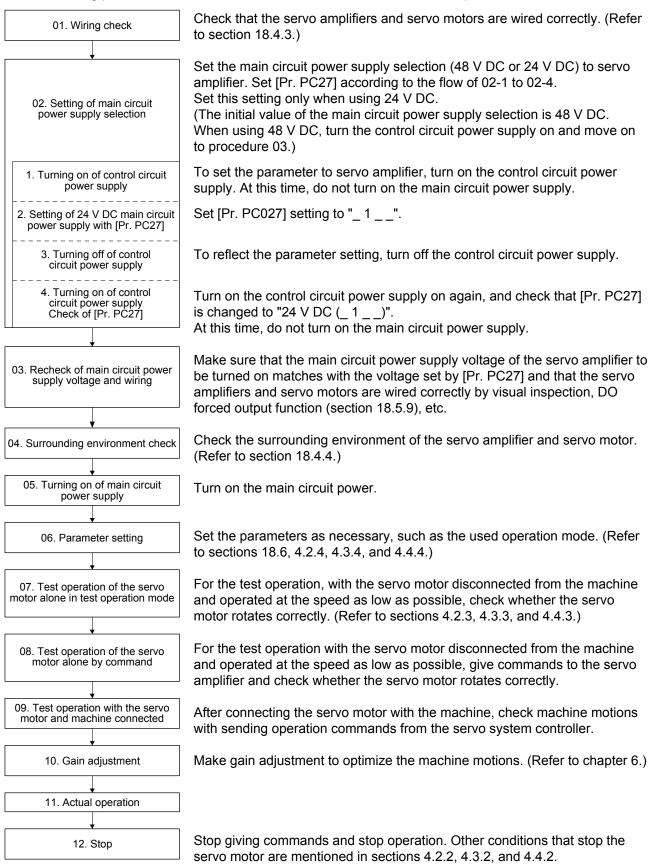
- ●Before starting operation, check the parameters. Improper settings may cause some machines to operate unexpectedly.
- ●The servo amplifier and servo motor may be hot while the power is on, and for some time after power-off. Take safety measures such as providing covers to avoid accidentally touching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

The items in the following table are the same as those for MR-J4-_A_(-RJ) servo amplifiers of 100 W or more. Refer to the section of the detailed explanation field for details.

Item	Detailed explanation
Startup in position control mode	Section 4.2
Startup in speed control mode	Section 4.3
Startup in torque control mode	Section 4.4

18.4.1 Startup procedure

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



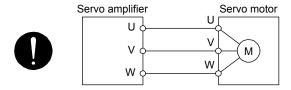
18. MR-J4-03A6(-RJ) SERVO AMPLIFIER

18.4.2 Troubleshooting when "24 V ERROR" lamp turns on

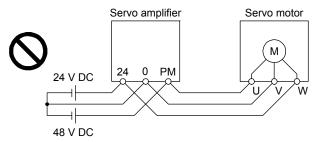
- (1) When overvoltage is applied to the control circuit in the servo amplifier, power supply to the circuit will be shut off and the "24 V ERROR" lamp will turn on. Then, the 3-digit, 7-segment LED on display will turn off. Immediately turn off the power and check the wiring, etc. to the main circuit power supply (48 V DC).
- (2) If the "24 V ERROR" lamp turns on with the 3-digit, 7-segment LED on, the control circuit power supply voltage (24 V DC) may be failure. Check that the voltage of the control circuit power supply is 21.6 V DC or more.

18.4.3 Wiring check

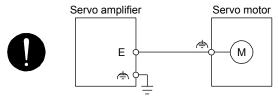
- Power supply system wiring
 Before switching on the main circuit and control circuit power supplies, check the following items.
 - (a) Power supply system wiring The power supplied to the power input terminals (24/0/PM) of the servo amplifier should satisfy the defined specifications. (Refer to section 18.1.3.)
 - (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).



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



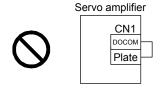
3) The noiseless grounding terminal (♠) of the servo motor should be connected to the E terminal of the servo amplifier.



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

(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 CN1 connector. You can use the function to check the wiring. In this case, switch on the control circuit power supply only. For details of I/O signal connection, refer to section 18.3.5.
- (b) A voltage exceeding 24 V DC is not applied to the pins of the CN1 connector.
- (c) Between plate and DOCOM of the CN1 connector should not be shorted.



18.4.4 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.

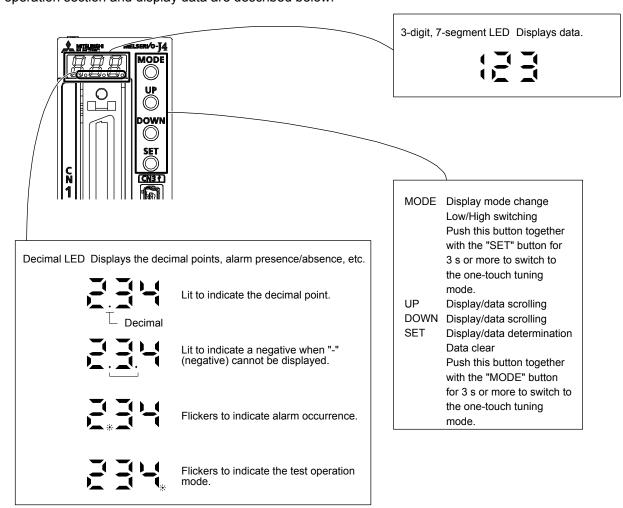
(2) Environment

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

18.5 Display and operation sections

18.5.1 Summary

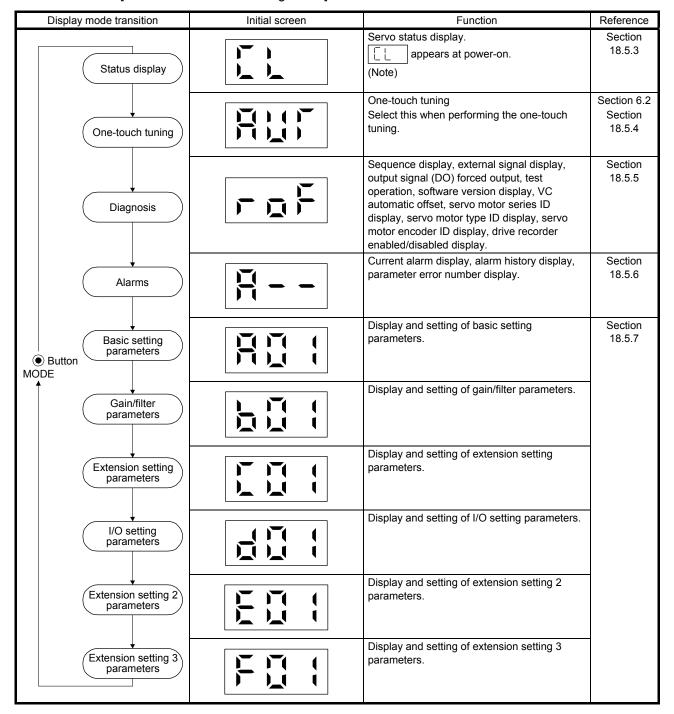
MR-J4-03A6(-RJ) servo amplifier has the display section (3-digit, 7-segment LED) and operation section (4 push buttons) for servo amplifier status display, alarm display, parameter setting, etc. Also, press the "MODE" and "SET" buttons at the same time for 3 s or more to switch to the one-touch tuning mode. The operation section and display data are described below.



18.5.2 Display flowchart

Press the "MODE" button once to shift to the next display mode. Refer to section 18.5.3 and later for the description of the corresponding display mode.

To refer to and set the gain/filter parameters, extension setting parameters and I/O setting parameters, enable them with [Pr. PA19 Parameter writing inhibit].



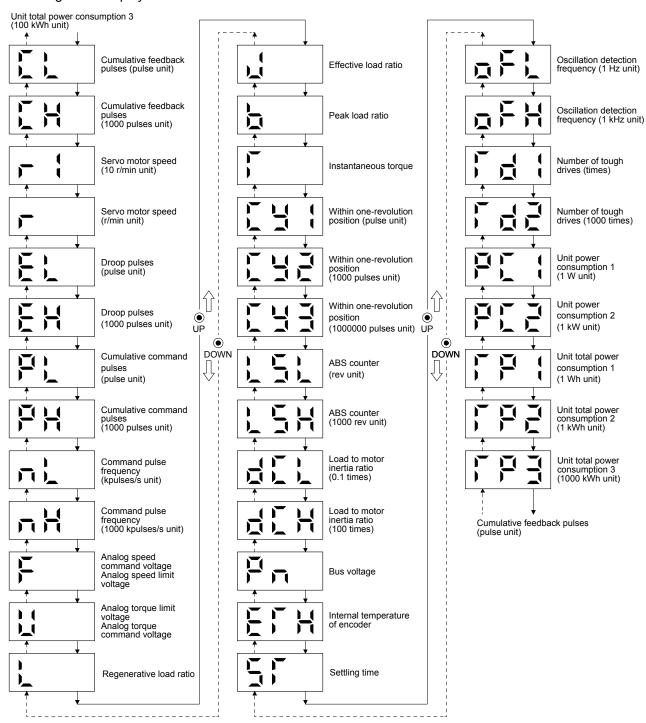
Note. When the axis name is set to the servo amplifier with MR Configurator2, the axis name is displayed and the servo status is then displayed.

18.5.3 Status display mode

The servo status during operation is shown on the 3-digit, 7-segment LED display. Press the "UP" or "DOWN" button to change display data as desired. When the required data is selected, the corresponding symbol is displayed. Press the "SET" button to display that data. At only power-on, however, data appears after the symbol of the status display selected in [Pr. PC36] has been shown for 2 s.

(1) Display transition

After selecting the status display mode with the "MODE" button, pressing the "UP" or "DOWN" button changes the display as shown below.



(2) Display examples

The following table shows the display examples.

ltere	04-	tuo	Displayed data
Item	Status		Servo amplifier display
	720000 pulses	pulse unit	
	720000 puises	1000 pulses unit	
Cumulative feedback pulses	-680000 pulses	pulse unit	The negative value is indicated by the lit decimal points in the upper two digits.
	-occord pulses	1000 pulses unit	The negative value is indicated by the lit decimal points in the upper two digits.
	7.0 times	0.1 times	At this time, the decimal point in the second digit flickers.
		100 times	"0" in 100 times display.
Load to motor inertia ratio	15.0 times	0.1 times	At this time, the decimal point in the second digit flickers.
		100 times	"0" in 100 times display.
	4194303 pulses	pulse unit	
Position within one-revolution		1000 pulses unit	
		1000000 pulses unit	14

(3) Status display list

The following table lists the servo statuses that may be shown. Refer to app. 8.3 (2) for the measurement point.

Status display	Symbol	Unit	Description
Cumulative feedback pulses (1 pulse unit)	CL	pulse	Feedback pulses from the servo motor encoder are counted and displayed. When the count exceeds ±999, it starts from 0. Negative value is indicated by the lit decimal points in the upper two digits.
Cumulative feedback pulses (1000 pulses unit)	Ch	1000 pulses	Press the "SET" button to reset the display value to zero. The internal counter subtracts 500000000 when the number exceeds 2000000000. In addition, The internal counter adds 500000000 when the number exceeds -2000000000.
Servo motor speed (10 r/min unit)	r1	10 r/min	The servo motor speed is displayed. Negative value is indicated by the lit decimal points in the upper two digits. Displays by 10 r/min unit.
Servo motor speed (1 r/min unit)	r	r/min	The servo motor speed is displayed. Negative value is indicated by the lit decimal points in the upper two digits.
Droop pulses (1 pulse unit)	EL	pulse	The numbers of droop pulses in the deviation counter are displayed. When the count exceeds ±999, it starts from 0.
Droop pulses (1000 pulses unit)	Eh	1000 pulses	The value displayed is not multiplied by the electronic gear (CMX/CDV). Negative value is indicated by the lit decimal points in the upper two digits.
Cumulative command pulses (1 pulse unit)	PL	pulse	Position command input pulses are counted and displayed. As the value displayed is not yet multiplied by the electronic gear (CMX/CDV), it may not match the indication of the cumulative feedback pulses.
Cumulative command pulses (1000 pulses unit)	Ph	1000 pulses	When the count exceeds ±999, it starts from 0. Negative value is indicated by the lit decimal points in the upper two digits. Press the "SET" button to reset the display value to zero.
Command pulse frequency (1 kpulse/s unit)	nL	kpulse/s	The frequency of position command input pulses is counted and displayed.
Command pulse frequency (1000 kpulses/s unit)	nh	1000 kpulses/s	The value displayed is not multiplied by the electronic gear (CMX/CDV).
Analog speed command voltage Analog speed limit voltage	F	V	Torque control mode Input voltage of VLA (Analog speed limit) voltage is displayed. Negative value is indicated by the lit decimal points in the upper two digits. 2) Speed control mode
			Input voltage of VC (Analog speed command) voltage is displayed. Negative value is indicated by the lit decimal points in the upper two digits.
Analog torque command voltage Analog torque limit voltage	U	V	Position control mode and speed control mode Voltage of TLA (Analog torque limit) voltage is displayed. Negative value is indicated by the lit decimal points in the upper two digits. Torque control mode Voltage of TC (Analog torque command) voltage is displayed. Negative value is indicated by the lit decimal points in the upper two digits.
Regenerative load ratio	L	%	The ratio of regenerative power to permissible regenerative power is displayed in %.
Effective load ratio	J	%	The continuous effective load current is displayed. The effective value in the past 15 s is displayed relative to the rated current of 100 %.
Peak load ratio	b	%	The maximum occurrence torque is displayed. The highest value in the past 15 s is displayed relative to the rated torque of 100 %.
Instantaneous torque	Т	%	The instantaneous torque is displayed. The value of torque being occurred is displayed in real time considering a rated torque as 100%.
Within one-revolution position (1 pulse unit)	Cy1	pulse	Position within one revolution is displayed in encoder pulses. When the count exceeds 999, it starts from 0. When the servo motor rotates in the CCW direction, the value is added.
Within one-revolution position (1000 pulses unit)	Cy2	1000 pulses	The within one-revolution position is displayed in 1000 pulse increments of the encoder. When the count exceeds 999, it starts from 0. When the servo motor rotates in the CCW direction, the value is added.

18. MR-J4-03A6(-RJ) SERVO AMPLIFIER

Status display	Symbol	Unit	Description
Within one-revolution position (1000000 pulses unit)	СуЗ	1000000 pulses	The within one-revolution position is displayed in 1000000 pulse increments of the encoder. When the count exceeds 999, it starts from 0. When the servo motor rotates in the CCW direction, the value is added.
ABS counter (1 rev unit)	LSL	rev	The travel distance from the home position is displayed as multi-revolution counter value of the absolution position encoder in the absolution position
ABS counter (1000 rev unit)	LSh	1000 rev	detection system. Negative value is indicated by the lit decimal points in the upper two digits.
Load to motor inertia ratio (0.1 times)	dCL	0.1 times	The estimated ratio of the load inertia moment to the servo motor shaft inertia
Load to motor inertia ratio (100 times)	dCh	100 times	moment is displayed.
Bus voltage	Pn	V	The voltage of main circuit converter is displayed. It is displayed rounding off 0.1 V unit.
Internal temperature of encoder	ETh	°C	Inside temperature of encoder detected by the encoder is displayed.
Settling time	ST	ms	Displays settling time. When it exceeds 999 ms, "999" will be displayed.
Oscillation detection frequency (1 Hz unit)	oFL	Hz	Fraguency at the time of excillation detection is displayed
Oscillation detection frequency (1 kHz unit)	oFh	kHz	Frequency at the time of oscillation detection is displayed.
Number of tough drive operations (times)	Td1	times	The number of tough drive functions activated is displayed.
Number of tough drive operations (1000 times)	Td2	1000 times	The number of lough drive functions activated is displayed.
Unit power consumption 1 (1 W unit)	PC1	W	Unit power consumption is displayed by increment of 1 W. Positive value indicate power running, and negative value indicate regeneration. The values in excess of ±999 can be counted. However, the counter shows only the lower 3-digits of the actual value since the servo amplifier display is 3-digits.
Unit power consumption 2 (1 kW unit)	PC2	kW	Negative value is indicated by the lit decimal points in the upper two digits. Unit power consumption is displayed by increment of 1 kW. Positive value indicate power running, and negative value indicate regeneration. The values in excess of ±99 can be counted. However, the counter shows only the lower 3-digits of the actual value since the servo amplifier display is 3-digits. Negative value is indicated by the lit decimal points in the upper two digits.
Unit total power consumption 1 (1 Wh unit)	TP1	Wh	Unit total power consumption is displayed by increment of 1 Wh. Positive value is cumulated during power running and negative value during regeneration. The values in excess of ±999 can be counted. However, the counter shows only the lower 3-digits of the actual value since the servo amplifier display is 3-digits. Negative value is indicated by the lit decimal points in the upper two digits.
Unit total power consumption 2 (1 kWh unit)	TP2	kWh	Unit total power consumption is displayed by increment of 1 kWh. Positive value is cumulated during power running and negative value during regeneration. The values in excess of ±999 can be counted. However, the counter shows only the lower 3-digits of the actual value since the servo amplifier display is 3-digits. Negative value is indicated by the lit decimal points in the upper two digits.
Unit total power consumption 3 (1000 kWh unit)	TP3	1000 kWh	Unit total power consumption is displayed by increment of 1000 kWh. Positive value is cumulated during power running and negative value during regeneration. The values in excess of ±99 can be counted. However, the counter shows only the lower 3-digits of the actual value since the servo amplifier display is 3-digits. Negative value is indicated by the lit decimal points in the upper two digits.

18. MR-J4-03A6(-RJ) SERVO AMPLIFIER

(4) Changing the status display screen

The status display item of the servo amplifier display shown at power-on can be changed by changing [Pr. PC36] settings. The item displayed in the initial status changes with the control mode as follows.

Control mode	Status display			
Position	Cumulative feedback pulses			
Position/speed	Cumulative feedback pulses/servo motor speed			
Speed	Servo motor speed			
Speed/torque	Servo motor speed/analog torque command voltage			
Torque	Analog torque command voltage			
Torque/position	Analog torque command voltage/ cumulative feedback pulses			

18.5.4 One-touch tuning

The contents mentioned in this section is an operation method only for executing one-touch tuning in the user command method on MR-J4-03A6(-RJ) servo amplifier by using push button. Refer to section 6.2 for details of one-touch tuning.

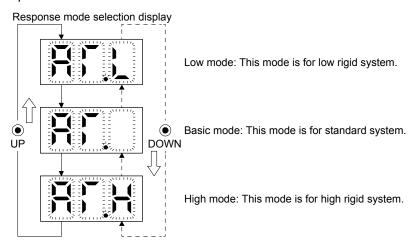
POINT

●Push the "MODE" and "SET" buttons at the same time for 3 s or more to switch to the response mode selection ("AT.") without going through the initial screen of the one-touch tuning ("AT").

Push the "MODE" button during motor driving to switch to the initial screen ("AT") of the one-touch tuning. Push the "SET" button for 2 s or more during displaying "AT" to switch to the response mode selection ("AT.").

(1) Response mode selection

Select a response mode of the one-touch tuning from 3 modes with "UP" or "DOWN". Refer to section 6.2.2 (1) (a) for a guideline of response mode.

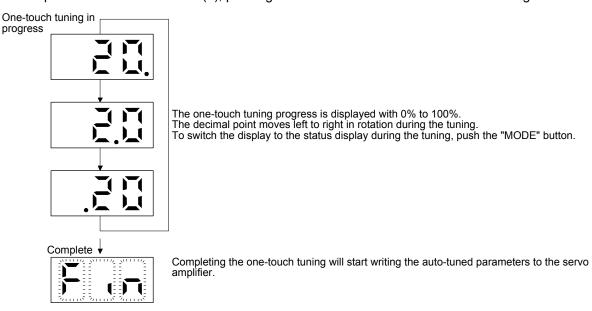


(2) One-touch tuning execution

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.

After the response mode is selected in (1), pushing the "SET" button will start one-touch tuning.



(3) Stop of one-touch tuning





The one-touch tuning mode can be stopped by pushing the "SET" button regardless of displayed item.



The stop symbol and error code "C 00" (cancel during tuning) will be displayed by turns with $2\,\mathrm{s}$ interval.

Error code



↓ Pushing the "SET" button will switch to the initial screen.

Initial screen



(4) If an error occurs

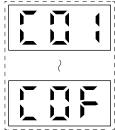
Stop symbol



If an error occurs during the one-touch tuning, the tuning will be forcibly terminated and the stop symbol and error code from "C 01" to "C 0F" will be displayed by turns with 2 s interval.



Error code



Check the error cause referring to the table 6.2 of (1) (d) of section 6.2.2.

 \downarrow Pushing the "SET" button will switch to the initial screen.

Initial screen



(5) If an alarm occurs

One-touch tuning in progress



If an alarm occurs during tuning, one-touch tuning will be forcibly terminated and the alarm No. will be displayed.



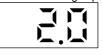






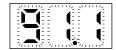
(6) If a warning occurs

One-touch tuning in progress



If a warning occurs during tuning, the alarm No. of the warning will be displayed. When the warning is one which continue the motor driving, the one-touch tuning will be continued.



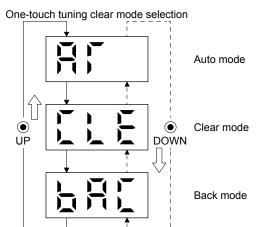


(7) Clearing one-touch tuning

Refer to table 6.1 of section 6.2 for the parameters which you can clear.

You can initialize the parameters changed by the one-touch tuning with the clear mode. You can reset the parameters to before tuning with the back mode.

- (a) Push the "MODE" button to switch to the initial screen ("AT") of the one-touch tuning.
- (b) Select the clear mode or back mode with the "UP" or "DOWN" button.



↓ To clear the one-touch tuning, push the "SET" button for 2 s.

One-touch tuning clear mode display (initializing)



The one-touch tuning clear mode is in progress. The clear mode symbol flickers for 3 s.

Lack Clearing one-touch tuning is completed, the initial screen will be displayed.

Initial screen



18.5.5 Diagnostic mode

	Name	Display	Description
Sequence			Not ready Indicates that the servo amplifier is being initialized or an alarm has occurred.
Sequence			Ready Indicates that the servo was switched on after completion of initialization and the servo amplifier is ready to operate.
			Drive recorder enabled When an alarm occurs in the status, the drive recorder will operate and write the status of occurrence.
Drive recorder ena	abled/disabled display		Drive recorder disabled The drive recorder will not operate on the following conditions.
			 You are using the graph function of MR Configurator2. You are using the machine analyzer
			function. 3. [Pr. PF21] is set to "-1".
External I/O signa	l display	Refer to section 18.5.8.	This indicates the on/off status of external I/O signal. The upper segments correspond to the input signals and the lower segments to the output signals.
Output signal (DO) forced output		This allows digital output signal to be switched on/off forcibly. For details, refer to section 18.5.9.
	JOG operation		JOG operation can be performed when there is no command from an external controller. For details, refer to section 18.5.10 (2).
	Positioning operation		Positioning operation can be performed when there is no command from an external controller. MR Configurator2 is required to perform positioning operation. For details, refer to section 4.5.9 (3).
Test operation mode	Motor-less operation		Without connecting the servo motor, output signals or status display monitoring can be provided in response to the input device as if the servo motor is actually running. For details, refer to section 4.5.9 (4).
	Machine analyzer operation		Merely connecting the servo amplifier allows the resonance point of the mechanical system to be measured. MR Configurator2 is required to perform machine analyzer operation. Refer to section 11.7 for details.
	For manufacturer adjustment		This is for manufacturer adjustment.

18. MR-J4-03A6(-RJ) SERVO AMPLIFIER

Name	Display	Description
Software version: lower	→ "SET"	Indicates the version of the software. The software version is displayed while the "SET" button is pressed and held. Press the "MODE" button to shift to the next display mode. Press the "UP" or "DOWN" button to shift to the next diagnosis menu.
Software version: upper	→ "SET"	Indicates the system number of the software. The software system number is displayed while the "SET" button is pressed and held. Press the "MODE" button to shift to the next display mode. Press the "UP" or "DOWN" button to shift to the next diagnosis menu.
Automatic VC offset		If offset voltages in the analog circuits inside and outside the servo amplifier cause the servo motor to rotate slowly at VC (Analog speed command) or VLA (Analog speed limit) of 0 V, this function automatically makes zero-adjustment of offset voltages. When using this function, enable the function in the following procedure. When it is enabled, [Pr. PC37] value changes to the automatically adjusted offset voltage. 1) Press the "SET" button once. 2) Set the number in the first digit to "1" with "UP" button. 3) Press the "SET" button. This function cannot be used if the input voltage of VC or VLA is -0.4 V or less, or +0.4 V or more. (Note)

Note. Even if VC automatic offset is performed and 0 V is input, the servo motor may not completely stop due to an internal error. To stop completely, turn off the ST1 or ST2.

18. MR-J4-03A6(-RJ) SERVO AMPLIFIER

Name	Display	Description
Servo motor series ID	↓ "SET"	Displays the series ID of the servo motor currently connected. Press the "SET" button to show the lower 3 digits of servo motor series ID. For indication details, refer to app. 1 of "Servo Motor Instruction Manual (Vol. 3)". Press the "UP" or "DOWN" button to shift to the next diagnosis menu.
Servo motor type ID	↓ "SET"	Displays the type ID of the servo motor currently connected. Press the "SET" button to show the lower 3 digits of servo motor type ID. For indication details, refer to app. 1 of "Servo Motor Instruction Manual (Vol. 3)". Press the "UP" or "DOWN" button to shift to the next diagnosis menu.
Servo motor encoder ID	↓ "SET"	Displays the encoder ID of the servo motor currently connected. Press the "SET" button to show the lower 3 digits of servo motor encoder ID. For indication details, refer to app. 1 of "Servo Motor Instruction Manual (Vol. 3)". Press the "UP" or "DOWN" button to shift to the next diagnosis menu.
For manufacturer adjustment	H	This is for manufacturer adjustment.

18.5.6 Alarm mode

The current alarm, past alarm history and parameter error are displayed. The alarm number that has occurred or the parameter numbers in error are displayed on the display.

Name	Display	Description	
		Indicates no occurrence of an alarm.	
Current alarm	2 s interval	Indicates the occurrence of [AL. 33.1 Main circuit voltage error]. Flickers at alarm occurrence. The alarm number and detail number are displayed alternately by intervals of 2 s.	
	33.1		
	↓ "SET"	Indicates that the last alarm is [AL. 50.1 Thermal overload error 1 during operation]. When an alarm is recorded to alarm history, the second digit decimal point flickers. Press and hold the "SET" button to show the detail number of [AL. 50].	
	↓ "SET"	Indicates the second last alarm is [AL. 33.1 Main circuit voltage error]. When an alarm is recorded to alarm history, the second digit decimal point flickers. Press and hold the "SET" button to show the detail number of [AL. 33].	
Alarm history	↓ "SET"	Indicates that there is no third alarm in the past. If there is no alarm history, the display will be as shown as in the left, when the "SET" button is pressed.	
	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Indicates that there is no sixteenth alarm in the past.	

18. MR-J4-03A6(-RJ) SERVO AMPLIFIER

Name	Display	Description
		This indicates no occurrence of [AL. 37 Parameter error].
Parameter error No.	"SET"	The parameter error number is displayed. The parameter group in which the parameter error has occurred is displayed. Press and hold the "SET" button to show the parameter number with the error. The display example on the left is when the data of [Pr. PA12 reverse rotation torque limit] becomes error. The parameter number is displayed by ascending order when several parameter errors occurred at the same time.

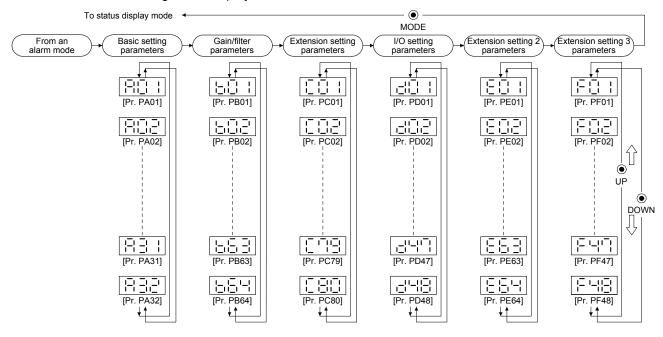
Functions at occurrence of an alarm

- (1) Any mode screen displays the current alarm.
- (2) Even during alarm occurrence, the other screen can be viewed by pressing the button in the operation area. At this time, the decimal point in the third digit remains flickering.
- (3) For any alarm, remove its cause and clear it in any of the following methods. (Refer to chapter 8 for the alarms that can be cleared.)
 - (a) Switch power off, then on.
 - (b) Press the "SET" button on the current alarm screen.
 - (c) Turn on RES (Reset).
- (4) Use [Pr. PC18] to clear the alarm history.
- (5) Push "UP" or "DOWN" to move to the next history.

18.5.7 Parameter mode

(1) Parameter mode transition

After selecting the corresponding parameter mode with the "MODE" button, pressing the "UP" or "DOWN" button changes the display as follows.



(2) Operation example

(a) Parameters of 3 or less decimal digits.

The following example gives the operation procedure to change [Pr. PA Reverse rotation torque limit].

Press "MODE" to switch to the basic setting parameter screen.

Parameter number selection



Press "UP" or "DOWN" to select parameter number.

Press "SET" to display the item to set to the selected parameter number.

Parameter contents display



Press "UP" or "DOWN" to shift to the setting display of the next parameter number.

Press the "MODE" button to shift to the next display.

Press the "SET" button once to display the setting.

Press the "SET" button once when the setting is displayed. The setting flickers and is possible to be changed.

Changing the parameter contents

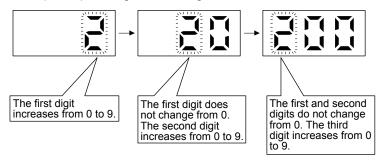


Press "UP" or "DOWN" to change the value and press "SET" to fix the setting. The setting will be displayed as it is after the setting is fixed.

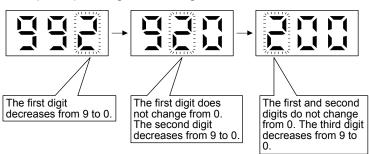
To cancel the setting data, press "MODE" for 2 s while the display is flickering. The setting before the change will be displayed.

Press and hold "UP" or "DOWN" to change the data continuously. In that case, only the highest digit changes.

Example of pressing and holding the "UP" button



Example of pressing and holding the "DOWN" button

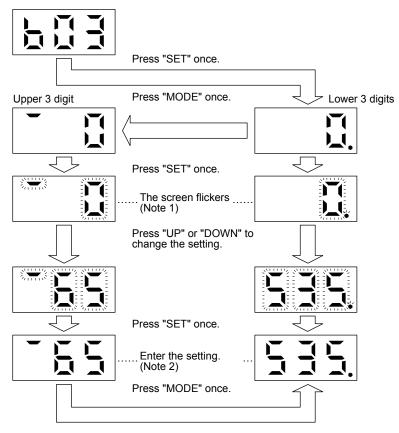


(b) Parameters of 4 to 6 decimal digits

The following example gives the operation procedure to change [Pr. PB03 Positioning command acceleration/deceleration time constants (position smoothing)] to "65535".

Press "MODE" to switch to the gain/filter setting parameter screen.

Press "UP" or "DOWN" to select [Pr. PB03].



Note 1. Pressing the "SET" button in either upper or lower 3-digit display makes the display flicker.

2. Pressing the "SET" button in either upper or lower 3-digit display fix the setting.

The display can be switched between upper and lower 3-digit by pressing the "MODE" button. Switching the display between upper and lower 3-digit is also possible by pressing the "MODE" button while the display is flickering.

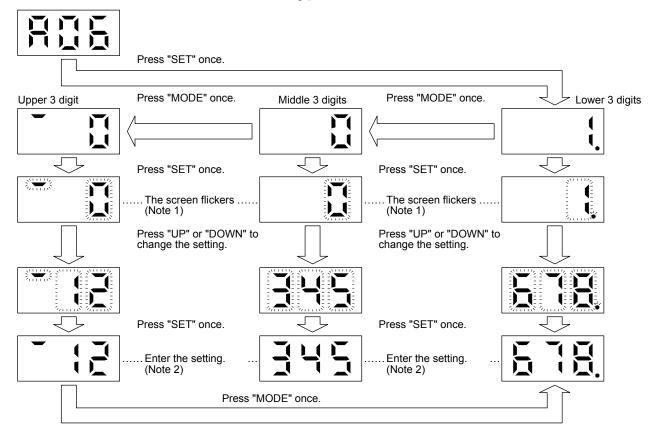
The changed value will be canceled when "MODE" is pressed for 2 s or more while flickering. To shift to the next parameter number, press the "UP" or "DOWN" button.

To change the screen to the other, press "UP" or "DOWN" to change the screen to other parameter number display screen and press "MODE".

(c) Parameters of 7 or more decimal digits

The following example gives the operation procedure to change the [Pr. PA06 Electronic gear numerator (command pulse multiplication numerator)] to "12345678".

Press "MODE" to switch to the basic setting parameter screen.



Note 1. Pressing the "SET" button in upper, middle, or lower 3-digit display makes the display flicker.

2. Pressing the "SET" button in upper, middle, or lower 3-digit display fix the setting.

The display can be switched among upper, middle, and lower 3-digits by pressing the "MODE" button.

Switching the display between upper, middle, and lower 3-digit is also possible by pressing the "MODE" button while the display is flickering.

The changed value will be canceled when "MODE" is pressed for 2 s or more while flickering. To shift to the next parameter number, press the "UP" or "DOWN" button.

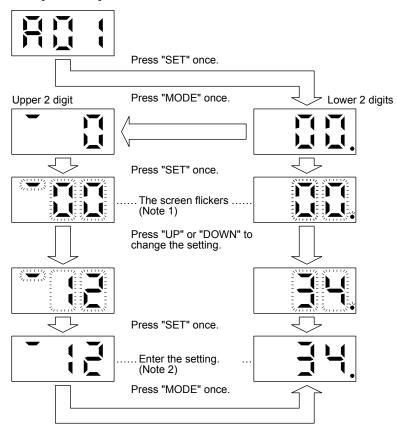
To change the screen to the other, press "UP" or "DOWN" to change the screen to other parameter number display screen and press "MODE".

(d) Parameter of hexadecimal

The following example gives the operation procedure to change the [Pr. PA01 Operation mode] to "1234".

Press "MODE" to switch to the basic setting parameter screen.

Press "UP" or "DOWN" to select [Pr. PA01].



Note 1. Pressing the "SET" button in upper, middle, or lower 2-digit display makes the display flicker.

2. Pressing the "SET" button in upper, middle, or lower 2-digits display fix the setting.

The display can be switched among upper, middle, and lower 2-digits by pressing the "MODE" button.

Switch the display between upper, middle, and lower 2-digit is also possible by pressing the "MODE" button while the display is flickering.

The changed value will be canceled when "MODE" is pressed for 2 s or more while flickering. To shift to the next parameter number, press the "UP" or "DOWN" button.

To change the screen to the other, press "UP" or "DOWN" to change the screen to other parameter number display screen and press "MODE".

18.5.8 External I/O signal display

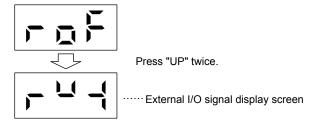
POINT

●The I/O signal settings can be changed using the I/O setting parameters [Pr. PD03] to [Pr. PD26], and [Pr. PD28].

The on/off states of the digital I/O signals connected to the servo amplifier can be confirmed.

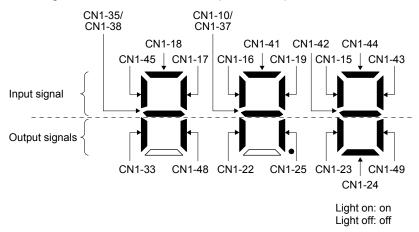
(1) Operation

The display screen at power-on. Use the "MODE" button to display the diagnostic screen.



(2) Display definition

The 7-segment LED segments and CN1 connector pins correspond as shown below.



The LED segment corresponding to the pin is lit to indicate on, and is extinguished to indicate off. The decimal point in the second digit flickers continuously. The signals corresponding to the pins in the respective control modes are indicated as follows:

(a) Control modes and I/O signals

		Signal		(Note 2) Sy	mbols of I/O	signals in co	ntrol modes		
Connector	Pin No.	input/output (Note 1) I/O	Р	P/S	S	S/T	Т	T/P	Related parameter
	10	I	PP	PP/-	(Note 3)	(Note 3)	(Note 3)	-/PP	Pr. PD43/Pr. PD44
	15	I	SON	SON	SON	SON	SON	SON	Pr. PD03/Pr. PD04
	16	I		-/SP2	SP2	SP2/SP2	SP2	SP2/-	Pr. PD05/Pr. PD06
	17	I	PC	PC/ST1	ST1	ST1/RS2	RS2	RS2/PC	Pr. PD07/Pr. PD08
	18	I	TL	TL/ST2	ST2	ST2/RS1	RS1	RS1/TL	Pr. PD09/Pr. PD10
	19	I	RES	RES	RES	RES	RES	RES	Pr. PD11/Pr. PD12
	22	0	INP	INP/SA	SA	SA/-		-/INP	Pr. PD23
	23	0	ZSP	ZSP	ZSP	ZSP	ZSP	ZSP	Pr. PD24
	24	0	INP	INP/SA	SA	SA/-		-/INP	Pr. PD25
CN1	25	0	TLC	TLC	TLC	TLC/VLC	VLC	VLC/TLC	Pr. PD26
	33	0	OP	OP	OP	OP	OP	OP	
	35	I	NP	NP/-	(Note 3)	(Note 3)	(Note 3)	-/NP	Pr. PD45/Pr. PD46
	37	I	PP2	PP2/-	(Note 4)	(Note 4)	(Note 4)	-/PP2	Pr. PD43/Pr. PD44
	38	I	NP2	NP2/-	(Note 4)	(Note 4)	(Note 4)	-/NP2	Pr. PD45/Pr. PD46
	41	I	CR	CR/SP1	SP1	SP1/SP1	SP1	SP1/CR	Pr. PD13/Pr. PD14
	42	I	EM2	EM2	EM2	EM2	EM2	EM2	
	43	I	LSP	LSP	LSP	LSP/-		-/LSP	Pr. PD17/Pr. PD18
	44	I	LSN	LSN	LSN	LSN/-		-/LSN	Pr. PD19/Pr. PD20
	45	Ī	LOP	LOP	LOP	LOP	LOP	LOP	Pr. PD21/Pr. PD22
	48	0	ALM	ALM	ALM	ALM	ALM	ALM	
	49	0	RD	RD	RD	RD	RD	RD	Pr. PD28

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

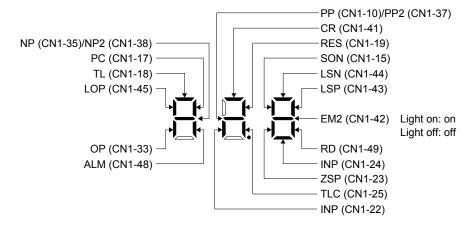
- 2. P: position control mode, S: speed control mode, T: torque control mode
 P/S: position/speed control switching mode, S/T: speed/torque control switching mode, T/P: torque/position switching mode
- 3. This is available as an input device of sink interface. Input devices are not assigned by default. Assign the input devices with [Pr. PD43] to [Pr. PD46] as necessary. Supply + of 24 V DC to CN1-12 pin.
- 4. This is available as an input device of source interface. Input devices are not assigned by default. Assign the input devices with [Pr. PD43] to [Pr. PD46] as necessary.

(b) Symbol and signal names

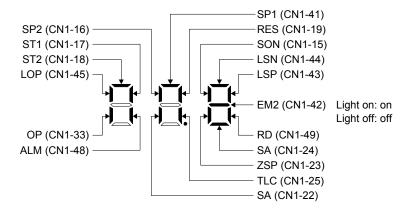
Symbol	Signal name	Symbol	Signal name
SON	Servo-on	RES	Reset
LSP	Forward rotation stroke end	EM2	Forced stop 2
LSN	Reverse rotation stroke end	LOP	Control switching
CR	Clear	TLC	Limiting torque
SP1	Speed selection 1	VLC	Limiting speed
SP2	Speed selection 2	RD	Ready
PC	Proportional control	ZSP	Zero speed detection
ST1	Forward rotation start	INP	In-position
ST2	Reverse rotation start	SA	Speed reached
RS1	Forward rotation selection	ALM	Malfunction
RS2	Reverse rotation selection	OP	Encoder Z-phase pulse (open collector)
TL	External torque limit selection		

(3) Display data at initial values

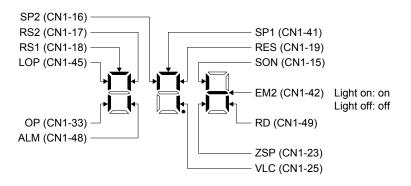
(a) Position control mode



(b) Speed control mode



(c) Torque control mode



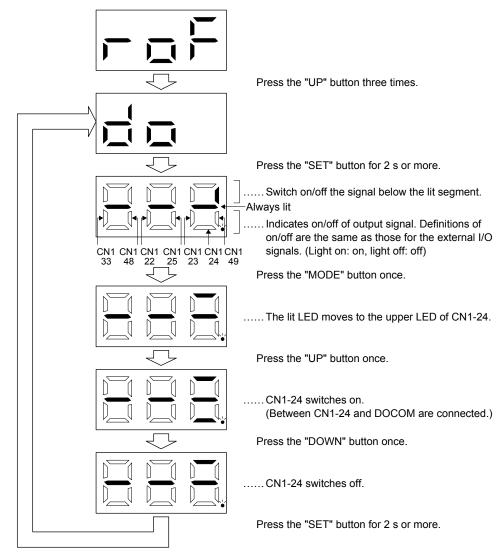
18.5.9 Output signal (DO) forced output

POINT

●When the servo system is used in a vertical lift application, turning on MBR (Electromagnetic brake interlock) by the DO forced output after assigning it to connector CN1 will release the electromagnetic brake, causing a drop. Take drop preventive measures on the machine side.

Output signals can be switched on/off forcibly independently of the servo status. Use this function for checking output signal wiring, etc. This operation must be performed in the servo off state by turning off SON (Servo-on).

The following shows the display at power-on. Use the "MODE" button to display the diagnostic screen.



18.5.10 Test operation mode



- The test operation mode is designed for checking servo operation. Do not use it for actual operation.
- ●If the servo motor operates unexpectedly, use EM2 (Forced stop 2) to stop it.

POINT

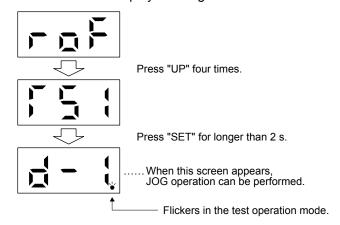
- ●The test operation mode cannot be used in the absolute position detection system by DIO ([Pr. PA03: _ _ 1]).
- •MR Configurator2 is required to perform positioning operation.
- Test operation cannot be performed if SON (Servo-on) is not turned off.

The items in the following table are the same as those for MR-J4-_A_(-RJ) servo amplifiers of 100 W or more. Refer to the section of the detailed explanation field for details.

Item	Detailed explanation	
Positioning operation	Section 4.5.9 (3)	
Motor-less operation	Section 4.5.9 (4)	
Program operation	Section 4.5.9 (5)	
Output signal (DO) forced output Section 4.5.9 (6)		

(1) Mode switching

The following shows the display at power-on. Select JOG operation or motor-less operation in the following procedure. Use the "MODE" button to display the diagnostic screen.



(2) JOG operation

POINT

■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__".

JOG operation can be performed when there is no command from the controller.

(a) Operation/drive

The servo motor rotates while holding down the "UP" or the "DOWN" button. The servo motor stops rotating by releasing the button. The operation condition can be changed using MR Configurator2. The initial operation condition and setting range for operation are listed below.

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

The following table shows how to use the buttons.

Button	Description
"UP"	Press to start CCW rotation.
UP	Release to stop.
"DOWN"	Press to start CW rotation.
DOWN	Release to stop.

If the USB cable is disconnected during JOG operation using the MR Configurator2, the servo motor decelerates to a stop.

(b) Status display

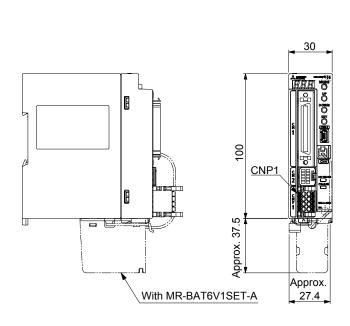
Press the "MODE" button in the JOG operation-ready status to call the status display screen. When the JOG operation is performed using the "UP" or "DOWN" button, the servo status is displayed during the JOG operation. Every time the "MODE" button is pushed, the next status display screen appears. When one cycle of the screen display is complete, it returns to the JOG operation-ready status screen. Refer to section 18.5.3 for details of status display. Note that the status display screen cannot be changed by the, "UP" or "DOWN" button during the JOG operation.

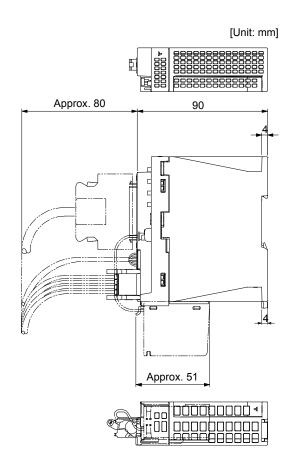
(c) Termination of JOG operation

To end the JOG operation, shut the power off once, or press the "MODE" button to switch to the next screen, and then hold down the "SET" button for 2 s or longer.



18.6 Dimensions





Terminal

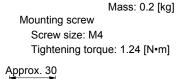
CNP1

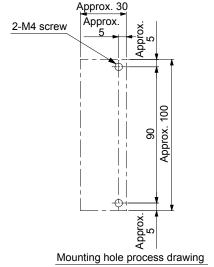
5 0 24 1

6 PM 2

7 W U 3

8 E V 4





18.7 Characteristics

The items in the following table are the same as those for MR-J4-_A_(-RJ) servo amplifiers of 100 W or more. Refer to the section of the detailed explanation field for details.

Item	Detailed explanation	
Cable bending life	Section 10.4	

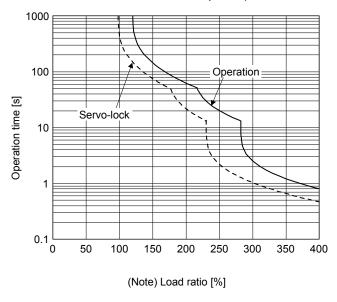
18.7.1 Overload protection characteristics

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. 18.1. [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 less of the 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-AK0136/HG-AK0236/HG-AK0336

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 30 r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal protection.

Fig. 18.1 Electronic thermal protection characteristics

18.7.2 Power supply capacity and generated loss

Table 18.4 indicates the required power supply capacities for main circuit and losses generated under rated load of the servo amplifier. 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 operated under the rated speed, required power supply capacities for main circuit will be less than the value of the table.

Table 18.4 Power supply capacity and generated heat per servo amplifier at rated output

Main circuit (48 V DC/24 V DC) Servo motor Required power supply		(Note) Servo amplifier-generated heat [W]	
	capacity [W]	At rated output	With servo-off
HG-AK0136	230	6	1
HG-AK0236	360	9	1
HG-AK0336	480	13	1

Note. Heat generated during regeneration is not included in the servo amplifier-generated heat

18.7.3 Dynamic brake characteristics

POINT

- ●The dynamic brake of MR-J4-03A6(-RJ) is an electronic type.
- Do not use dynamic brake to stop in a normal operation as it is the function to stop in emergency.
- ■Be sure to enable EM1 (Forced stop 1) after servo motor stops when using EM1 (Forced stop 1) frequently in other than emergency.
- ●The time constant "r" for the electronic dynamic brake will be shorter than that of normal dynamic brake. Therefore, coasting distance will be longer than that of normal dynamic brake. For how to set the electronic dynamic brake, refer to [Pr. PF09] and [Pr. PF15].

(1) Dynamic brake operation

(a) Calculation of coasting distance

Fig. 18.2 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use equation 18.1 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 (1) (b) of 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.

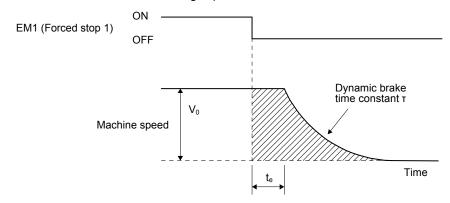
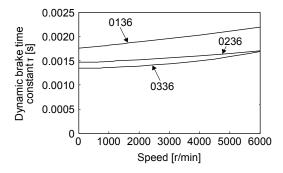


Fig. 18.2 Dynamic brake operation diagram

$$L_{\text{max}} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\}$$
 (18.1)

(b) Dynamic brake time constant

The following shows necessary dynamic brake time constant τ for equation 18.1.



HG-AK series

18. MR-J4-03A6(-RJ) SERVO AMPLIFIER

(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 servo amplifier 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-AK0136	
HG-AK0236	30
HG-AK0336	

18.7.4 Inrush currents at power-on of main circuit and control circuit

POINT

■The inrush current values can change depending on frequency of turning on/off the power and ambient temperature.

Since large inrush currents flow in the power supplies, use circuit protector. For circuit protectors, it is recommended that the inertia delay type, which is not tripped by an inrush current, be used. Refer to section 18.8.4 for details of the circuit protector.

This following table indicates the inrush current (reference data) when the power of output side of power unit is turned on in the conditions: main circuit of 55.2 V DC, control circuit of 26.4 V DC, and wiring length of 1 m.

Servo amplifier	Inrush current		
Servo amplinei	Main circuit power supply (PM/0)	Control circuit power supply (24/0)	
MR-J4-03A6(-RJ)	70 A (attenuated to approx. 0 A in 1 ms)	0.5 A (attenuated to approx. 0 A in 60 ms)	

18.8 Options and peripheral equipment

_WARNING

• Before connecting options and peripheral equipment, turn off the power and wait 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.

The items in the following table are the same as those for MR-J4-_A_(-RJ) servo amplifiers of 100 W or more. Refer to the section of the detailed explanation field for details.

Item	Detailed explanation	
Junction terminal block MR-TB50	Section 11.6	
MR Configurator2	Section 11.7	
Battery	Section 11.8	
Relay (recommended) Section 11.13		
Noise reduction techniques Section 11.14		

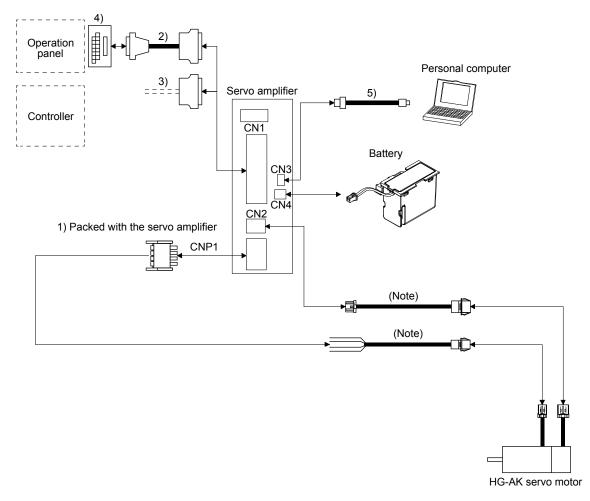
18.8.1 Cable/connector sets

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.

Purchase the cable and connector options indicated in this section.

18.8.2 Combinations of cable/connector sets



Note. Refer to "Servo Motor Instruction Manual (Vol. 3)" for servo motor power cables and encoder cables.

No.	Name	Model	Description		Remark
1)	CNP1 connector		Model: DFMC 1,5/ 4-ST-3,5-LR or ed (Phoenix Contact) Applicable wire size: AWG 24 to 16 Insulator OD: to 2.9 mm	quivalent	Supplied with servo amplifier
2)	Junction terminal block cable	MR-J2M- CN1TBL_M Cable length: 0.5 m, 1 m (Refer to section 11.6.)	Junction terminal block connector Connector: D7950-B500FL (3M)	CN1 connector Connector: 10150-6000EL Shell kit: 10350-3210-000 (3M or equivalent)	For junction terminal block connection
3)	CN1 connector set	MR-J3CN1	Connector: 10150-3000PE Shell kit: 10350-52F0-008 (3M or equivalent)		
4)	Junction terminal block	MR-TB50	Refer to section 11.6.		
5)	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

18.8.3 Selection example of wires

POINT

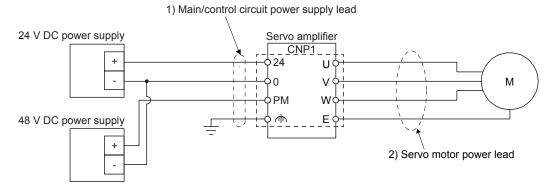
- ■To comply with the IEC/EN/UL/CSA standard, use the wires shown in app. 4 for wiring. To comply with other standards, use a wire that is complied with each standard.
- Selection conditions of wire size are as follows.

Construction condition: Single wire set in midair

Wire length: 30 m or less

The voltage drops because of the cable conductor resistance. Especially for main circuit/control circuit power supply wiring, wire to secure the required input voltage at servo amplifier input section. It is recommended that the cable length be as short as possible.

The following diagram shows the wires used for wiring. Use the wires or equivalent given in this section.



The following shows the wire size selection example.

Table 18.5 Wire size selection example 1 (HIV wire)

	Wire [mm²]		
Servo amplifier	1) 24/0/PM/ <i>/</i> ♣	2) U/V/W/E	
	1) Z4/0/1 W//-	(Note)	
MR-J4-03A6(-RJ)	AWG 16	AWG 19	

Note. The wire size shows applicable size of the servo amplifier connector and terminal block. For wires connecting to the servo motor, refer to "Servo Motor Instruction Manual (Vol. 3)".

18.8.4 Circuit protector

Power supply specification	Circuit protector (Note)	
Control circuit power supply (24 V DC)	CP30-BA 1P 1-M 1A	
Main circuit power supply (48 V DC)	CP30-BA 1P 1-M 3A	
Main circuit power supply (24 V DC)	CP30-BA 1P 1-M 5A	

Note. For operation characteristics, use an intermediate speed type.

18.9 Communication function (Mitsubishi general-purpose AC servo protocol)

POINT

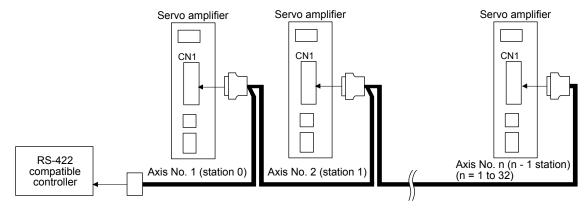
●The USB communication function and RS-422 communication function are mutually exclusive. They cannot be used together.

With MR-J4-03A6(-RJ) servo amplifier, driving servo, changing parameters, operating motor function, etc. is possible using RS-422 communication (Mitsubishi general-purpose AC servo protocol). In this section, only the configuration of operating RS-422 communication function with MR-J4-03A6(-RJ) servo amplifier is described. Refer to chapter 14 for details of the communication specification and protocol, etc.

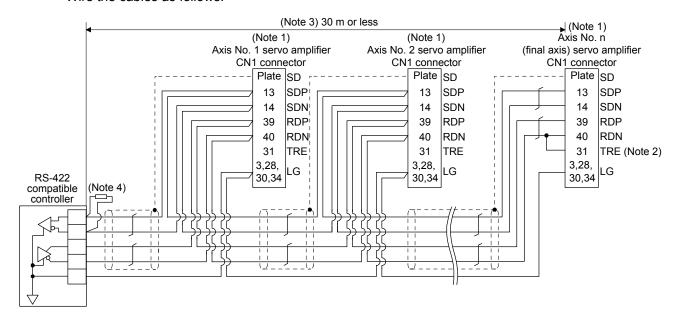
(1) Configuration diagram

(a) Diagrammatic sketch

Up to 32 axes of servo amplifiers from stations 0 to 31 can be operated on the same bus.



(b) Cable connection diagram
Wire the cables as follows.



18. MR-J4-03A6(-RJ) SERVO AMPLIFIER

Note 1. Connector set MR-J3CN1 (3M or equivalent)

Connector: 10150-3000PE Shell kit: 10350-52F0-008

- 2. Connect between TRE and RDN of the final axis servo amplifier.
- 3. The overall length is 30 m or less in low-noise environment.
- 4. If the RS-422 compatible controller does not have a termination resistor, terminate it with a 150 Ω resistor.

18. MR-J4-03A6(-RJ) SERVO AMPLIFIER

MEMO		

19. MR-D01 EXTENSION I/O UNIT

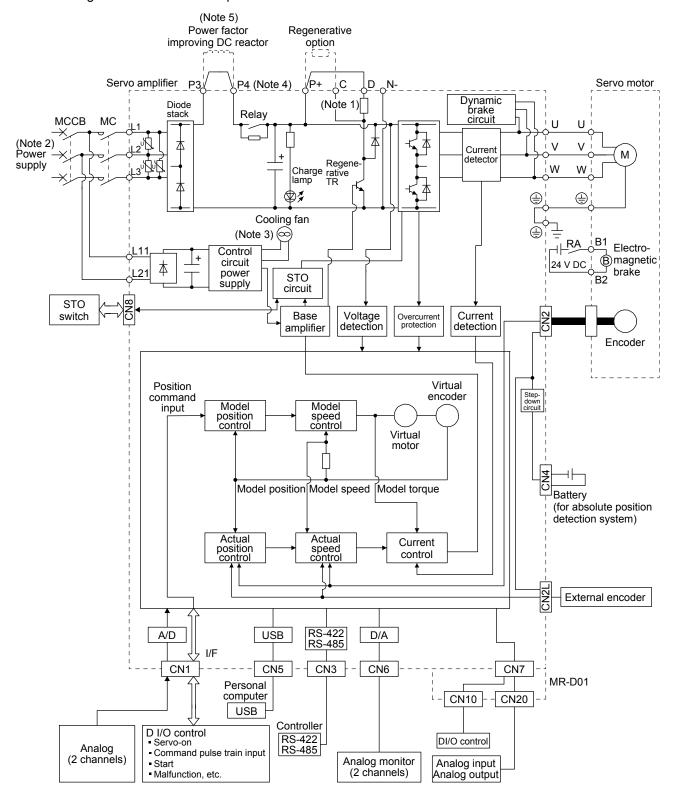
MR-D01 is an extension I/O unit that can extend the input/output signals of MR-J4-_A_-RJ servo amplifiers.

POINT

- ●MR-D01 is available with MR-J4-_A_-RJ servo amplifiers with software version B7 or later.
- ●MR-D01 cannot be used with the MR-J4-_A_ servo amplifier.
- ●MR-D01 cannot be used with the MR-J4-DU_A_(-RJ) drive unit.
- ●MR-D01 cannot be used with MR-J4-03A6(-RJ) servo amplifiers.

19.1 Function block diagram

The function block diagram of this servo is shown below. The following illustration is an example of MR-J4-20A-RJ.



19. MR-D01 EXTENSION I/O UNIT

Note 1. The built-in regenerative resistor is not provided for MR-J4-10A-RJ.

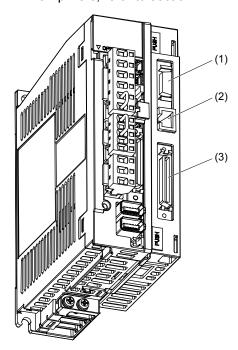
- 2. For power supply specifications, refer to section 1.3.
- 3. Servo amplifiers MR-J4-70A-RJ or more have a cooling fan.
- 4. MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of MR-J3 servo amplifiers.
- 5. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

19.2 Structure

19.2.1 Parts identification

(1) Interface

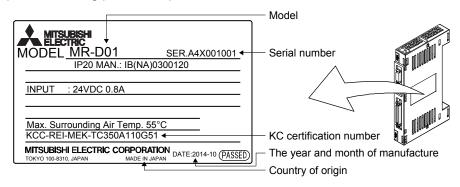
The following figure shows the interface of when MR-D01 is connected to MR-J4-20A-RJ. For servo amplifiers, refer to section 1.7.1.



No.	Name/Application	Detailed explanation
(1)	Analog input signal connector (CN20) Connect analog input signals of analog torque limit and override.	Section 19.5.1
(2)	Manufacturer setting connector (CN30) This connector is attached on the MR-D01, but not for use.	
(3)	I/O signal connector (CN10) Connect digital I/O signal and analog output signal.	Section 19.5.1

(2) Rating plate

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



19.2.2 Installation and removal of the MR-D01 extension I/O unit

∕NWARNING

●Before installing or removing MR-D01, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. 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.

- Avoid installing and removing MR-D01 repeatedly. Any contact failure of the connector may be caused.
- Avoid unsealing MR-D01 to be free of dust and dirt against the connector except installing. Make sure to use the pre-packing when storing.
- Avoid using MR-D01 of which the hook and knobs for fixing are damaged. Any contact failure of the connector may be caused.

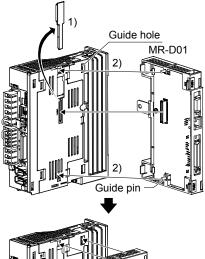


- ↑ CAUTION ●When mounting/dismounting MR-D01 to/from MR-J4-500A-RJ to MR-J4-22KA-RJ and MR-J4-350A4-RJ to MR-J4-22KA4-RJ servo amplifiers, avoid dropping out the installing screw inside it. Otherwise, it may cause a malfunction.
 - ■When mounting MR-D01 to MR-J4-500A-RJ to MR-J4-22KA-RJ and MR-J4-350A4-RJ to MR-J4-22KA4-RJ servo amplifiers, avoid damaging the control board by the fixing plate. Otherwise, it may cause a malfunction.
 - Make sure to tighten MR-D01 with the enclosed installing screws when installing.

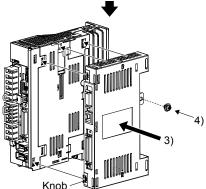
POINT

- ●The internal circuits of the servo amplifier and MR-D01 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.

- (1) For MR-J4-200A(4)-RJ or less and MR-J4-350A-RJ
 - (a) Installation of MR-D01

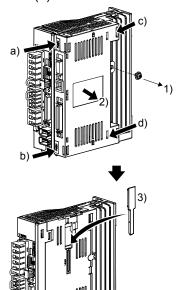


- 1) Remove the covers of CN7 and CN9 connectors. Make sure to store the removed cover.
- 2) Find the guide hole on the side of the servo amplifier. To the guide hole, insert the MR-D01's guide pins.



- Push the four corners of the side of MR-D01 simultaneously to the servo amplifier until the four knobs click so that the CN7 connector is connected straight.
- 4) Tighten the unit with the enclosed installing screw (M4).

(b) Removal of MR-D01

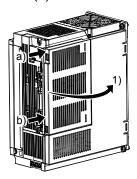


- 1) Remove the installing screw.
- 2) Keep pushing the knobs (a),b), c), d)) and pull out MR-D01 to the arrow direction. Avoid pulling out MR-D01 while it is tightened with the installation screw.

3) After removing MR-D01, make sure to cap the CN7 and CN9 connectors to avoid dust and dirt.

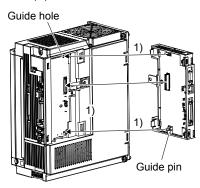
(2) MR-J4-500A-RJ to MR-J4-700A-RJ and MR-J4-350A4-RJ to MR-J4-700A4-RJ

(a) Removal of the side cover

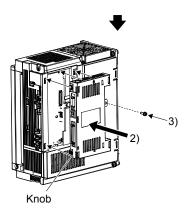


1) Keep pushing the knobs (a), b)) and pull out the side cover to the arrow direction.

(b) Installation of MR-D01

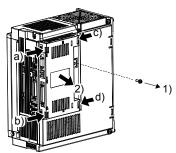


1) Find the guide hole on the side of the servo amplifier. To the guide hole, insert the MR-D01's guide pins.



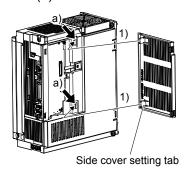
- Push the four corners of the side of MR-D01 simultaneously to the servo amplifier until the four knobs click so that the CN7 connector is connected straight.
- 3) Tighten the unit with the enclosed installing screw (M4).

(c) Removal of MR-D01



- 1) Remove the installing screw.
- 2) Keep pushing the knobs (a),b), c), d)) and pull out MR-D01 to the arrow direction. Avoid pulling out MR-D01 while it is tightened with the installation screw.

(d) Installation of the side cover



 Insert the side cover setting tabs into the sockets a) of the servo amplifier.



Push the side cover at the supporting point a) until the knobs click.

(3) MR-J4-11KA(4)-RJ to MR-J4-22KA(4)-RJ

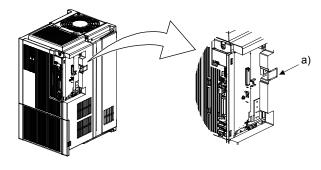


● Avoid touching any remained burr after cutting off the part a) of the case. Otherwise, it may cause injury.

The installing screw holes for the MR-J4-11KA(4)-RJ to MR-J4-22KA(4)-RJ are covered and the screw holes for mounting are not shown at shipping. When installing the unit for the first time, cut off the part a) of the case after removing the side cover.

When cutting off the part a), avoid damaging the case of the servo amplifier. After cutting off it, inside of the servo amplifier has been exposed even though the side cover and the unit are installed. Avoid unwanted parts from entering through the opened area into the servo amplifier.

For installing or removing the unit, refer to (2) in this section. The side cover structure is the same for MR-J4-11KA(4)-RJ to MR-J4-22KA(4)-RJ and for this unit. Install or remove the side cover with the same way as for the unit.



19.3 Configuration including peripheral equipment

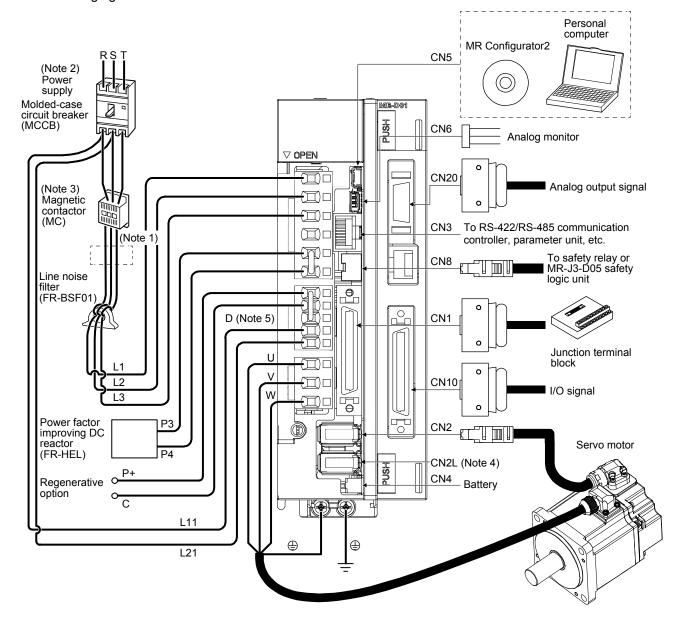
⚠CAUTION

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.

The following figure shows the interface of when MR-D01 is connected to MR-J4-20A-RJ.



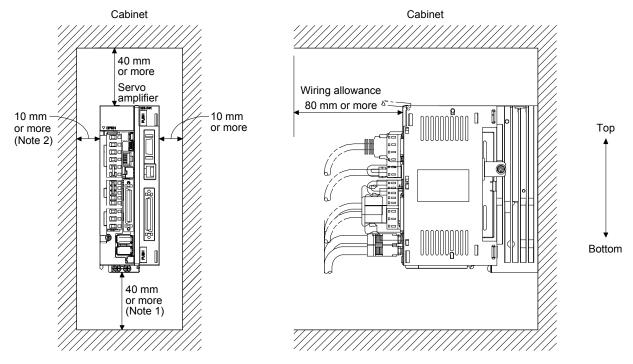
19. MR-D01 EXTENSION I/O UNIT

- Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
 - 2. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open. For power supply specifications, refer to section 1.3.
 - 3. Depending on the main circuit voltage and operation pattern, a bus voltage may drop, causing dynamic brake deceleration during forced stop deceleration. When dynamic brake deceleration is not required, delay the time to turn off the magnetic contactor.
 - 4. When using an MR-J4-_A-RJ servo amplifier in the linear servo system or in the fully closed loop system, connect an external encoder to this connector. Refer to Table 1.1 and "Linear Encoder Instruction Manual" for the compatible external encoders.
 - 5. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.

19.4 Installation direction and clearances



- The equipment must be installed in the specified direction. Otherwise, it may cause malfunction.
- Leave specified clearances between the servo amplifier and cabinet walls or other equipment. Otherwise, it may cause malfunction.
- (1) Installation clearances of the servo amplifier
 - (a) Installation of one servo amplifier



Note 1. For the 11 kW to 22 kW servo amplifiers, the clearance between the bottom and the ground will be 120 mm or more.

2. For the MR-J4-500A-RJ, the clearance between the left side and wall will be 25 mm or more.

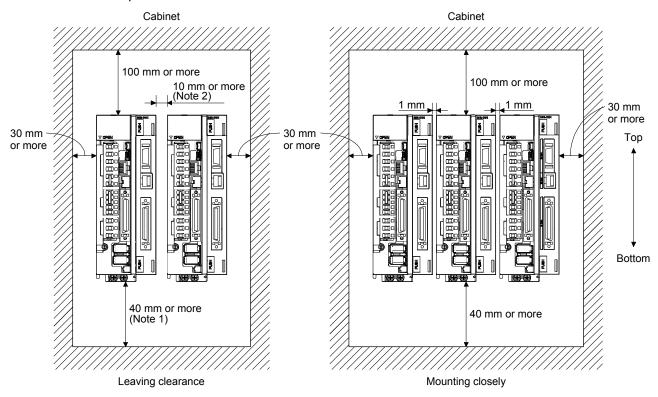
(b) Installation of two or more servo amplifiers

POINT

- ◆Close mounting is possible depending on the capacity of the servo amplifier. For the possibility of close mounting, refer to section 1.3.
- •When mounting the servo amplifiers closely, do not install the servo amplifier whose depth is larger than that of the left side servo amplifier since CNP1, CNP2, and CNP3 connectors cannot be disconnected.

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 environmental conditions.

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, operate the servo amplifiers at the ambient temperature of 0 °C to 45 °C or at 75% or less of the effective load ratio.



Note 1. For the 11 kW to 22 kW servo amplifiers, the clearance between the bottom and the ground will be 120 mm or more.

2. When you install MR-J4-500A-RJ on the right side, the clearance between the left side and the wall will be 25 mm or more.

(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.

19.5 Signals and wiring

POINT

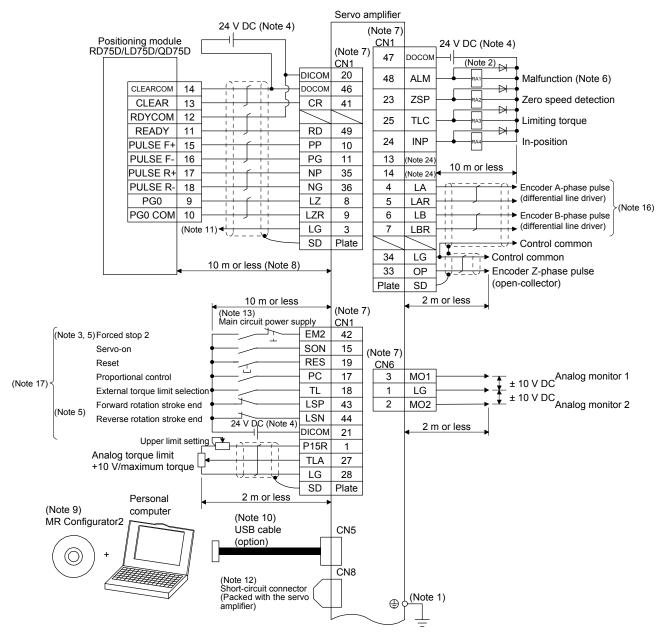
●Input signals of the servo amplifier are valid even when the MR-D01 has been connected. When the same input devices have been assigned to the servo amplifier and MR-D01 and both input signals are turned on, the input signal that has turned on first is enabled. Even though turning off one of the input signals that have been turned on is attempted, the input signal cannot be turned off. Refer to the following table for details. The following table shows ST1 (Forward rotation start) as an example.

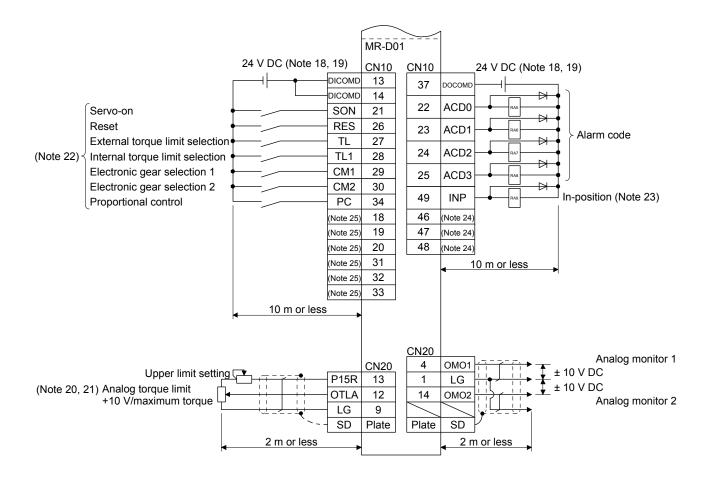
Device	(Note) Servo amplifier	(Note) MR-D01	Servo motor
	0	0	Stop
ST1	0	1	Forward rotation
	1	0	Forward rotation
	1	1	Forward rotation

Note. 0: Off 1: On

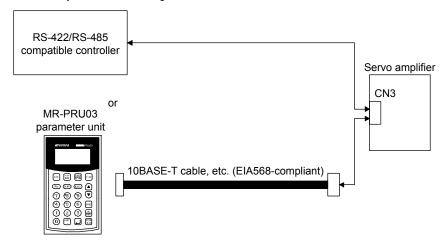
19.5.1 I/O Signal Connection Example

- (1) Position control mode
 - (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 of these power supplies must be 500 mA or lower. 500 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) 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 11.7.)
 - 10. Controllers or parameter units can also be connected via the CN3 connector with the RS-422/RS-485 communication. Note that using the USB communication function (CN5 connector) prevents the RS-422/RS-485 communication function (CN3 connector) from being used, and vice versa. They cannot be used together.

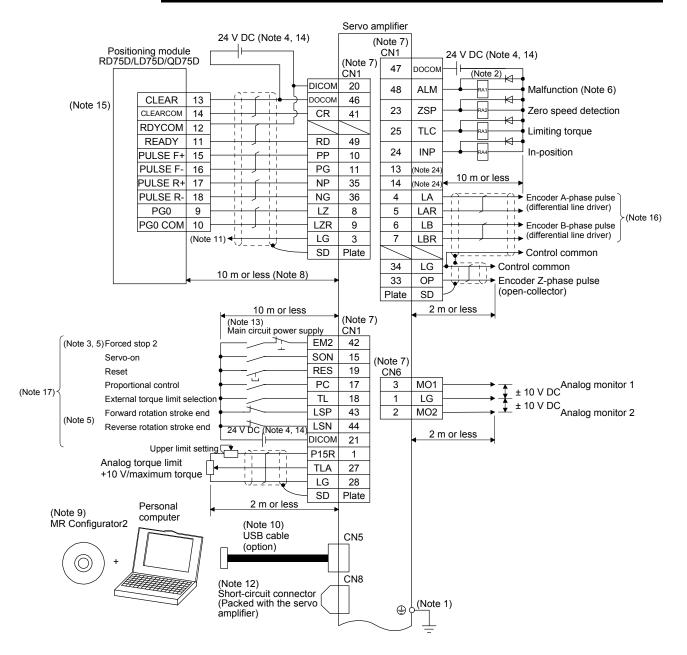


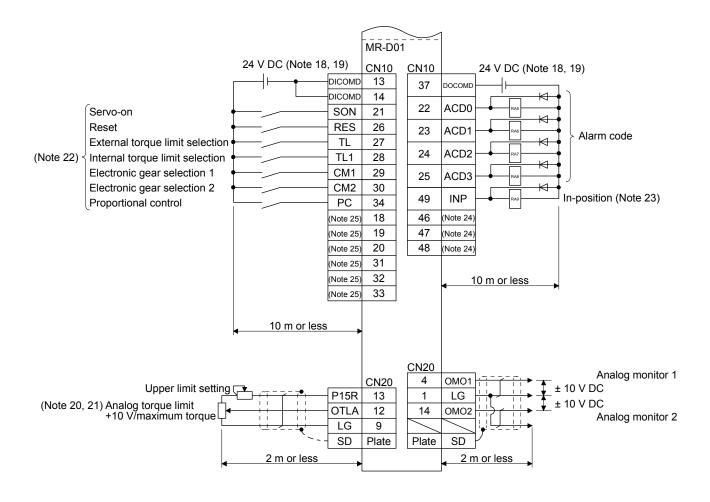
- 11. This connection is not necessary for RD75D, LD75D, and QD75D. However, to enhance noise tolerance, it is recommended to connect LG of servo amplifier and control common depending on the positioning module.
- 12. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 13. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 14. Plus and minus of the power of source interface are the opposite of those of sink interface.
- 15. CLEAR and CLEARCOM of source interface are interchanged to sink interface.
- 16. When a command cable for connection with the controller side malfunctions due to disconnection or noise, a position mismatch can occur. To avoid the position mismatch, check encoder A-phase pulse and encoder B-phase pulse on the controller side
- 17. The devices can be changed by [Pr. PD03] to [Pr. PD14], [Pr. PD17] to [Pr. PD22], and [Pr. PD43] to [Pr. PD46].
- 18. Supply 24 V DC ± 10% to interfaces of the MR-D01 from outside. The total current capacity of these power supplies must be 800 mA or lower. 800 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 3.8.2 (1) that gives the current value necessary for the interface.
- 19. As the 24 V DC for the input/output signals, one 24 V DC power supply can be used to supply to the servo amplifier and MR-D01. In this case, select an appropriate power supply capacity depending on the number of points of the input/output signals to be used
- 20. The CN1-27 pin and CN20-12 pin are exclusive. The CN1-27 pin is set by default. Select this item with [Pr. Po11].
- 21. OTLA will be available when TL (External torque limit selection) is enabled with [Pr. Po02] to [Pr. Po07], [Pr. Po27], and [Pr. Po28]. (Refer to section 19.5.3 (5).)
- 22. The devices can be changed by [Pr. Po02] to [Pr. Po07].
- 23. The device can be changed by [Pr. Po08] and [Pr. Po09].
- 24. Output devices are not assigned by default. Assign the output devices with [Pr. PD47], [Pr. Po08], and [Pr. Po09] as necessary
- 25. Input devices are not assigned by default. Assign the input devices with [Pr. Po05], [Pr. Po06], [Pr. Po27], and [Pr. Po28] as necessary.

(b) For source I/O interface

POINT

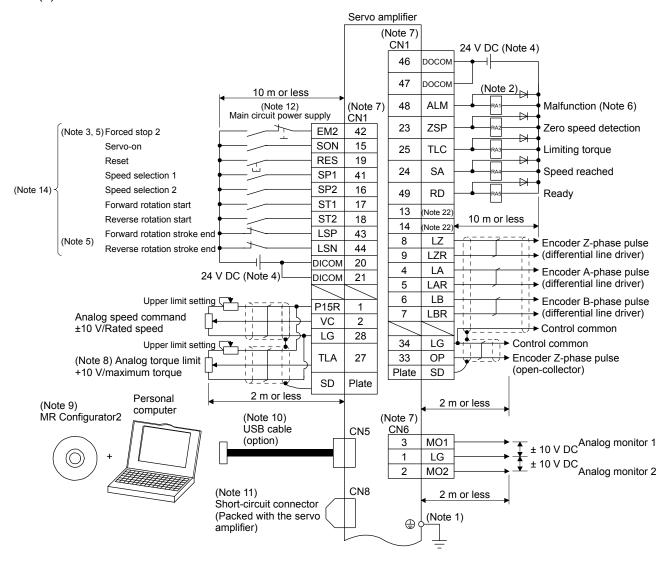
●For notes, refer to (1) (a) of this section.

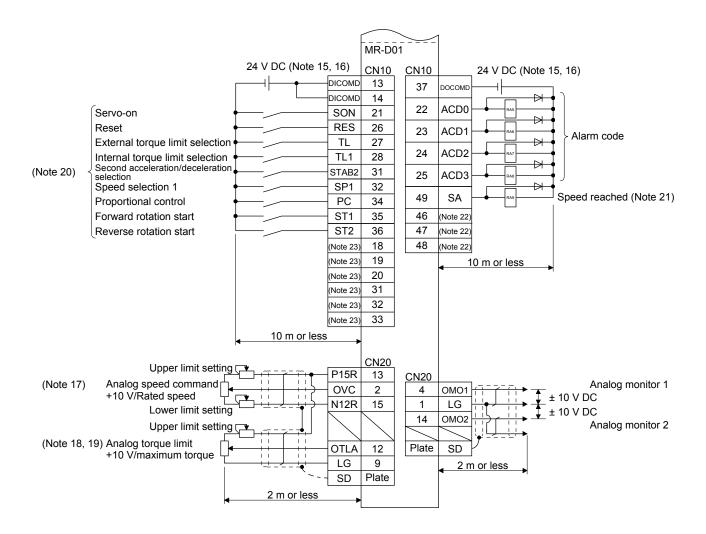




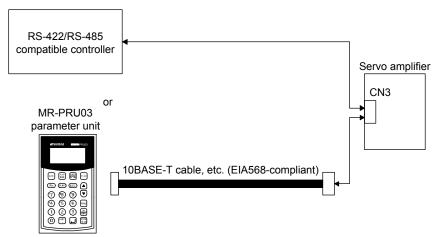
(2) Speed control mode

(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 of these power supplies must be 500 mA or lower. 500 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. A 24 V DC power supply can be used for both input signal and output signal.
 - 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. PD03] to [Pr. PD22]. (Refer to section 3.6.1 (5).)
 - 9. Use SW1DNC-MRC2-_. (Refer to section 11.7.)
 - 10. Controllers or parameter units can also be connected via the CN3 connector with the RS-422/RS-485 communication. Note that using the USB communication function (CN5 connector) prevents the RS-422/RS-485 communication function (CN3 connector) from being used, and vice versa. They cannot be used together.

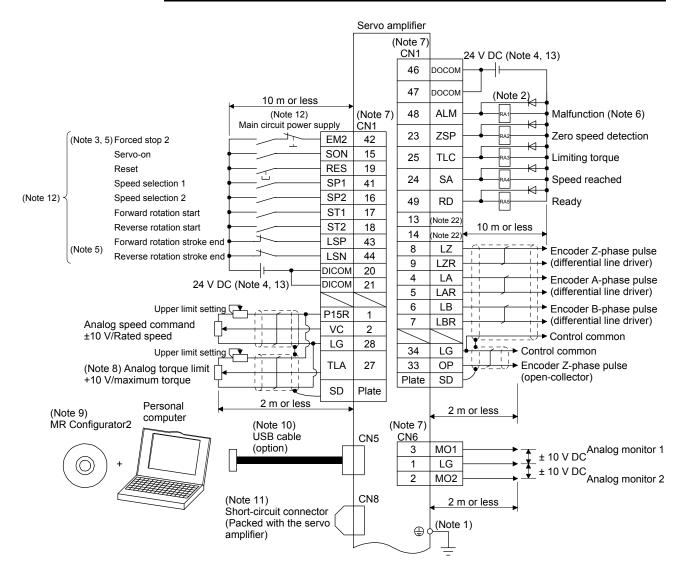


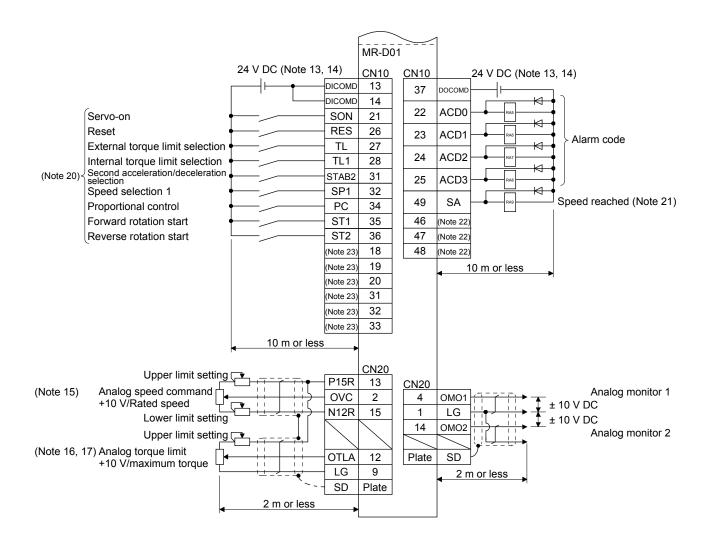
- 11. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 12. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 13. Plus and minus of the power of source interface are the opposite of those of sink interface.
- 14. The devices can be changed by [Pr. PD03] to [Pr. PD14], [Pr. PD17] to [Pr. PD22], and [Pr. PD43] to [Pr. PD46].
- 15. Supply 24 V DC ± 10% to interfaces of the MR-D01 from outside. The total current capacity of these power supplies must be 800 mA or lower. 800 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 3.8.2 (1) that gives the current value necessary for the interface.
- 16. As the 24 V DC for the input/output signals, one 24 V DC power supply can be used to supply to the servo amplifier and MR-D01. In this case, select an appropriate power supply capacity depending on the number of points of the input/output signals to be used
- 17. The CN1-2 pin and CN20-2 pin are exclusive. The CN1-2 pin is set by default. Select this item with [Pr. Po11].
- 18. The CN1-27 pin and CN20-12 pin are exclusive. The CN1-27 pin is set by default. Select this item with [Pr. Po11].
- 19. OTLA will be available when TL (External torque limit selection) is enabled with [Pr. Po02] to [Pr. Po07], [Pr. Po27], and [Pr. Po28]. (Refer to section 11.5.3 (6).)
- 20. The devices can be changed by [Pr. Po02] to [Pr. Po07].
- 21. The device can be changed by [Pr. Po08] and [Pr. Po09].
- 22. Output devices are not assigned by default. Assign the output devices with [Pr. PD47], [Pr. Po08], and [Pr. Po09] as necessary.
- 23. Input devices are not assigned by default. Assign the input devices with [Pr. Po05], [Pr. Po06], [Pr. Po27], and [Pr. Po28] as necessary.

(b) For source I/O interface

POINT

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



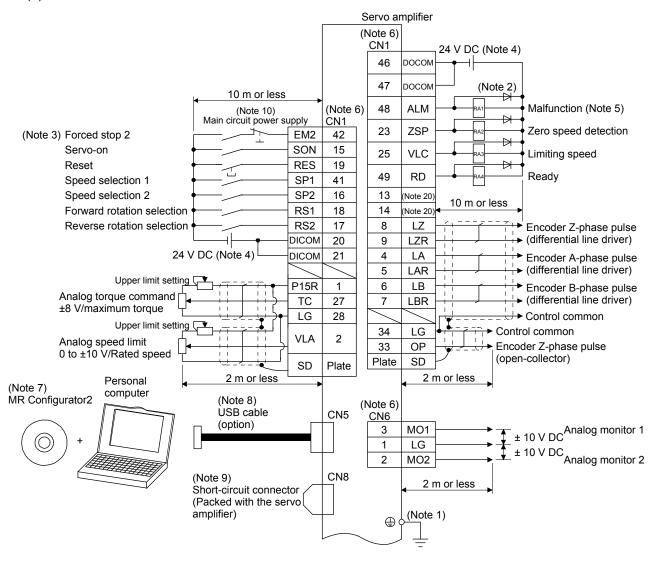


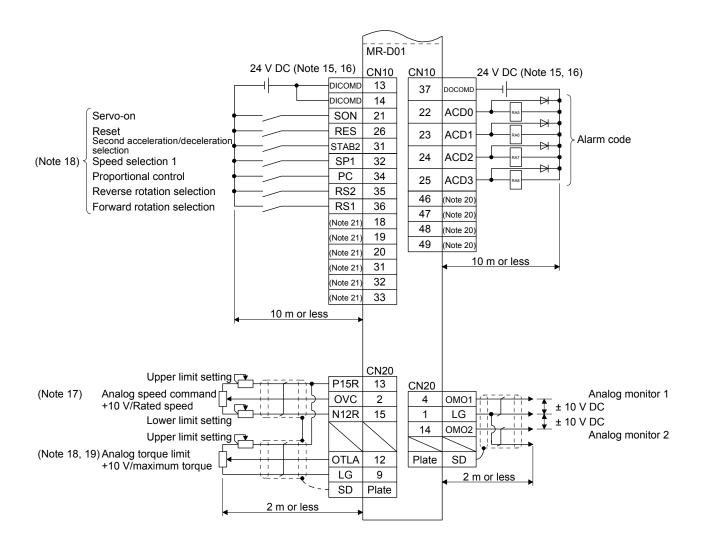
(3) Torque control mode

POINT

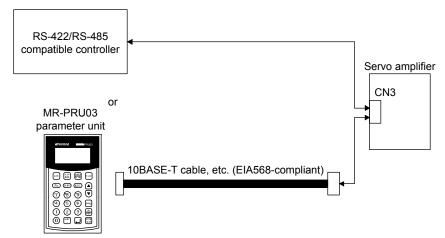
■EM2 has the same function as EM1 in the torque control mode.

(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 of these power supplies must be 500 mA or lower. 500 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. A 24 V DC power supply can be used for both input signal and output signal.
 - 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 11.7.)
 - 8. Controllers or parameter units can also be connected via the CN3 connector with the RS-422/RS-485 communication. Note that using the USB communication function (CN5 connector) prevents the RS-422/RS-485 communication function (CN3 connector) from being used, and vice versa. They cannot be used together.

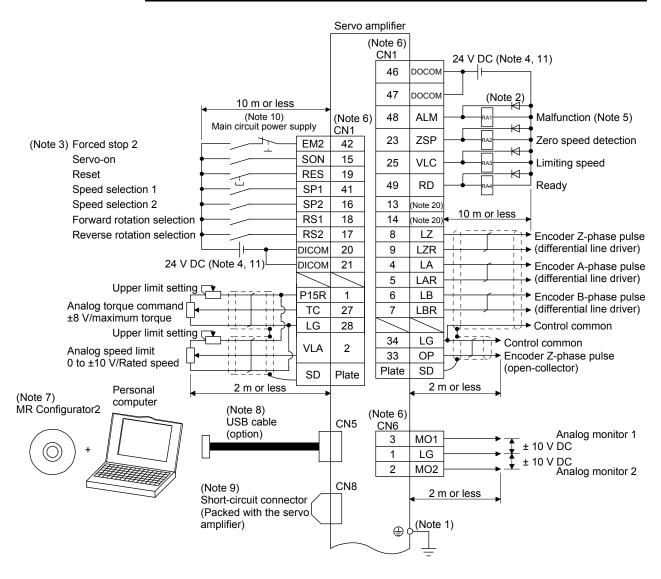


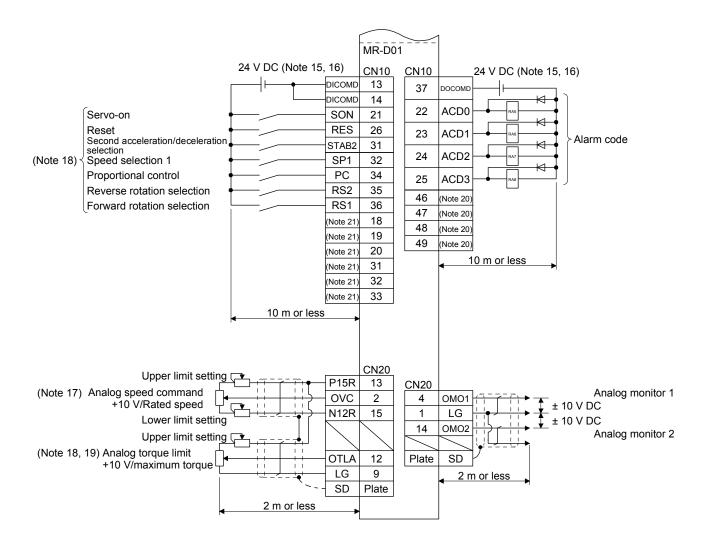
- 9. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 10. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 11. Plus and minus of the power of source interface are the opposite of those of sink interface.
- 12. The devices can be changed by [Pr. PD03] to [Pr. PD14], [Pr. PD17] to [Pr. PD22], and [Pr. PD43] to [Pr. PD46].
- 13. Supply 24 V DC ± 10% to interfaces of the MR-D01 from outside. The total current capacity of these power supplies must be 800 mA or lower. 800 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 3.8.2 (1) of "MR-J4-_A_(-RJ) Servo Amplifier Instruction Manual" that gives the current value necessary for the interface.
- 14. As the 24 V DC for the input/output signals, one 24 V DC power supply can be used to supply to the servo amplifier and MR-D01. In this case, select an appropriate power supply capacity depending on the number of points of the input/output signals to be used
- 15. The CN1-2 pin and CN20-2 pin are exclusive. The CN1-2 pin is set by default. Select this item with [Pr. Po11].
- 16. The CN1-27 pin and CN20-12 pin are exclusive. The CN1-27 pin is set by default. Select this item with [Pr. Po11].
- 17. OTLA will be available when TL (External torque limit selection) is enabled with [Pr. Po02] to [Pr. Po07], [Pr. Po27], and [Pr. Po28]. (Refer to section 11.5.3 (6).)
- 18. The devices can be changed by [Pr. Po02] to [Pr. Po07].
- 19. The device can be changed by [Pr. Po08] and [Pr. Po09].
- 20. Output devices are not assigned by default. Assign the output devices with [Pr. PD47], [Pr. Po08], and [Pr. Po09] as necessary.
- 21. Input devices are not assigned by default. Assign the input devices with [Pr. Po05], [Pr. Po06], [Pr. Po27], and [Pr. Po28] as necessary.

(b) For source I/O interface

POINT

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





19.5.2 Connectors and pin assignment

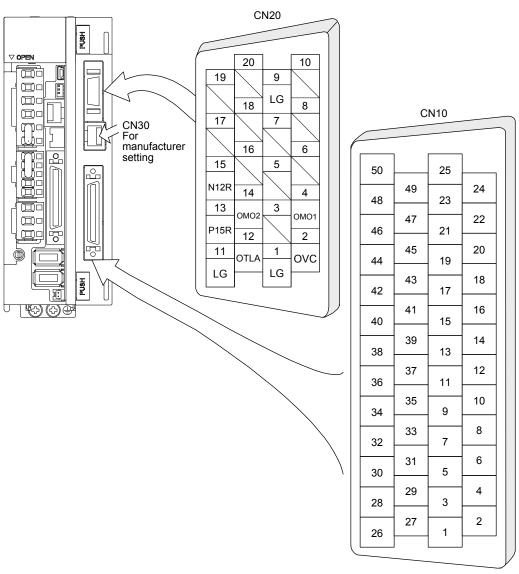
POINT

- ■The pin assignment of the connectors is as viewed from the cable connector wiring section.
- The CN30 connector is for manufacturer setting. This connector is attached on the MR-D01 servo amplifier, but not for use.
- For the pin assignment of the CN10 connector, refer to (2) in this section.

For details of each signal (device), refer to section 19.5.3.

(1) Pin assignment

The following shows the front view of the servo amplifier for when MR-J4-10A-RJ and MR-D01 are used.



For the pin assignment, refer to (2) of this section.

(2) Pin assignment of the CN10 connector

D: N	(Note 1)	(Note 2) I/C) signals in co	ntrol modes	D 1 1 1 1
Pin No.	I/O	Р	S	Т	Related parameter
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13		DICOMD	DICOMD	DICOMD	
14		DICOMD	DICOMD	DICOMD	
15					
16					
17					
18					Pr. Po27
19					Pr. Po27
20					Pr. Po28
21		SON	SON	SON	Pr. Po02
22	0	ACD0	ACD0	ACD0	11.1 002
23	0	ACD1	ACD1	ACD1	
24	0	ACD2	ACD2	ACD2	
25	0	ACD3	ACD3	ACD3	
26	ı	RES	RES	RES	Pr. Po02
27	i	TL	TL	TKLO	Pr. Po03
28	ı	TL1	TL1		Pr. Po03
29	i	CM1	111		Pr. Po04
30	i	CM2			Pr. Po04
31	i	OWE	STAB2	STAB2	Pr. Po05
32	ı		SP1	SP1	Pr. Po05
33			51 1	51 1	Pr. Po06
34		PC	PC		Pr. Po06
35	i		ST1	RS2	Pr. Po07
36	ı		ST2	RS1	Pr. Po07
37		DOCOMD	DOCOMD	DOCOMD	11.1001
38		20001110	DOGGIVID	DOCONID	
39					
40					
41					
42					
43					
43					
45					
					Pr. Po08
46 47					
48					Pr. Po08 Pr. Po09
48		INP	SA		Pr. Po09
	0		SA	60	F1. P009
50		SD	SD	SD	

Note 1. I: Input signal, O: Output signal

2. P: Position control mode

S: Speed control mode

T: Torque control mode

19. MR-D01 EXTENSION I/O UNIT

19.5.3 Signal (device) explanations

This section describes the signals (devices) of the MR-D01 extension I/O unit.

The connector pin No. column in the table lists the pin Nos. which devices are assigned to by default.

For the I/O interfaces (symbols in the I/O division column in the table), refer to section 19.5.4 (2).

The symbols in the control mode field of the table shows the followings.

- P: Position control mode
- S: Speed control mode
- T: Torque control mode
- "O" and " Δ " of the table shows the followings.
- O: Usable device by default.
- Δ: Usable device by setting the following parameters.
 - [Pr. Po02] to [Pr. Po09], [Pr. Po27], and [Pr. Po28]

(1) I/O device

(a) Input device

Device	Symbol	Connector pin No.	Function and application	I/O division	n	ontr node	е
		·		arviolori	Р	S	Т
Servo-on	SON	CN10-21	Same as when a servo amplifier is used alone. Refer to section 3.5 (1)	DI-1	0	0	0
Reset	RES	CN10-26	(a).	DI-1	0	0	0
Forward rotation stroke end	LSP			DI-1	Δ	Δ	Δ
Reverse rotation stroke end	LSN						
External torque limit selection	TL	CN10-27		DI-1	0	0	
Internal torque limit selection	TL1	CN10-28		DI-1	0	0	
Forward rotation start	ST1	CN10-35		DI-1	\setminus	0	
Reverse rotation start	ST2	CN10-36			\setminus		
Forward rotation selection	RS1	CN10-36		DI-1	\setminus		0
Reverse rotation selection	RS2	CN10-35			$ \ $		
Speed selection 1	SP1	CN10-32		DI-1		0	0
Speed selection 2	SP2			DI-1		Δ	Δ
Speed selection 3	SP3			DI-1		Δ	Δ
Proportional control	PC	CN10-34		DI-1	0	0	
Clear	CR			DI-1	Δ		abla
Electronic gear selection 1	CM1	CN10-29		DI-1	0		\setminus
Electronic gear selection 2	CM2	CN10-30		DI-1	0		
Gain switching	CDP			DI-1	Δ	Δ	
Control switching	LOP			DI-1	fur app	efer nction and licatolum	on tion
Second acceleration/dec eleration selection	STAB2	CN10-31		DI-1		0	0
Fully closed loop selection	CLD			DI-1	Δ		
Motor-side/load- side deviation counter clear	MECR			DI-1	Δ		

(b) Output device

Device	Symbol	Connector pin No.	Function and application		1	ontr node S	
Malfunction	ALM		Same as when a servo amplifier is used alone. Refer to section 3.5 (1) (b).	DO-1	Δ	<u>S</u>	Δ
Dynamic brake interlock	DB			DO-1	Δ	Δ	Δ
Ready	RD			DO-1	Δ	Δ	Δ
In-position	INP	CN10-49		DO-1	0		
Speed reached	SA	CN10-49		DO-1		0	
Limiting speed	VLC			DO-1			Δ
Limiting torque	TLC			DO-1	Δ	Δ	
Zero speed detection	ZSP			DO-1	Δ	Δ	Δ
Electromagnetic brake interlock	MBR			DO-1	Δ	Δ	Δ
Warning	WNG			DO-1	Δ	Δ	Δ
Battery warning	BWNG			DO-1	Δ	Δ	Δ
Alarm code 0	ACD0	(CN10-22)	To use these signals, set [Pr. Po12] to " 1".	DO-1	Δ	Δ	Δ
Alarm code 1	ACD1	(CN10-23)	For details of the alarm codes, refer to chapter 8.	DO-1			
Alarm code 2	ACD2	(CN10-24)		DO-1			
Alarm code 3	ACD3	(CN10-25)		DO-1			
Absolute position undetermined	ABSV		Same as when a servo amplifier is used alone. Refer to section 3.5 (1) (b).	DO-1	Δ		
During tough drive	MTTR			DO-1	Δ	Δ	Δ
During fully closed loop control	CLDS			DO-1	Δ		

(2) Input signal

Device	Symbol	Connector	Function and application	I/O	_	onti	
		pin No.		division	Р	S	Т
Analog torque limit	OTLA	CN20-12	To use this signal, set [Pr. Po11] to "_ 1". When OTLA is enabled, iorque is limited in the full servo motor output torque range. Apply 0 V to +10 V DC between OTLA and LG. Connect + of the power supply to OTLA. The maximum torque is generated at +10 V. Resolution: 12 bits		0	0	0
Analog torque command	ОТС		To use this signal, set [Pr. Po11] to "_ 1". This is used to control torque in the full servo motor output torque range. Apply 0 V to ±8 V DC between OTC and LG. The maximum torque is generated at ±8 V. (Refer to section 3.6.3 (1).) The torque at ±8 V can be changed with [Pr. PC13]. If a value equal to or larger than the maximum torque is input to OTC, the value is clamped at the maximum torque.	Analog input			0
Analog speed command	OVC	CN20-2	To use this signal, set [Pr. Po11] to " 1_". The signal controls the servo motor setting speed by applying -10 V to +10 V DC to between OVC and LG. The percentage will be 0% with -10 V, 100% with 0 V, and 200% with +10 V to the servo motor setting speed. Resolution: 12 bits	Analog input		0	
Analog speed limit	OVLA		To use this signal, set [Pr. Po11] to " 1 _". Apply 0 V to ±10 V DC between OVLA and LG. Speed set in [Pr. PC12] is provided at ±10 V. (Refer to section 3.6.3 (3).) If a limited value equal to or larger than the permissible speed is input to OVLA, the value is clamped at the permissible speed.	Analog input	\setminus		0

19. MR-D01 EXTENSION I/O UNIT

(3) Output signal

Device	Device Symbol Connector		Function and application			Contro	
		pin No.		division	Р	S	Т
Analog monitor 1	OMO1	CN20-4	This signal outputs the data set in [Pr. Po13] to between OMO1 and LG in terms of voltage. Resolution: 12 bits or equivalent	Analog output	0	0	0
Analog monitor 2	OMO2	CN20-14			0	0	0

(4) Power supply

Device Symb		Connector	Function and application		Function and application		r	Control mode	
	,	pin No.					Р	S	Т
MR-D01 digital I/F power supply input	DICOMD	CN10-13 CN10-14	Input 24 V DC (24 V DC ± 10% 500 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 the 24 V DC external power supply.		0	0	0		
MR-D01 digital I/F power supply input	DOCOMD	CN10-37	Common terminal of input signals such as SON, RES, and others 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 the 24 V DC external power supply.		0	0	0		
15 V DC power supply	P15R	CN20-13	This outputs 15 V DC to between P15R and LG. This is available as the power for TC/TLA/VC/VLA. Permissible current: 30 mA		0	0	0		
-12 V DC power supply	N12R	CN20-15	This outputs -12 V DC to between N12R and LG. This is available as the lower for VC. However, the voltage varies within the range of -12 V to -15 V. Permissible current: 30 mA		0	0	0		
Control common	LG	CN20-1 CN20-9	Common terminal of OTLA, OVC, OMO1, OMO2, P15R, and N12R. Pins are connected internally.		0	0	0		
Shield	SD	CN10-50 Plate	Connect the external conductor of the shielded wire.		0	0	0		

(5) Torque limit



● 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.

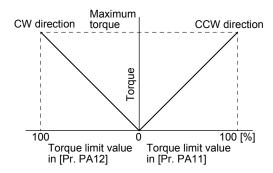
⚠ CAUTION •When using the torque limit, check that [Pr. PB06 Load to motor inertia ratio] is set properly. Improper settings may cause an unexpected operation such as an overshoot.

POINT

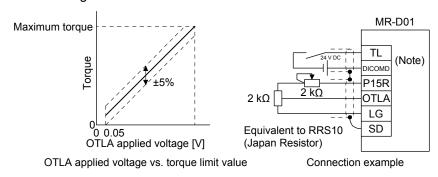
●To use OTLA (Analog torque limit), set [Pr. Po11] to "_ 1 _

(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 OTLA (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.



Note. This diagram shows sink I/O interface. For source I/O interface, refer to section 19.5.4 (5).

(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 OTLA (Analog torque limit). When TL1 (Internal torque limit selection) is enabled with [Pr. Po02] to [Pr. Po07], [Pr. Po27], and [Pr. Po28], you can select [Pr. PC35 internal torque limit 2/Internal thrust 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.

(Note) In	out device				Enabled torq	ue limit value
TL1	TL	Limi	Limit value status		CCW power running/ CW regeneration	CW power running/ CCW regeneration
0	0				Pr. PA11	Pr. PA12
0	4	OTLA	>	Pr. PA11 Pr. PA12	Pr. PA11	Pr. PA12
0	'	OTLA	<	Pr. PA11 Pr. PA12	OTLA	OTLA
1	0	Pr. PC35	Pr. PC35 > Pr. PA11 Pr. PA12		Pr. PA11	Pr. PA12
'	0	Pr. PC35	<	Pr. PA11 Pr. PA12	Pr. PC35	Pr. PC35
1	1	OTLA	>	Pr. PC35	Pr. PC35	Pr. PC35
l	I	OTLA	<	Pr. PC35	OTLA	OTLA

Note. 0: Off 1: On

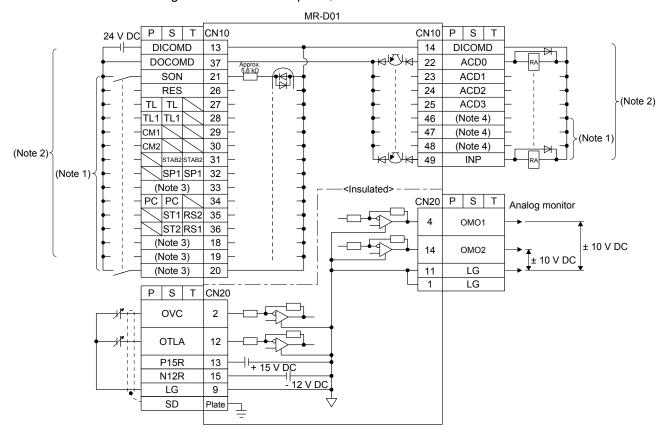
(c) TLC (Limiting torque)

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.

19.5.4 Interface

(1) Internal connection diagram

The following shows an example of internal connection diagram of the position control mode. For the internal connection diagram of the servo amplifier, refer to section 3.9.1.



Note 1. The devices can be changed by [Pr. Po02] to [Pr. Po09], [Pr. Po27], and [Pr. Po28].

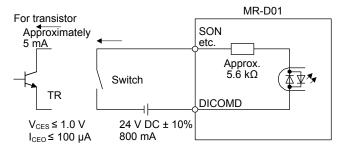
- 2. This diagram shows sink I/O interface. For source I/O interface, refer to (5) of this section.
- 3. Input devices are not assigned by default. Assign the input devices with [Pr. Po06], [Pr. Po27], and [Pr. Po28] as necessary.
- 4. Output devices are not assigned by default. Assign the output devices with [Pr. Po08] and [Pr. Po09] as necessary.

(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 19.5.3. Refer to the following and make connection with the external device.

(a) 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.



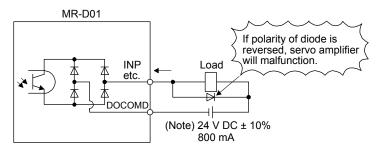
(b) Digital output interface DO-1

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 from 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.

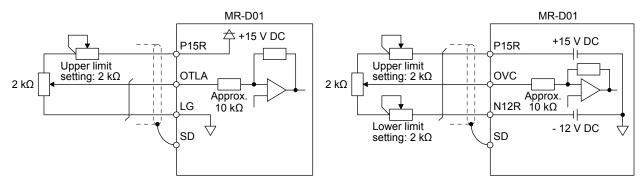
(Rated current: 40 mA or less, maximum current: 50 mA or less, inrush current: 100 mA or less) A maximum of 2.6 V voltage drop occurs in the servo amplifier.

The following shows a connection diagram for sink output.

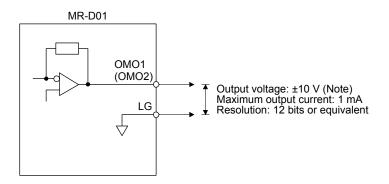


Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply a high voltage (maximum of 26.4 V) from an external source.

(3) Analog input Input impedance 10 k Ω to 12 k Ω



(4) Analog output



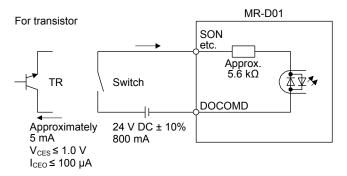
Note. Output voltage range varies depending on the monitored signal. When connecting analog output to an external device, use the withstand voltage of 15 V DC or higher.

(5) Source I/O interface

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

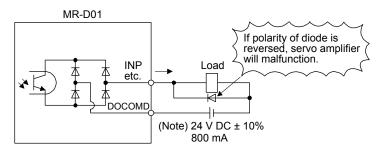
(a) Digital input interface DI-1

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



(b) 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.



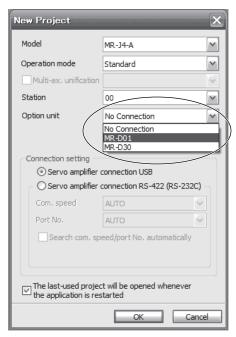
Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply a high voltage (maximum of 26.4 V) from an external source.

19.6 Monitor display with MR Configurator2

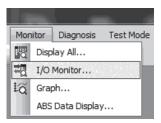
The following shows how to display the input/output monitor with MR Configurator2 when MR-D01 has been connected.

(1) Initial setting

When MR-D01 has been connected, click "MR-D01" from the "Option unit" menu in the creating new project window of MR Configurator2.



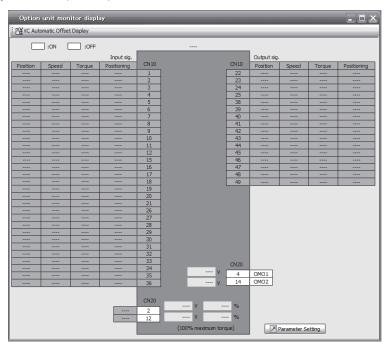
(2) How to open the optional unit monitor window Click "Monitor" in the menu bar and "I/O Monitor" from the menu.



| Nast | Mast |

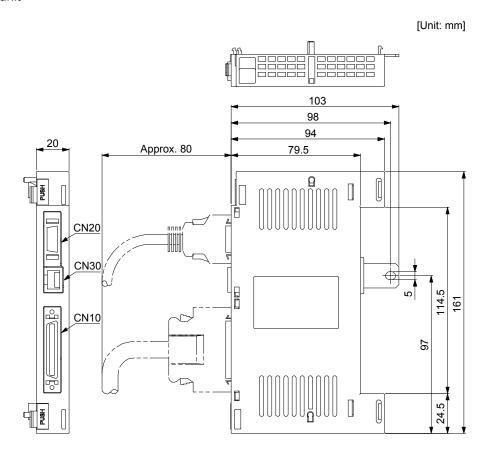
The following window is displayed. Click "Option unit monitor" in the menu bar.

The following window is displayed. The input/output monitor on the MR-D01 side can be checked.

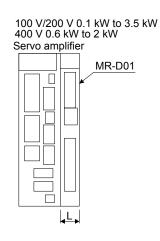


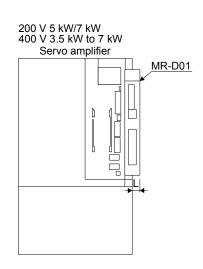
19.7 Dimensions

19.7.1 MR-D01 extension I/O unit



19.7.2 When an MR-D01 extension IO unit is connected to a servo amplifier

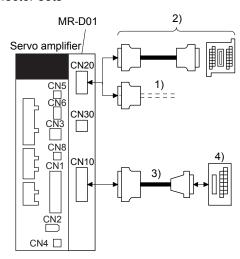




Servo amplifier	L [mm]
MR-J4-10A1-RJ to MR-J4-40A1-RJ	20
MR-J4-10A-RJ to MR-J4-100A-RJ	
MR-J4-60A4-RJ to MR-J4-100A4-RJ	
MR-J4-200A-RJ/MR-J4-350A-RJ	15
MR-J4-200A4-RJ	
MR-J4-500A-RJ/MR-J4-700A-RJ	10
MR-J4-350A4-RJ to MR-J4-700A4-RJ	
MR-J4-11KA-RJ to MR-J4-22KA-RJ	0
MR-J4-11KA4-RJ to MR-J4-22KA4-RJ	

19.8 Options peripheral equipment

19.8.1 Combinations of cable/connector sets

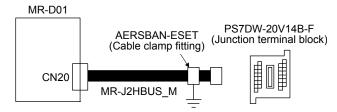


No.	Product name	Model	Description	Application
1)	Connector set	MR-CCN1	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent)	
2)	Junction terminal block (recommended)		Junction terminal block PS7DW-20V14B-F is not option. For using the junction terminal block, option MR-J2HBUS_M is necessary. Refer to section 19.8.2 for details.	
3)	Junction terminal block cable	MR-J2M- CN1TBL_M Cable length: 0.5, 1 m (Refer to section 19.9.3.)	Junction terminal block connector Connector: D7950-B500FL (3M) CN10 connector Connector: 10150-6000EL Shell kit: 10350-3210-000 (3M or equivalent)	For junction terminal block connection
4)	Junction terminal block	MR-TB50	Refer to section 19.8.3.	

19.8.2 PS7DW-20V14B-F (Junction terminal block) (recommended)

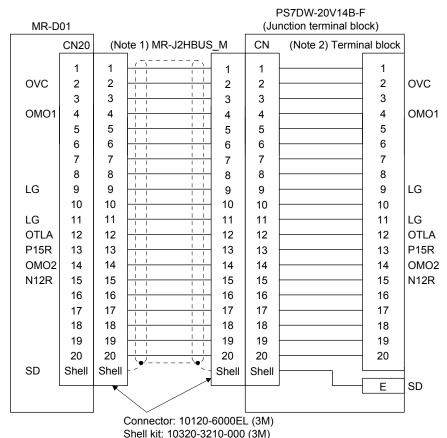
(1) Usage

Always use the PS7DW-20V14B-F (Junction terminal block) (Toho Technology)) with the option cable (MR-J2HBUS_M) as a set. A connection example is shown below.



Ground the option cable on the junction terminal block side with AERSBAN-ESET (cable clamp fitting). For how to use the cable clamp fitting, refer to section 11.14 (2) (c).

(2) Connection of MR-J2HBUS_M cable and junction terminal block



Note 1. Symbol indicating cable length is put in _.

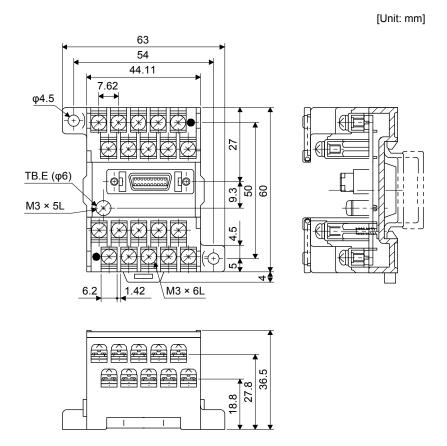
05: 0.5 m

1: 1 m

5: 5 m

2. Do not connect anything to the terminal where no signal has been assigned.

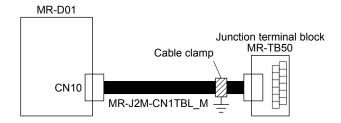
(3) Dimensions of junction terminal block



19.8.3 MR-TB50 (Junction terminal block)

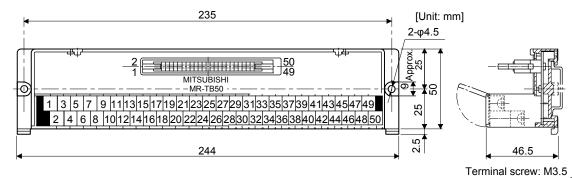
(1) Usage

Always use MR-TB50 (Junction terminal block) with MR-J2M-CN1TBL_M (Junction terminal block cable) as a set.



Ground the junction terminal block cable on the junction terminal block side with the supplied AERSBAN-ESET (cable clamp fitting). For how to use the cable clamp fitting, refer to section 11.14 (2) (c).

(2) Dimensions of MR-TB50



Applicable wire: 2 mm²
Crimp terminal width: 7.2 mm or less

(3) Connection diagram of MR-J2M-CN1TBL_M cable and MR-TB50
The following connection diagram shows for position control mode as an example.

CN10			(Note 1)				(Note 2)	
Symbol		MR-J2	M-CN1TE	3L_M			Termina	
Oymboi	1	<u> </u>			1	1	т	1
	2				2	2		2
	3	1.1		1.1	3	3		3
	4				4	4		4
	5	1.1		1.1	5	5		5
	6				6	6		6
	7	1.1		1.1	7	7		7
	8				8	8		8
	9	1.1		1.1	9	9		9
	10				10	10		10
	11	1.1		i i	11	11		11
	12				12	12	-	12
DICOMD	13	ii	,		13		-	
						13	-	13 14
DICOMD	14	ii			14	14	-	
	15				15	15	-	15
	16	i i		i i	16	16	-	16
(Niete 2)	17	1 1			17	17	-	17
(Note 3)	18	i i		ii	18	18	-	18
(Note 3)	19			1 1	19	19	-	19
(Note 3)	20	i i		ii	20	20	-	20
SON	21				21	21	-	21
ACD0	22	i i		i i	22	22	-	22
ACD1	23	1 1			23	23	-	23
ACD2	24	i i		i i	24	24	-	24
ACD3	25				25	25		25
RES	26	11		ii	26	26		26
TL TI 4	27				27	27	-	27
TL1	28	i i		i i	28	28	-	28
CM1	29	1 1			29	29	-	29
CM2	30	ii			30	30	-	30
(Note 3)	31			1 1	31	31	-	31
(Note 3) (Note 3)	32	i i		ii	32	32 33	-	32 33
	33			1 1	33		-	
PC (Nata 2)	34	ii		ii	34	34	-	34
(Note 3)	35				35	35	-	35
(Note 3) DOCOMD	36 37	i i			36	36 37	-	36 37
					37		-	
	38 39	ii		ii	38 39	38 39	-	38 39
	40				40	40	-	
	40		,	ii	41	41	-	40 41
	42				42	42	-	42
	43	ii	,		43	42	-	43
	44				44	43	-	43
	45		,	ii	45	45	-	45
(Note 3)						46	-	46
	46	ii		ii	46			
(Note 3)	47 48				47 48	47 48		47 48
(Note 3)		i i		i i				
INP	49	<u></u>			49	49		49
SD SD	50	, , , -		-	50	50		50
	Plate	1			1	1		

Note 1. Symbol indicating cable length is put in $_$. 05: 0.5 m

1: 1 m

- $2.\,$ Do not connect anything to the terminal where no signal has been assigned.
- 3. Output devices are not assigned by default. Assign the output devices with [Pr. Po05] to [Pr. Po09], [Pr. Po27], and [Pr. Po28] as necessary.

APPENDIX

App. 1 Peripheral equipment manufacturer (for reference)

Names given in the table are as of May 2016.

Manufacturer	Reference
NEC TOKIN	NEC TOKIN Corporation
Kitagawa Industries	Kitagawa Industries Co., Ltd.
JST	J.S.T. Mfg. Co., Ltd.
Junkosha	Purchase from Toa Electric Industrial Co. Ltd., Nagoya Branch
3M	3M
SEIWA ELECTRIC	Seiwa Electric Mfg. Co. Ltd.
Soshin Electric	Soshin Electric Co., Ltd.
TE Connectivity	TE Connectivity Ltd. Company
TDK	TDK Corporation
Molex	Molex
Toho Technology	Toho Technology Corp. Yoshida Terminal Block Division

App. 2 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	Туре	Lithium content	Mass of battery	Remark
ER6	MR-J3BAT	Cell	0.65 g	16 g	Cells with more than 0.3 grams of
	MR-BAT	Cell	0.48 g	13 g	lithium content must be handled as
ER17330	A6BAT	Cell	0.48 g	13 g	dangerous goods (Class 9) depending on packaging requirements.

(b) Battery unit (assembled battery)

Model	Option model	Туре	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.
	MR-BAT6V1	Assembled battery (Two)	1.20 g	34 g	Assembled batteries with more than 0.3 grams of lithium content must be
CR17335A	MR-BAT6V1SET(-A) Assembled battery (Two)		1.20 g	34 g	handled as dangerous goods (Class 9) depending on packaging
	MR-BAT6V1BJ	Assembled battery (Two)	1.20 g	34 g	requirements.

(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		The package must pass a 1.2 m drop test, and the
Less than two assembled batteries per package with less than two grams of lithium content	UN3090 PI968 Section II	handling label with battery illustration (size: 120 × 110 mm) must be attached on the package.
More than eight cells per package with less than one gram of lithium content		The package must pass a 1.2 m drop test, and the handling label with battery illustration (size: 120 ×
More than two assembled batteries per package with less than two grams of lithium content	UN3090 PI968 Section IB	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).
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
Assembled batteries with more than two grams of lithium content	ONSOSO FISOS SECIION IA	attached or others to comply with dangerous goods (Class 9).

- (b) Transportation of lithium metal batteries packed with or contained in equipment
 - 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.
 - 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

(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 (Fig. app. 1) must be attached to the package of a Mitsubishi cell or battery. In addition, attaching it to the outer package containing several packages of Mitsubishi 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. 3 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 symbol mark is for EU countries only.

This symbol 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 centre. Please, help us to conserve the environment we live in!

App. 4 Compliance with global standards

App. 4.1 Terms related to safety (IEC 61800-5-2 Stop function)

STO function (Refer to IEC 61800-5-2:2007 4.2.2.2 STO.) The MR-J4 servo amplifiers have the STO function. The STO function shuts down energy to servo motors, thus removing torque. This function electronically cuts off power supply in the servo amplifier. In addition, MR-J4-03A6 and MR-J4W2-0303B6 don't support this function.

App. 4.2 About safety

This chapter explains safety of users and machine operators. Please read the section carefully before mounting the equipment. In this installation guide, the specific warnings and cautions levels are classified as follows.

App. 4.2.1 Professional engineer

Only professional engineers should mount MR-J4 servo amplifiers. Here, professional engineers should meet the all 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. 4.2.2 Applications of the devices

MR-J4 servo amplifiers comply with the following standards.

- IEC/EN 61800-5-1, IEC/EN 61800-3, IEC/EN 60204-1
- ISO/EN ISO 13849-1 Category 3 PL e, IEC/EN 62061 SIL CL 3, IEC/EN 61800-5-2 (STO) (Except for MR-J4-03A6 and MR-J4W2-0303B6. Refer to app. 4.8.1 for compatible models.)

MR-J4 servo amplifiers can be used with the MR-D30 functional safety unit, MR-J3-D05 safety logic unit, or safety PLCs. (except for MR-J4-03A6 and MR-J4W2-0303B6)

App. 4.2.3 Correct use

Always use the MR-J4 servo amplifiers within specifications (voltage, temperature, etc. Refer to section 1.3 for details.). 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 •It takes 15 minutes maximum for capacitor discharging. Do not touch the unit and terminals immediately after power of

(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) Power Wiring (local wiring and crimping tool)

Use only copper wires or copper bus bars for wiring. The following table shows the stranded wire sizes [AWG] and the crimp terminal symbols rated at 75 °C/60 °C.

Table app. 1 Recommended wires

	75	°C/60 °C stranded	wire [AWG] (Note	2)
Servo amplifier (Note 7)	L1/L2/L3 ⊕	L11/L21	P+/C	U/V/W/⊕ (Note 3)
MR-J4-03A6/MR-J4W2-0303B6	19/- (Note 5)			19/- (Note 6)
MR-J4-10_(1)/MR-J4-20_(1)/MR-J4-40_(1)/MR-J4-60_(4)/ MR-J4-70_/MR-J4-100_(4)/MR-J4-200_(4) (T)/ MR-J4-350_4	14/14	14/14	14/14	14/14
MR-J4-200_ (S)	12/12			
MR-J4-350_	12/12			12/12
MR-J4-500_ (Note 1)	10: a/10: a		14: c/14: c	10: b/10: b
MR-J4-700_ (Note 1)	8: b/8: b		12: a/12: a	8: b/8: b
MR-J4-11K_ (Note 1)	6: d/4: f		12: e/12: e	4: f/4: f
MR-J4-15K_ (Note 1)	4: f/3: f		10: e/10: e	3: g/2: g
MR-J4-22K_ (Note 1)	1: h/-: -	14: c/14: c	10: i/10: i	1: j/-: -
MR-J4-500_4 (Note 1)	14: c/14: c	14. 6/14. 6	14: c/14: c	12: a/10: a
MR-J4-700_4 (Note 1)	12: a/12: a		14. 6/14. 6	10: a/10: a
MR-J4-11K_4 (Note 1)	10: e/10: e		14: k/14: k	8: I/8: I
MR-J4-15K_4 (Note 1)	8: I/8: I		12: e/12: e	6: d/4: d
MR-J4-22K_4 (Note 1)	6: m/4: m		12: i/12: i	6: n/4: n
MR-J4WB	14/14 (Note 4)	14/14	14/14	14/14

Note 1. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.

- 2. Alphabets in the table indicate crimping tools. Refer to table app. 2 for the crimp terminals and crimping tools.
- 3. 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.
- 4. Use the crimp terminal c for the PE terminal of the servo amplifier.
- 5. This value is of 24/0/PM/ \oplus for MR-J4-03A6 and MR-J4W2-0303B6.
- 6. This value is of U/V/W/E for MR-J4-03A6 and MR-J4W2-0303B6.
- 7. "(S)" means 1-phase 200 V AC power input and "(T)" means 3-phase 200 V AC power input in the table.

Table app. 2 Recommended crimp terminals

	Servo amplifier-si	de crimp terminals	
Symbol	Crimp terminal (Note 2)	Applicable tool	Manufacturer
а	FVD5.5-4	YNT-1210S	
b (Note 1)	8-4NS	YHT-8S	
С	FVD2-4	YNT-1614	
d	FVD14-6	YF-1	
е	FVD5.5-6	YNT-1210S	
f	FVD22-6	YF-1	
g	FVD38-6	YF-1	JST (J.S.T. Mfg. Co.,
h	R60-8	YF-1	Ltd.)
i	FVD5.5-8	YNT-1210S	Liu.)
j	CB70-S8	YF-1	
k	FVD2-6	YNT-1614	
I	FVD8-6	YF-1	
m	FVD14-8	YF-1	
n	FVD22-8	YF-1	

Note 1. Coat the crimping part with an insulation tube.

2. Some crimp terminals may not be mounted depending on the size. Make sure to use the recommended ones or equivalent ones.

(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, refer to section 11.10.

Servo amplifier (100 V class)	Molded-case circuit breaker (120 V AC)	Fuse (300 V)
MR-J4-10_1/MR-J4-20_1/MR-J4-40_1	NV50-SVFU-15A (50 A frame 15 A)	20 A

Servo amplifier (200 V class) (Note)	Molded-case circuit breaker (240 V AC)	Fuse (300 V)
MR-J4-10_/MR-J4-20_/MR-J4-40_/MR-J4-60_ (T)/MR-J4-70_ (T)/ MR-J4W2-22B (T)	NF50-SVFU-5A (50 A frame 5 A)	10 A
MR-J4-60_ (S)/MR-J4-70_ (S) /MR-J4-100_ (T)/MR-J4W2-22B (S)/ MR-J4W2-44B (T)/MR-J4W2-77B (T)/MR-J4W3-222B/ MR-J4W3-444B (T)	NF50-SVFU-10A (50 A frame 10 A)	15 A
MR-J4-100_ (S)/MR-J4-200_ (T)/MR-J4W2-44B (S)/ MR-J4W2-1010B	NF50-SVFU-15A (50 A frame 15 A)	30 A
MR-J4-200_ (S)/MR-J4-350_/MR-J4W2-77B (S)/ MR-J4W3-444B (S)	NF50-SVFU-20A (50 A frame 20 A)	40 A
MR-J4-500_	NF50-SVFU-30A (50 A frame 30 A)	60 A
MR-J4-700_	NF50-SVFU-40A (50 A frame 40 A)	80 A
MR-J4-11K_	NF100-CVFU-60A (100 A frame 60 A)	125 A
MR-J4-15K_	NF100-CVFU-80A (100 A frame 80 A)	150 A
MR-J4-22K_	NF225-CWU-125A (225 A frame 125 A)	300 A

Note. "(S)" means 1-phase 200 V AC power input and "(T)" means 3-phase 200 V AC power input in the table.

Servo amplifier (400 V class)	Molded-case circuit breaker (480 V AC)	Fuse (600 V)
MR-J4-60_4/MR-J4-100_4	NF100-HRU-5A (100 A frame 5 A)	10 A
MR-J4-200_4	NF100-HRU-10A (100 A frame 10 A)	15 A
MR-J4-350_4	NF100-HRU-10A (100 A frame 10 A)	20 A
MR-J4-500_4	NF100-HRU-15A (100 A frame 15 A)	30 A
MR-J4-700_4	NF100-HRU-20A (100 A frame 20 A)	40 A
MR-J4-11K_4	NF100-HRU-30A (100 A frame 30 A)	60 A
MR-J4-15K_4	NF100-HRU-40A (100 A frame 40 A)	80 A
MR-J4-22K_4	NF100-HRU-60A (100 A frame 60 A)	125 A

(c) Power supply

This servo amplifier can be supplied from star-connected supply with grounded neutral point of overvoltage category II (overvoltage category II for 1-phase servo amplifiers, MR-J4-03A6, and MR-J4W2-0303B6) 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.

In case of MR-J4-03A6 and MR-J4W2-0303B6, use DC power supplies of reinforced insulation type to main circuit, control circuit, and UL listed (recognized) 48 V DC/24 V DC power supplies which can generate more than 1.2 A/2.4 A per axis.

(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.

The MR-J4-700 4 is high protective earthing conductor current equipment, the minimum size of the protective earthing conductor must comply with the local safety regulations.





(2) EU compliance

The MR-J4 servo amplifiers are designed to comply with the following directions to meet requirements for mounting, using, and periodic technical inspections: Machinery directive (2006/42/EC), EMC directive (2014/30/EU), and Low-voltage directive (2014/35/EU).

(a) EMC requirement

MR-J4 servo amplifiers comply with category C3 in accordance with EN 61800-3. As for I/O wires (max. length 10 m. However, 3 m for STO cable for CN8.) and encoder cables (max. length 50 m), use shielded wires and ground the shields. Install an EMC filter and surge protector on the primary side for input and output of 200 V class and for output of 400 V class servo amplifiers. In addition, use a line noise filter for outputs of the 11 kW and 15 kW of 400 V class servo amplifiers. The following shows recommended products.

EMC filter: Soshin Electric HF3000A-UN series (200 V class), TF3000C-TX series (400 V class)

Surge protector: Okaya Electric Industries RSPD-250-U4 series

Line noise filter: Mitsubishi Electric FR-BLF

MR-J4 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 the necessary requirements and standards (2006/42/EC, 2014/30/EU and 2014/35/ 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 each MR-J4 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. 4.8.1. The servo amplifier needs to be installed at or below of 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 (Not More Than 5 kA rms Symmetrical Amperes, 48 Volts Maximum for MR-J4-03A6 and MR-J4W2-0303B6).

(c) Overload protection characteristics

The MR-J4 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.4.4 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 판 매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으 로 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.) In addition, use an EMC filter, surge protector, ferrite core, and line noise filter on the primary side for inputs. Use a ferrite core and line noise filter for outputs. Use a distance greater than 30 m between the product and third party sensitive radio communications for an MR-J4-22K (4).

App. 4.2.4 General cautions for safety protection and protective measures

Observe the following items to ensure proper use of the MR-J4 servo amplifiers.

- (1) For safety components and installing systems, only qualified personnel and professional engineers should perform.
- (2) When mounting, installing, and using the MELSERVO MR-J4 servo amplifier, always observe standards and directives applicable in the country.
- (3) The item about noises of the test notices in the manuals should be observed.

App. 4.2.5 Residual risk

- (1) Be sure that all safety related switches, relays, sensors, etc., meet the required safety standards.
- (2) Perform all risk assessments and safety level certification to the machine or the system as a whole.
- (3) If the upper and lower power module in the servo amplifier are shorted and damaged simultaneously, the servo motor may make a half revolution at a maximum.
- (4) Only qualified personnel are authorized to install, start-up, repair or service the machines in which these components are installed. Only trained engineers should install and operate the equipment. (ISO 13849-1 Table F.1 No.5)
- (5) Separate the wiring for safety observation function from other signal wirings. (ISO 13849-1 Table F.1 No.1)
- (6) Protect the cables with appropriate ways (routing them in a cabinet, using a cable guard, etc.).
- (7) Keep the required clearance/creepage distance depending on voltage you use.

App. 4.2.6 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. 4.2.7 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, MR-BAT6V1SET-A, MR-BAT6V1, and MR-BAT6V1BJ) 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. 4.3 Mounting/dismounting

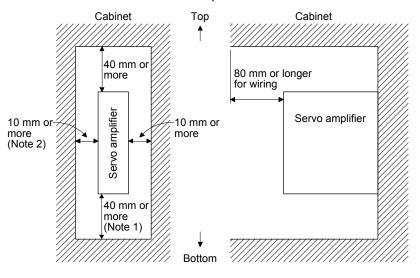
Installation direction and clearances

- 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.



- ■The regenerative resistor supplied with 11 kW to 22 kW servo amplifiers does not have a protective cover. Touching the resistor (including wiring/screw hole area) may cause a burn injury and electric shock. Even if the power was shut-off, be careful until the bus voltage discharged and the temperature decreased because of the following reasons.
 - It may cause a burn injury due to very high temperature without cooling.
 - It may cause an electric shock due to charged capacitor of the servo amplifier.

To adapt your machine using MR-J4-03A6 or MR-J4W2-0303B6 to IEC/EN 60950-1, either supply the amplifier with a power supply complying with the requirement of 2.5 stated in IEC/EN 60950-1 (Limited Power Source), or cover the amplifier and motors connected to the outputs with a fire enclosure.



Note 1. For 11 kW to 22 kW servo amplifiers, the clearance between the bottom and ground will be 120 mm or more.

2. For MR-J4-500_, the clearance on the left side will be 25 mm or more.

App. 4.4 Electrical Installation and configuration diagram

AWARNING

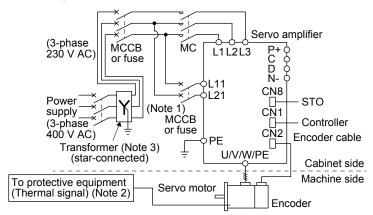
Turn off the molded-case circuit breaker (MCCB) to avoid electrical shocks or damages to the product before starting the installation or wiring.



- ●The installation complies with IEC/EN 60204-1. The voltage supply to machines must be 20 ms or more of tolerance against instantaneous power failure as specified in IEC/EN 60204-1.
- ■Connecting a servo motor for different axis to U, V, W, or CN2_ of the servo amplifier may cause a malfunction.

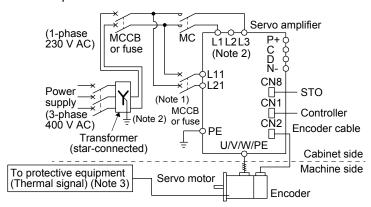
The following shows representative configuration examples to conform to the IEC/EN/UL/CSA standards.

(1) 3-phase input for MR-J4 1-axis servo amplifier



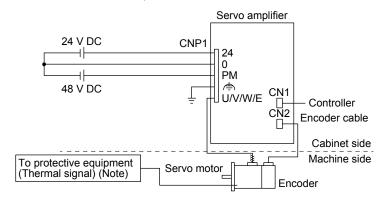
- Note 1. When the wire sizes of L1 and L11 are the same, MCCB or fuse is not required.
 - 2. Please use a thermal sensor, etc. for thermal protection of the servo motor.
 - 3. For 400 V class, a step-down transformer is not required.

(2) 1-phase input for MR-J4 1-axis servo amplifier



- Note 1. When the wire sizes of L1 and L11 are the same, MCCB or fuse is not required.
 - When using a 100 V class servo amplifier, step down the power supply voltage to 100 V and connect the main circuit power supply lines to L1 and L2. For 1-phase 200 V AC servo amplifiers, connect the lines to L1 and L3.
 - 3. Please use a thermal sensor, etc. for thermal protection of the servo motor.

(3) Main circuit 48 V DC input for MR-J4 1-axis servo amplifier



Note. Please use a thermal sensor, etc. for thermal protection of the servo motor.

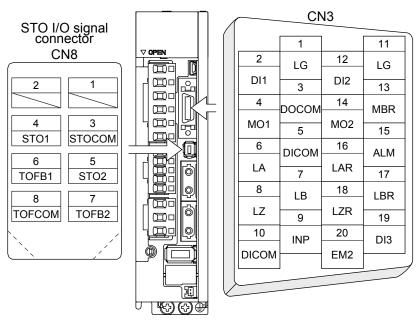
The connectors described by rectangles are safely separated from the main circuits described by circles. The connected motors will be limited as follows.

- (1) HG/HF/HC/HA series servo motors (Mfg.: Mitsubishi Electric)
- (2) Using a servo motor complied with IEC 60034-1 and Mitsubishi Electric encoder (OBA, OSA)

App. 4.5 Signal

App. 4.5.1 Signal

The following shows MR-J4-10B signals as a typical example. For other servo amplifiers, refer to each servo amplifier instruction manual.



App. 4.5.2 I/O device

Input device

Symbol	Device	Connector	Pin No.
EM2	Forced stop 2	CN3	20
STOCOM	Common terminal for input signals STO1/STO2		3
STO1	STO1 state input	CN8	4
STO2	STO2 state input		5

Output device

Ī	Symbol	Device	Connector	Pin No.
ľ	TOFCOM	Common terminal for monitor output signal in STO state		8
Ī	TOFB1	Monitor output signal in STO1 state	CN8	6
ľ	TOFB2	Monitor output signal in STO2 state		7

Power supply

Symbol	Device	Connector	Pin No.
DICOM	Digital I/F power supply input		5, 10
DOCOM	Digital I/F common	CN3	3
SD	Shield		Plate

App. 4.6 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. 4.6.1 Inspection items

It is recommended that the following points periodically be checked.

(1) Check for loose terminal block screws. Retighten any loose screws. (Except for MR-J4-03A6 and MR-J4W2-0303B6)

Servo amplifier		Tightening torque [N•m]													
Servo ampliner	L1	L2	L3	N-	P3	P4	P+	С	D	L11	L21	J	V	W	PE
MR-J4-10_(1)/MR-J4-20_(1)/			_												
MR-J4-40_(1)/MR-J4-60_(4)/					_										1.2
MR-J4-70_/MR-J4-100_(4)/											_				1.2
MR-J4-200_(4)/MR-J4-350_(4)													_		
MR-J4-500_					1.2					0	.8		1	.2	
MR-J4-700_(4)/MR-J4-500_4		1.2				0	.8		1	.2					
MR-J4-11K_(4)/MR-J4-15K_(4)		3.0				1	.2		3	.0					
MR-J4-22K_(4)	6.0 1.2 6.0				.0										
MR-J4WB															1.2

- (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.

App. 4.6.2 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 life. For parts replacement, please contact your local sales office.

Part name	Life guideline				
Smoothing capacitor	(Note 3) 10 years				
	Number of power-on,				
Relay	forced stop and controller forced stop times: 100 000 times				
	Number of on and off for STO: 1,000,000 times				
Cooling fan	10,000 hours to 30,000 hours (2 years to 3 years)				
(Note 1) Battery backup time	Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C)				
(Note 2) Battery life	5 years from date of manufacture				

- Note 1. The time is for using MR-J4 1-axis servo amplifier with an rotary servo motor using MR-BAT6V1SET, MR-BAT6V1SET-A, or MR-BAT6V1BJ. For details and other battery backup time, refer to chapter 12.
 - 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 normal 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. 4.7 Transportation and storage

- ●Transport the products correctly according to their mass.
- Stacking in excess of the limited number of product packages is not allowed.
- Do not hold the front cover to transport the servo amplifier. Otherwise, it may drop.



- CAUTION •Install the product in a load-bearing place of servo amplifier and servo motor in accordance with the instruction manual.
 - ●Do not get on or put heavy load on the equipment.
 - For detailed information on transportation and handling of the battery, refer to app. 2 and app. 3.

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/s² 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), Terminal block IP00
			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. 4.8 Technical data

App. 4.8.1 MR-J4 servo amplifier

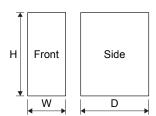
	ltem	MR-J4-10_/ MR-J4-20_/ MR-J4-40_/ MR-J4-60_/ MR-J4-70_/ MR-J4-100_/ MR-J4-200_/ MR-J4-222B/ MR-J4W2-44B/ MR-J4W3-222B/ MR-J4W3-444B	MR-J4-350_/ MR-J4-500_/ MR-J4-700_/ MR-J4W2-1010B/ MR-J4-11K_/ MR-J4-15K_/ MR-J4-22K_	MR-J4-10_1/ MR-J4-20_1/ MR-J4-40_1	MR-J4-60_4/ MR-J4-100_4/ MR-J4-200_4/ MR-J4-350_4/ MR-J4-500_4/ MR-J4-700_4/ MR-J4-11K_4/ MR-J4-15K_4/ MR-J4-22K_4	MR-J4-03A6/ MR-J4W2-0303B6
Main circuit (line voltage)		3-phase or 1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz (Note 2)	3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz (Note 2)	1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz	3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz	48 V DC or 24 V DC
supply	Control circuit (line voltage)	1-phase 200 V / 50/60 Hz	24 V DC			
	Interface (SELV)		_, 300 mA; 00 mA)			
Control method						
Safety observation function (STO) IEC/EN 61800-5-2 (Note 3)		EN IS				
Mean time to dangerous failure						
Effectiveness of fault monitoring of a system or subsystem						
Average failures	probability of dangerous per hour					
Mission time						
Response performance		8 n				
Pollution degree						
Overvoltage category		1-pha 3-pha	II (IEC/EN 60664-1)			
Protective class			III (IEC/EN 61800-5-1)			
Short-cir (SCCR)	cuit current rating	100 kA				5 kA (Note 1)

Note 1. For the use in US/Canada, constitute a branch circuit including the power supply which endures SCCR of 5 kA minimum in the industrial cabinet.

^{2.} For MR-J4-_-RJ, 283 V DC to 340 V DC are also supported.

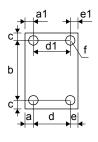
^{3.} Servo amplifiers manufactured in June 2015 or later comply with SIL 3 requirements. However, MR-J4-_A_/MR-J4-_B_ servo amplifiers manufactured in China comply with SIL 3 requirements from the December 2015 production.

App. 4.8.2 Dimensions/mounting hole process drawing



Conto amplifiar	Variab	Maga [kg]		
Servo amplifier	W	Н	D	Mass [kg]
MR-J4-03A6	30	100	90	0.2
MR-J4-10_(1)/MR-J4-20_(1) (Note)	40 (50)	168	135 (155)	0.8 (1.0)
MR-J4-40_(1)/MR-J4-60_ (Note)	40 (50)	168	170 (155)	1.0
MR-J4-70_/MR-J4-100_	60	168	185	1.4
MR-J4-200_(4)	90	168	195	2.1
MR-J4-350_	90	168	195	2.3
MR-J4-500_	105	250	200	4.0
MR-J4-700_	172	300	200	6.2
MR-J4-11K_(4)/MR-J4-15K_(4)	220	400	260	13.4
MR-J4-22K_(4)	260	400	260	18.2
MR-J4-60_4/MR-J4-100_4	60	168	195	1.7
MR-J4-350_4	105	250	200	3.6
MR-J4-500_4	130	250	200	4.3
MR-J4-700_4	172	300	200	6.5
MR-J4W2-0303B6	30	168	100	0.3
MR-J4W2-22B/MR-J4W2-44B	60	168	195	1.4
MR-J4W2-77B/MR-J4W2-1010B	85	168	195	2.3
MR-J4W3-222B/MR-J4W3-444B	85	168	195	2.3

Note. The value in the parenthesis shows the value of MR-J4-_GF_.



Servo amplifier	Variable dimensions [mm]								Screw size
	а	a1	b	С	d	d1	е	e1	f
MR-J4-03A6			90 ± 0.5	5			4	4	M4
MR-J4-10_(1)/MR-J4-20_(1)/ MR-J4-40_(1)/MR-J4-60_	6	6	156 ± 0.5	6					M5
MR-J4-70_/MR-J4-100_	12	12	156 ± 0.5	6	42 ± 0.3				M5
MR-J4-200_(4)/MR-J4-350_	6	45	156 ± 0.5	6	78 ± 0.3				M5
MR-J4-500_	6	6	235 ± 0.5	7.5	93 ± 0.5	93 ± 0.5			M5
MR-J4-700_	6	6	285 ± 0.5	7.5	160 ± 0.5	160 ± 0.5			M5
MR-J4-11K_(4)/MR-J4-15K_(4)	12	12	380 ± 0.5	10	196 ± 0.5	196 ± 0.5			M5
MR-J4-22K_(4)	12	12	376 ± 0.5	12	236 ± 0.5	236 ± 0.5			M10
MR-J4-60_4/MR-J4-100_4	12	12	156 ± 0.5	6	42 ± 0.3				M5
MR-J4-350_4	6	6	235 ± 0.5	7.5	93 ± 0.5	93 ± 0.5			M5
MR-J4-500_4	6	6	235 ± 0.5	7.5	118 ± 0.5	118 ± 0.5			M5
MR-J4-700_4	6	6	285 ± 0.5	7.5	160 ± 0.5	160 ± 0.5			M5
MR-J4W2-0303B6	6	6	156 ± 0.5	6					M5
MR-J4W2-22B/MR-J4W2-44B	6	6	156 ± 0.5	6					M5
MR-J4W2-77B/MR-J4W2-1010B	6	6	156 ± 0.5	6	73 ± 0.3				M5
MR-J4W3-222B/MR-J4W3-444B	6	6	156 ± 0.5	6	73 ± 0.3				M5

App. 4.9 Check list for user documentation



MR-J4 installation checklist for manufacturer/installer

The following items must be satisfied by the initial test operation at least. The manufacturer/installer must be responsible for checking the standards in the items.

Maintain and keep this checklist with related documents of machines to use this for periodic inspection.

 Is it based on directive/standard applied to the machine? 	Yes [], No []
2. Is directive/standard contained in Declaration of Conformity (DoC)?	Yes [], No []
3. Does the protection instrument conform to the category required?	Yes [], No []
4. Are electric shock protective measures (protective class) effective?	Yes [], No []
5. Is the STO function checked (test of all the shut-off wiring)?	Yes [], No []

Checking the items will not be instead of the first test operation or periodic inspection by professional engineers.

App. 5 MR-J3-D05 Safety logic unit

App. 5.1 Contents of the package

Open packing, and confirm the content of packing.

Contents	Quantity
MR-J3-D05 Safety logic unit	1
Connector for CN9 1-1871940-4 (TE Connectivity)	1
Connector for CN10 1-1871940-8 (TE Connectivity)	1
MR-J3-D05 Safety Logic Unit Installation Guide	1

App. 5.2 Terms related to safety

App. 5.2.1 Stop function for IEC/EN 61800-5-2

(1) STO function (Refer to IEC/EN 61800-5-2: 2007 4.2.2.2 STO.)

This function is integrated into the MR-J4 series servo amplifiers.

The STO function shuts down energy to servo motors, thus removing torque. This function electronically cuts off power supply in servo amplifiers for MR-J4 series servo amplifiers.

The purpose of this function is as follows.

- 1) Uncontrolled stop according to stop category 0 of IEC/EN 60204-1
- 2) Preventing unexpected start-up
- (2) SS1 function (Refer to IEC/EN 61800-5-2: 2007 4.2.2.3C Safe stop 1 temporal delay.) SS1 is a function which initiates the STO function when the previously set delay time has passed after the servo motor starts decelerating. The delay time can be set with MR-J3-D05. The purpose of this function is as follows. This function is available by using an MR-J4 series servo amplifier with MR-J3-D05.
 - Controlled stop according to stop category 1 of IEC/EN 60204-1

App. 5.2.2 Emergency operation for IEC/EN 60204-1

- (1) Emergency stop (Refer to IEC/EN 60204-1: 2005 9.2.5.4.2 Emergency Stop.) Emergency stop must override all other functions and actuation in all operation modes. Power to the machine driving part which may cause a hazardous state must be either removed immediately (stop category 0) or must be controlled to stop such hazardous state as soon as possible (stop category 1). Restart must not be allowed even after the cause of the emergency state has been removed.
- (2) Emergency switching off (Refer to IEC/EN 60204-1: 2005 9.2.5.4.3 Emergency Switching OFF.) Removal of input power to driving device to remove electrical risk and to meet above mentioned safety standards.

App. 5.3 Cautions

The following basic safety notes must be read carefully and fully in order to prevent injury to persons or damage to property.

Only qualified personnel are authorized to install, start-up, repair or service the machines in which these components are installed.

They must be familiar with all applicable local safety regulations and laws in which machines with these components are installed, particularly the standards and guidelines mentioned in this Instruction Manual and the requirements mentioned in ISO/EN ISO 13849-1, IEC 61508, IEC/EN 61800-5-2, and IEC/EN 60204-1. The staff responsible for this work must be given express permission from the company to perform start-up, programming, configuration, and maintenance of the machine in accordance with the safety standards.



Improper installation of the safety related components or systems may cause improper operation in which safety is not assured, and may result in severe injuries or even death.

Protective Measures

 As described in IEC/EN 61800-5-2, the Safe Torque Off (STO) function only prevents the servo amplifier from supplying energy to the servo motor. Therefore, if an external force acts upon the drive axis, additional safety measures, such as brakes or counter-weights must be used.

App. 5.4 Residual risk

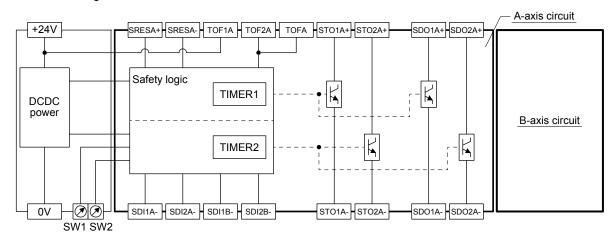
Machine manufacturers are responsible for all risk evaluations and all associated residual risks. Below are residual risks associated with the STO/EMG function. Mitsubishi is not liable for any damages or injuries caused by the residual risks.

- (1) The SS1 function only guarantees the delay time before STO/EMG is engaged. Proper setting of this delay time is the full responsibility of the company and/or individuals responsible for installation and commissioning of the safety related system. The system, as a whole, must pass safety standards certification.
- (2) When the SS1 delay time is shorter than the required servo motor deceleration time, if the forced stop function is malfunctioning, or if STO/EMG is engaged while the servo motor is still rotating; the servo motor will stop with the dynamic brake or freewheeling.
- (3) For proper installation, wiring, and adjustment, thoroughly read the manual of each individual safety related component.
- (4) Be sure that all safety related switches, relays, sensors, etc., meet the required safety standards. The Mitsubishi Electric safety related components mentioned in this manual are certified by Certification Body as meeting the requirements of ISO/EN ISO 13849-1 Category 3, PL d and IEC 61508 SIL 2.
- (5) Safety is not assured until safety-related components of the system are completely installed or adjusted.
- (6) When replacing a servo amplifier etc. or MR-J3-D05, confirm that the new equipment is exactly the same as those being replaced. Once installed, be sure to verify the performance of the functions before commissioning the system.

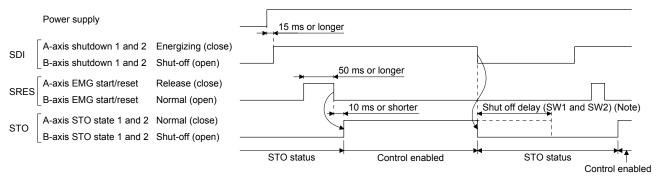
- (7) Perform all risk assessments and safety level certification to the machine or the system as a whole. It is recommended that a Certification Body final safety certification of the system be used.
- (8) To prevent accumulation of multiple malfunctions, perform a malfunction check at regular intervals as deemed necessary by the applicable safety standard. Regardless of the system safety level, malfunction checks should be performed at least once per year.
- (9) If the upper and lower power module in the servo amplifier are shorted and damaged simultaneously, the servo motor may make a half revolution at a maximum.

App. 5.5 Block diagram and timing chart

(1) Function block diagram



(2) Operation sequence



Note. Refer to App. 5.10.

App. 5.6 Maintenance and disposal

MR-J3-D05 is equipped with LED displays to check errors for maintenance. Please dispose this unit according to your local laws and regulations.

App. 5.7 Functions and configuration

App. 5.7.1 Summary

MR-J3-D05 has two systems in which the each system has SS1 function (delay time) and output of STO function.

App. 5.7.2 Specifications

Voltage	Safety log	gic unit model	MR-J3-D05
Power supply Compatible system 2 systems (A-axis, B-axis independent)		Voltage	24 V DC
Compatible system 2 systems (A-axis, B-axis independent)			24 V DC ± 10%
Shut-off input	capacity		0.5 (Note 1, 2)
Shut-off release input 2 points (1 point × 2 systems) SRES_: (source/sink compatible) (Note 3)	Compatible syst	em	2 systems (A-axis, B-axis independent)
Feedback input 2 points (1 point × 2 systems) TOF_: (source compatible) (Note 3)	Shut-off input		
Input type	Shut-off release	input	2 points (1 point × 2 systems) SRES_: (source/sink compatible) (Note 3)
Shut-off output 8 points (4 point × 2 systems) Photocoupler insulation, open-collector type Permissible current: 40 mA/1 output, Inrush current: 100 mA/1 output Delay time setting Standards certified by CB Response performance (when delay time is set to 0 s) (Note 4) Safety performance Performance Safety performance Performance (MTTFd) Diagnosis converge (DC avg) Average probability of dangerous failures per hour (PFH) Compliance to standards Structure Natural-cooling, open (IP rating: IP 00) Ambient temperature Ambient temperature Ambient temperature A-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-	Feedback input		
Shut-off output Spoints (4 point × 2 systems) SDO_: (source/sink compatible) (Note 3)	Input type		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
Delay time setting A-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. Accuracy: ±2% Functional safety STO, SS1 (IEC/EN 61800-5-2) EMG STOP, EMG OFF IEC/EN 60204-1) EN ISO 13849-1 category 3 PL d, IEC 61508 SIL 2, EN 62061 SIL CL 2, and EN 61800-5-2 SIL Response performance (when delay time is set to 0 s) (Note 4) Safety performance Mean time to dangerous failure (MTTFd) Diagnosis converge (DC avg) Average probability of dangerous failures per hour (PFH) Compliance to standards CE marking CE marking Ambient temperature Ambient humidity Permissible current: 40 mA/1 output, Inrush current: 100 mA/1 output of 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. Accuracy: ±2% STO, SS1 (IEC/EN 61800-5-2) EMG STOP, EMG OFF IEC/EN 60204-1) End G1508 SIL 2, EN 62061 SIL CL 2, and EN 61800-5-2 SIL 61800-5-1 EN 6	Shut-off output		8 nointe (1 noint x 2 evetame) — ` ' ' ' '
Delay time setting A-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. B-axis: Select from 0 s, 1.4 s, 2.8 s, 5.6 s, 9.8 s, or 30.8 s. Accuracy: ±2% Functional safety Standards certified by CB Response performance (when delay time is set to 0 s) (Note 4) Safety performance (MTTFd) Diagnosis converge (DC avg) Average probability of dangerous failures per hour (PFH) Compliance to standards Structure Ambient temperature Ambient humidity Average - Arbient Structure Ambient humidity Permissible current: 40 mA/1 output, Intrust current: 10 mA/1 output, Intrust current Intrust current: 10 mA/1 output, Intrust current: 10 mA/1 output, Intrust current: 10 mA/1 output, Intrust current Intrust current: 10 mA/1 output, Intrust current Intrust current: 10 mA/1 output, Intrust current Intrust current current current current curre	0		
B-axis: Select from 0 s, 1.4 s, 2.8 s, 9.8 s, or 30.8 s. Accuracy: ±2% STO, SS1 (IEC/EN 61800-5-2) EMG STOP, EMG OFF IEC/EN 60204-1) Standards certified by CB Response performance (when delay time is set to 0 s) (Note 4) Safety Mean time to dangerous failure (MTFd) Diagnosis converge (DC avg) Average probability of dangerous failures per hour (PFH) Compliance to standards Structure B-axis: Select from 0 s, 1.4 s, 2.8 s, 9.8 s, or 30.8 s. Accuracy: ±2% STO, SS1 (IEC/EN 61800-5-2) EMG OFF IEC/EN 60204-1) EN ISO 13849-1 category 3 PL d, IEC 61508 SIL 2, EN 62061 SIL CL 2, and EN 61800-5-2 SIL 10 ms or less (STO input off → shut-off output off) is set to 0 s) (Note 4) Safety Mean time to dangerous failure (MTFd) Diagnosis converge (DC avg) Average probability of dangerous failures per hour (PFH) Compliance to standards STructure Natural-cooling, open (IP rating: IP 00) Ambient temperature Ambient humidity 90 %RH or less (non-condensing), storage: 90 %RH or less (non-condensing)	Output type		Permissible current: 40 mA/1 output, Inrush current: 100 mA/1 output
EMG STOP, EMG OFF IEC/EN 60204-1) Standards certified by CB Response performance (when delay time is set to 0 s) (Note 4) Mean time to dangerous failure (MTFd) Diagnosis converge (DC avg) Average probability of dangerous failures per hour (PFH) Compliance to standards Structure EMG STOP, EMG OFF IEC/EN 60204-1) EN ISO 13849-1 category 3 PL d, IEC 61508 SIL 2, EN 62061 SIL CL 2, and EN 61800-5-2 SIL EN ISO 13849-1 category 3 PL d, IEC 61508 SIL 2, EN 62061 SIL CL 2, and EN 61800-5-2 SIL 10 ms or less (STO input off → shut-off output off) 11 ms or less (STO input off → shut-off output off) 12 ms or less (STO input off → shut-off output off) 13 ms or less (STO input off → shut-off output off) 14 ms or less (STO input off → shut-off output off) 15 ms or less (STO input off → shut-off output off) 16 ms or less (STO input off → shut-off output off) 17 ms or less (STO input off → shut-off output off) 18 ms or less (STO input off → shut-off output off) 19 ms or less (STO input off → shut-off output off) 19 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 11 ms or less (STO input off → shut-off output off) 12 ms or less (STO input off → shut-off output off) 13 ms or less (STO input off → shut-off output off) 14 ms or less (STO input off → shut-off output off) 15 ms or less (STO input off → shut-off output off → shut-off outp	-		B-axis: Select from 0 s, 1.4 s, 2.8 s, 9.8 s, or 30.8 s. Accuracy: ±2%
Safety performance Mean time to dangerous failure (MTTFd) Diagnosis converge (DC avg) Average probability of dangerous failures per hour (PFH) Compliance to standards Structure EMG STOP, EMG OFF IEC/EN 60204-1) I CL 2, and EN 61800-5-2 SIL 10 ms or less (STO input off → shut-off output off) is set to 0 s) (Note 4) Mean time to dangerous failure	Functional safet	V	STO, SS1 (IEC/EN 61800-5-2)
by CB Response performance (when delay time is set to 0 s) (Note 4) Safety performance (MTTFd) Diagnosis converge (DC avg) Average probability of dangerous failures per hour (PFH) Compliance to standards Structure EN ISO 13849-1 category 3 PL d, IEC 61508 SIL 2, EN 62061 SIL CL 2, and EN 61800-5-2 SIL 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 516 years 93.1% 4.75 × 10° [1/h] LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061 Structure Ambient temperature Ambient humidity 90 %RH or less (non-condensing), storage: -20 °C to 65 °C (non-freezing) Ambient or less (non-condensing)	T directorial salet	,	EMG STOP, EMG OFF IEC/EN 60204-1)
performance (when delay time is set to 0 s) (Note 4) Safety performance Mean time to dangerous failure (MTTFd) Diagnosis converge (DC avg) Average probability of dangerous failures per hour (PFH) Compliance to standards Structure Ambient temperature Ambient humidity performance 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 11 ms or less (STO input off → shut-off output off) 12 ms or less (STO input off → shut-off output off) 13 ms or less (STO input off → shut-off output off) 14 ms or less (STO input off → shut-off output off) 15 ms or less (STO input off → shut-off output off) 16 ms or less (STO input off → shut-off output off) 16 ms or less (STO input off → shut-off output off) 17 ms or less (STO input off → shut-off output off) 18 ms or less (STO input off → shut-off output off) 18 ms or less (STO input off → shut-off output off) 19 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 10 ms or less (STO input off → shut-off output off) 11 ms or less (STO input off → shut-off output off) 12 ms or less (STO input off → shut-off output off) 13 ms or less (STO input off → shut-off output off) 14 ms or less (STO input off → shut-off output off) 15 ms or less (STO input off → shut-off output off) 16 ms or less (STO input off → shut-off output off) 17 ms or less (STO input off → shut-off output off) 18 ms or less (STO input off → shut-off output off) 18 ms or less (STO input off → shut-off output off) 18 ms or less (STO input off → shut-off output off output		- 10	EN ISO 13849-1 category 3 PL d, IEC 61508 SIL 2, EN 62061 SIL CL 2, and EN 61800-5-2 SIL 2
performance dangerous failure (MTTFd) Diagnosis converge (DC avg) Average probability of dangerous failures per hour (PFH) Compliance to standards Structure Ambient temperature Ambient humidity dangerous failure (MTTFd) 93.1% 4.75 × 10° [1/h] 4.75 × 10° [1/h] LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061 Natural-cooling, open (IP rating: IP 00)		performance (when delay time is set to 0 s)	10 ms or less (STO input off → shut-off output off)
converge (DC avg) Average probability of dangerous failures per hour (PFH) Compliance to standards CE marking Ambient CE marking Ambient CE marking CE marking CE marking CE marking Ambient CE marking CE marking CE marking Ambient CE marking Ambient CE marking Ambient CE marking CE marking Ambient Ambient CE marking Ambient Ambient CE marking Ambient	,	dangerous failure	516 years
Average probability of dangerous failures per hour (PFH) Compliance to standards CE marking CE marking CE marking LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061 Structure Natural-cooling, open (IP rating: IP 00) Ambient temperature Ambient humidity 90 %RH or less (non-condensing), storage: 90 %RH or less (non-condensing)			93.1%
Compliance to standards CE marking EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061 Structure Natural-cooling, open (IP rating: IP 00) Ambient temperature Ambient humidity 90 %RH or less (non-condensing), storage: 90 %RH or less (non-condensing)		Average probability of dangerous failures	4.75 × 10 ⁻⁹ [1/h]
Ambient temperature 0 °C to 55 °C (non-freezing), storage: -20 °C to 65 °C (non-freezing) Ambient humidity 90 %RH or less (non-condensing), storage: 90 %RH or less (non-condensing)	· ·	CE marking	EMC: EN 61800-3
Ambient temperature 0 °C to 55 °C (non-freezing), storage: -20 °C to 65 °C (non-freezing) Ambient humidity 90 %RH or less (non-condensing), storage: 90 %RH or less (non-condensing)	Structure	1	
Environment Ambience Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt	Environment	Ambient humidity	90 %RH or less (non-condensing), storage: 90 %RH or less (non-condensing)
		Ambience	Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt
Altitude Max. 1000 m above sea level		Altitude	Max. 1000 m above sea level
Vibration resistance 5.9 m/s² at 10 Hz to 55 Hz (directions of X, Y, and Z axes)			5.9 m/s ² at 10 Hz to 55 Hz (directions of X, Y, and Z axes)
Mass [kg] 0.2 (including CN9 and CN10 connectors)	Mass	[kg]	0.2 (including CN9 and CN10 connectors)

Note 1. Inrush current of approximately 1.5 A flows instantaneously when turning the control circuit power supply on. Select an appropriate capacity of power supply considering the inrush current.

- 2. Power-on duration of the safety logic unit is 100,000 times.
- 3. _: in signal name indicates a number or axis name.
- 4. For the test pulse input, contact your local sales office.

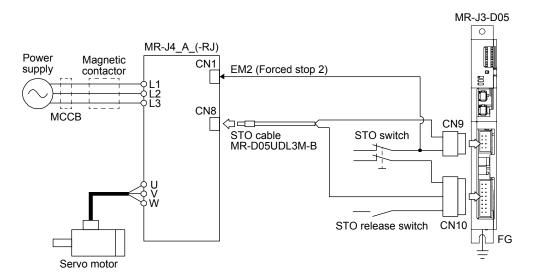
App. 5.7.3 When using MR-J3-D05 with an MR-J4 series servo amplifier

(1) System configuration diagram

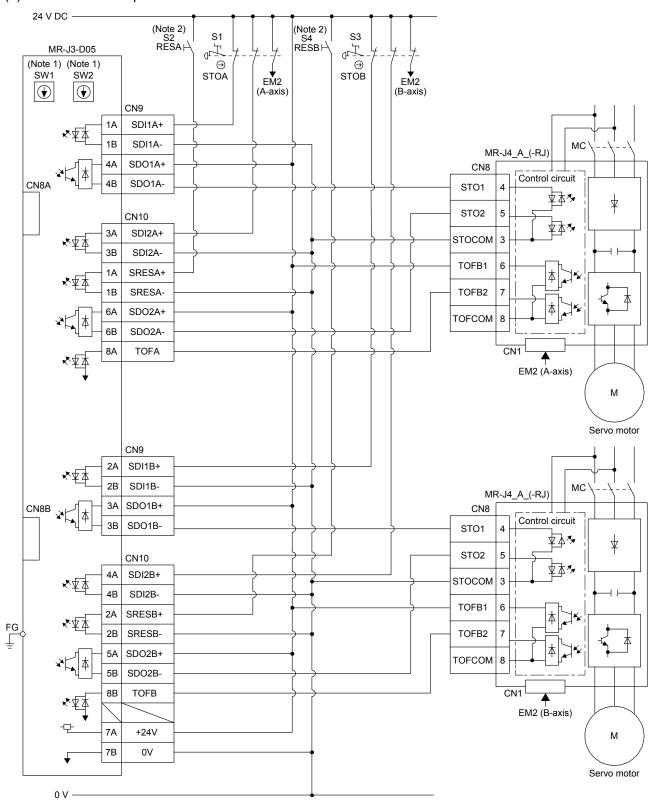
The following shows the connection targets of the STO switch and STO release switch.

POINT

■MR-D05UDL_M (STO cable) for MR-J3 series cannot be used.



(2) Connection example



Note 1. Set the delay time of STO output with SW1 and SW2. These switches are located where dented from the front panel.

2. To release the STO state (base circuit shut-off), turn RESA and RESB on and turn them off.

App. 5.8 Signal

App. 5.8.1 Connector/pin assignment

(1) CN8A

Device	Symbol	Pin No.	Function/application	I/O division
A-axis STO1	STO1A-	1	Outputs STO1 to A-axis driving device.	0
	STO1A+	4	Outputs the same signal as A-axis STO2.	
			STO state (base shutdown): Between STO1A+ and STO1A- is opened.	
			STO release state (in driving): Between STO1A+ and STO1A- is closed.	
A-axis STO2	STO2A-	5	Outputs STO2 to A-axis driving device.	0
	STO2A+	6	Outputs the same signal as A-axis STO1.	
			STO state (base shutdown): Between STO2A+ and STO2A- is opened.	
			STO release state (in driving): Between STO2A+ and STO2A- is closed.	
A-axis STO	TOF2A	7	Inputs STO state of A-axis driving device.	
state	TOF1A	8	STO state (base shutdown): Open between TOF2A and TOF1A.	
			STO release state (in driving): Close between TOF2A and TOF1A.	

(2) CN8B

Device	Symbol	Pin No.	Function/application	I/O division
B-axis STO1	STO1B-	1	Outputs STO1 to B-axis driving device.	0
	STO1B+	4	Outputs the same signal as B-axis STO2.	
			STO state (base shutdown): Between STO1B+ and STO1B- is opened.	
			STO release state (in driving): Between STO1B+ and STO1B- is closed.	
B-axis STO2	STO2B-	5	Outputs STO2 to B-axis driving device.	0
	STO2B+	6	Outputs the same signal as B-axis STO1.	
			STO state (base shutdown): Between STO2B+ and STO2B- is opened.	
			STO release state (in driving): Between STO2B+ and STO2B- is closed.	
B-axis STO	TOF2B	7	Inputs STO state of B-axis driving device.	I
state	TOF1B	8	STO state (base shutdown): Open between TOF2B and TOF1B.	
			STO release state (in driving): Close between TOF2B and TOF1B.	

(3) CN9

Device	Symbol	Pin No.	Function/application	I/O division
A-axis	SDI1A+	1A	Connect this device to a safety switch for A-axis driving device.	DI-1
shutdown 1	SDI1A-	1B	Input the same signal as A-axis shutdown 2.	
			STO state (base shutdown): Open between SDI1A+ and SDI1A	
			STO release state (in driving): Close between SDI1A+ and SDI1A	
B-axis	SDI1B+	2A	Connect this device to a safety switch for B-axis driving device.	DI-1
shutdown 1	SDI1B-	2B	Input the same signal as B-axis shutdown 2.	
			STO state (base shutdown): Open between SDI1B+ and SDI1B	
			STO release state (in driving): Close between SDI1B+ and SDI1B	
A-axis SDO1	SDO1A+	4A	Outputs STO1 to A-axis driving device.	DO-1
	SDO1A-	4B	Outputs the same signal as A-axis SDO2.	
			STO state (base shutdown): Between SDO1A+ and SDO1A- is opened.	
			STO release state (in driving): Between SDO1A+ and SDO1A- is closed.	
B-axis SDO1	SDO1B+	3A	Outputs STO1 to B-axis driving device.	DO-1
	SDO1B-	3B	Outputs the same signal as B-axis SDO2.	
			STO state (base shutdown): Between SDO1B+ and SDO1B- is opened.	
			STO release state (in driving): Between SDO1B+ and SDO1B- is closed.	

(4) CN10

Device	Symbol	Pin No.	Function/application	I/O division
A-axis	SDI2A+	3A	Connect this device to a safety switch for A-axis driving device.	DI-1
shutdown 2	SDI2A-	3B	Input the same signal as A-axis shutdown 1.	
			STO state (base shutdown): Open between SDI2A+ and SDI2A	
			STO release state (in driving): Close between SDI2A+ and SDI2A	
B-axis	SDI2B+	4A	Connect this device to a safety switch for B-axis driving device.	DI-1
shutdown 2	SDI2B-	4B	Input the same signal as B-axis shutdown 1.	
			STO state (base shutdown): Open between SDI2B+ and SDI2B	
			STO release state (in driving): Close between SDI2B+ and SDI2B	
A-axis EMG	SRESA+	1A	Signal for releasing STO state (base shutdown) on A-axis driving device.	DI-1
start/reset	SRESA-	1B	Releases STO state (base shutdown) on A-axis driving device by switching between	
			SRESA+ and SRESA- from on (connected) to off (opened).	
B-axis EMG	SRESB+	2A	Signal for releasing STO state (base shutdown) on B-axis driving device.	DI-1
start/reset	SRESB-	2B	Releases STO state (base shutdown) on B-axis driving device by switching between	
4 : 0000	00004	0.4	SRESB+ and SRESB- from on (connected) to off (opened).	DO 4
A-axis SDO2	SDO2A+	6A	Outputs STO2 to A-axis driving device.	DO-1
	SDO2A-	6B	Outputs the same signal as A-axis STO1.	
			STO state (base shutdown): Between SDO2A+ and SDO2A- is opened.	
	00000		STO release state (in driving): Between SDO2A+ and SDO2A- is closed.	50.4
B-axis SDO2	SDO2B+	5A	Outputs STO2 to B-axis driving device.	DO-1
	SDO2B-	5B	Outputs the same signal as B-axis SDO1.	
			STO state (base shutdown): Between SDO2B+ and SDO2B- is opened.	
			STO release state (in driving): Between SDO2B+ and SDO2B- is closed.	\perp
Control circuit power supply	+24V	7A	Connect + side of 24 V DC.	
Control circuit power GND	0V	7B	Connect - side of 24 V DC.	
A-axis STO state	TOFA	8A	TOFA is internally connected with TOF2A.	
B-axis STO state	TOFB	8B	TOFB is internally connected with TOF2B.	

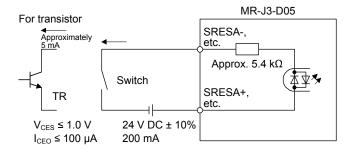
App. 5.8.2 Interfaces

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

(1) Sink I/O interface (CN9, CN10 connector)

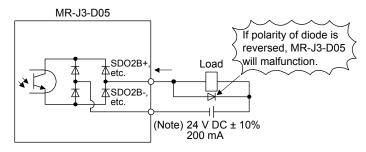
(a) Digital input interface DI-1

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



(b) Digital output interface DO-1

This is a circuit of collector output terminal of the output transistor. When the output transistor is turned on, collector terminal current will be applied for the output. 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 MR-J3-D05.

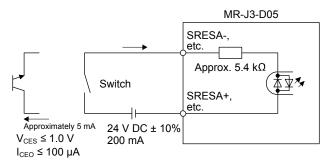


Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

(2) Source I/O interfaces (CN9, CN10 connector)

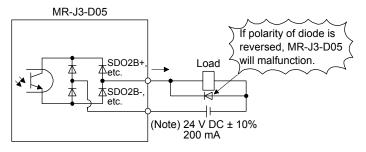
(a) Digital input interface DI-1

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



(b) Digital output interface DO-1

This is a circuit of emitter output terminal of the output transistor. When the output transistor is turned on, current will be applied from the output to a load. A maximum of 2.6 V voltage drop occurs in the MR-J3-D05.



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.

App. 5.8.3 Wiring CN9 and CN10 connectors

Handle with the tool with care when connecting wires.

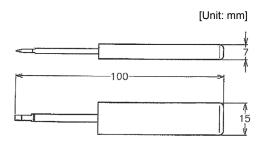
(1) Wire strip

- (a) Use wires with size of AWG 24 to 20 (0.22 mm² to 0.5 mm²) (recommended electric wire: UL1007) and strip the wires to make the stripped length 7.0 mm ± 0.3 mm. Confirm the stripped length with gauge, etc. before using the wires.
- (b) If the stripped wires are bent, feazed or too thick due to twisting too much, fix the wires by twisting lightly, etc. Then, confirm the stripped length before using the wires. Do not use excessively deformed wires.
- (c) Smooth out the wire surface and stripped insulator surface.

(2) Connecting wires

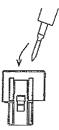
Before connecting wires, be sure to pull out the receptacle assembly from the header connector. If wires are connected with inserted connector, the connector and the printed board may malfunction.

- (a) Using extraction tool (1891348-1 or 2040798-1)
 - 1) Dimensions and mass



Mass : Approx. 20 g

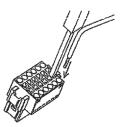
- 2) Connecting wires
 - a) Confirm the model number of the housing, contact and tool to be used.
 - b) Insert the tool diagonally into the receptacle assembly.



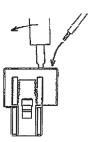
c) Insert the tool until it hits the surface of the receptacle assembly. At this stage, the tool is vertical to the receptacle assembly.



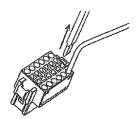
d) Insert wires in the wiring hole till the end. The wires should be slightly twisted in advance to prevent it from being feazed.



It is easy to insert the wire if the wire is inserted diagonally while twisting the tool.



e) Remove the tool.



(b) Using a screwdriver

To avoid damaging housings and springs when wiring with screwdriver, do not put excessive force. Be cautious when connecting.

1) Adjusting screw driver

Diameter: 2.3 mm ± 0.05 mm Length: 120 mm or less

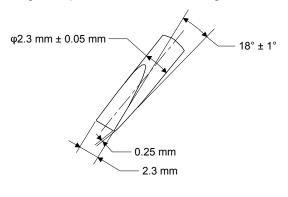
Width: 2.3 mm Thickness: 0.25 mm

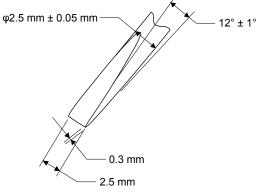
Angle in tip of the blade: 18 ± 1 degrees

Diameter: 2.5 mm ± 0.05 mm Length: 120 mm or less

Width: 2.5 mm Thickness: 0.3 mm

Angle in tip of the blade: 12 ± 1 degrees



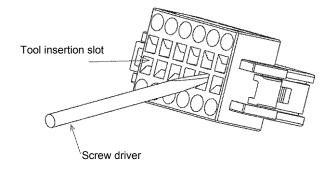


Screwdriver diameter: φ 2.3 mm

Screwdriver diameter: ϕ 2.5 mm

2) Connecting wires

- a) Insert a screwdriver in the front slot a little diagonally, and depress the spring. While depressing the spring, insert the wires until they hit the end. Note that the housing and spring may be damaged if the screwdriver is inserted strongly. Never insert the screwdriver in the wire hole. Otherwise, the connector will be damaged.
- b) Pull the screwdriver out while pressing the wires. Connecting wires is completed.
- c) Pull the wire lightly to confirm that the wire is surely connected.
- d) To remove the wires, depress the spring by the screwdriver in the same way as connecting wires, and then pull the wires out.



(3) Connector insertion

Insert the connector all the way straight until you hear or feel clicking. When removing the connector, depress the lock part completely before pulling out. If the connector is pulled out without depressing the lock part completely, the housing, contact and/or wires may be damaged.

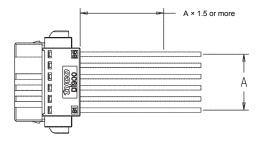
(4) Compatible wire

Compatible wire size is listed below.

Wire size					
mm²	AWG				
0.22	24				
0.34	22				
0.50	20				

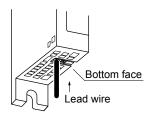
(5) Others

(a) Fix a wire tie at least distance of "A" × 1.5 away from the end of the connector.



(b) Be sure that wires are not pulled excessively when the connector is inserted.

App. 5.8.4 Wiring FG

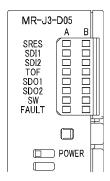


Wire range

Single wire: ϕ 0.4 mm to 1.2 mm (AWG 26 to AWG 16) Stranded wire: 0.2 mm² to 1.25 mm² (AWG 24 to AWG 16), wire ϕ 0.18 mm or more

App. 5.9 LED display

I/O status, malfunction and power on/off are displayed with LED for each A-axis and B-axis.



LED	Description	LE	D
LED	Description	Column A	Column B
SRES	Monitor LED for start/reset Off: The start/reset is off. (The switch contact is opened.) On: The start/reset is on. (The switch contact is closed.)		
SDI1	Monitor LED for shut-off 1 Off: The shut-off 1 is off. (The switch contact is closed.) On: The shut-off 1 is on. (The switch contact is opened.)		
SDI2	Monitor LED for shut-off 2 Off: The shut-off 2 is off. (The switch contact is closed.) On: The shut-off 2 is on. (The switch contact is opened.)		
TOF	Monitor LED for STO state Off: Not in STO state On: In STO state	A	D avia
SDO1	Monitor LED for SDO1 Off: Not in STO state On: In STO state	- A-axis	B-axis
SDO2	Monitor LED for SDO2 Off: Not in STO state On: In STO state		
SW	Monitor LED for confirming shutdown delay setting Off: The settings of SW1 and SW2 do not match. On: The settings of SW1 and SW2 match.		
FAULT	FAULT LED Off: Normal operation (STO monitoring state) On: Fault has occurred.		
POWER	Power supply Off: Power is not supplied to MR-J3-D05. On: Power is being supplied to MR-J3-D05.		

App. 5.10 Rotary switch setting

Rotary switch is used to shut off the power after control stop by SS1 function.

Set the delay time for STO output after STO shut off switch is pressed. Set same setting for SW1 and SW2, and set the rotary switch setting according to the delay time in the table below.

Setting cannot be changed while power is on. Notify users that setting cannot be changed by putting a seal or by another method so that end users will not change the setting after the shipment.

0 to F in the following table is the set value of the rotary switches (SW1 and SW2).

Rotary switch setting and delay time at A/B-axis [s]

			B-axis				
		0 s	1.4 s	2.8 s	5.6 s	9.8 s	30.8 s
	0 s	0	1	2	-	3	4
	1.4 s		-	5	-	6	7
A ovio	2.8 s			8	-	9	Α
A-axis	5.6 s				-	В	С
	9.8 s					D	E
	30.8 s						F

APPENDIX

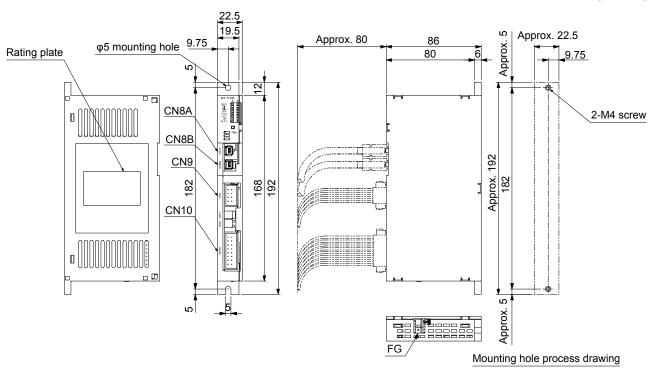
App. 5.11 Troubleshooting

When power is not supplied or FAULT LED turns on, refer the following table and take the appropriate action.

Event	Description	Cause	Action
Power is not supplied.	Power LED does not turn on although power is supplied.	24 V DC power supply is malfunctioning.	Replace the 24 V DC power supply.
		Wires between MR-J3-D05 and 24 V DC power supply are disconnected or are in contact with other wires.	Check the wiring.
		3. MR-J3-D05 is malfunctioning.	Replace the MR-J3-D05.
FAULT LED is on.	FAULT LED of A-axis or B-axis is on, and will not turn	The delay time settings are not matched.	Check the settings of the rotary switch.
	off.	2. Switch input error	Check the wiring or sequence of the input signals.
		3. TOF signal error	Check the connection with the servo amplifier.
		4. MR-J3-D05 is malfunctioning.	Replace the MR-J3-D05.

App. 5.12 Dimensions

[Unit: mm]



Pin assignment CN8A CN8B 8 TOF1A 8 TOF1B TOF2A TOF2B STO2A+ STO2B-STO1A+ STO1B+ STO1B-STO1A-CN9 CN10 1A SDI1A+ 1B SDI1A-1A SRESA+ 1B SRESA-2A SRESB+ 2B SDI1B-SRESB-SDI1B+ 3A 3B SDO1B-3B SDI2A-SDI2A+ 4A 4B SDO1A-4A 4B SDI2B+ SDI2B-5B SDO2B-5A SDO2B+ 6A 6B SDO2A+ SDO2A-7A 7B +24V 0V 8A TOFA 8B TOFB

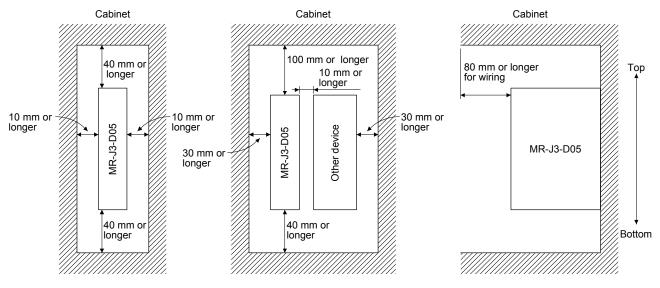
Mounting screw Screw size: M4

Tightening torque: 1.2 N•m

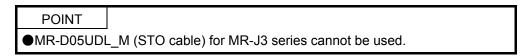
Mass: 0.2 [kg]

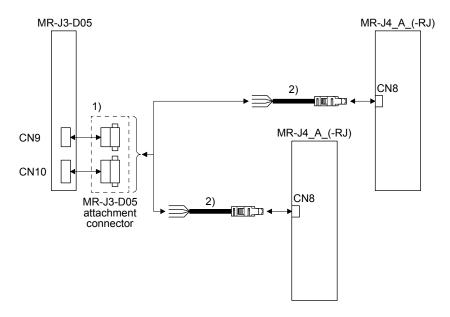
App. 5.13 Installation

Follow the instructions in this section and install MR-J3-D05 in the specified direction. Leave clearances between MR-J3-D05 and other equipment including the cabinet.



App. 5.14 Combinations of cable/connector





No.	Name	Model	Description			
1)	Connector	MR-J3-D05 attachment connector				
			Connector for CN9: 1-1871940-4	Connector for CN10: 1-1871940-8		
			(TE Connectivity)	(TE Connectivity)		
2)	STO cable	MR-D05UDL3M-B	Connector set: 2069250-1			
		Cable length: 3 m	(TE Connectivity)			
			وحرا المال			

App. 6 EC declaration of conformity

CERTIFICAD

CEPTNФИКАТ

CERTIFICAT

ERTIFI

The MR-J4 series servo amplifiers and MR-J3-D05 safety logic unit comply with the safety component laid down in the Machinery directive.

I C A



CERTIFICATE

No. Z10 15 11 66509 023

Holder of Certificate: MITSUBISHI ELECTRIC CORPORATION

Nagoya Works 5-1-14, Yada-Minami Higashi-ku, Nagoya-shi

Aichi

461-8670 JAPAN

Factory(ies): 87457, 83304

Certification Mark:



Product: AC servo systems

Model(s): Drive Unit MR-J4 Series

For nomenclature see attachment

Parameters: Safety Funtion (EN 61800-5-2):

STO

Ambient temperature:

Operation: 0°C to 55°C Storage: -20°C to 65°C

Altitude: Max. 2000m above sea level

Tested EN ISO 13849-1:2008/AC:2009 (Cat 3, PL e) according to: EN 62061:2005/A1:2013 (SILCL 3)

EN 62061:2005/A1:2013 (SILCL 3) IEC 61508-1(ed.2) (SIL 3) IEC 61508-2(ed.2) (SIL 3)

IEC 61508-4(ed.2) (SIL 3) IEC 61800-5-1(ed.2) IEC 61800-5-2(ed.1) IEC 61326-3-1(ed.1)

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.: MN86533T

Valid until: 2020-11-15

2020-11-15

Date, 2015-11-16 (Matthias Ramold)

Page 1 of 4

10V 809 685155

TÜV®

A1 / 04.11

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstraße 65 · 80339 München · Germany



ZERTIFIKAT CERTIFICATE

EC Type-Examination Certificate

Reg.-No.: 01/205/5196/12

Product tested

AC Servo Drive with integrated safety function "Safe Torque

Certificate holder

Mitsubishi Electric Corporation Nagoya Works

1-14 Yada-Minami 5-chome Higashi-ku Nagoya 461-8670

Japan

Type designation

MR-J4-*A* MR-J4-*B* Manufacturer see certificate holder

MR-J4W2-*B* MR-J4W3-*B*

Codes and standards EN 61800-5-2:2007 forming the basis of testing

EN 61800-5-1:2007 (in extracts) EN 61800-3:2004 EN ISO 13849-1:2008 + AC:2009 EN 62061:2005 + AC:2010 EN 60204-1:2006 + A1:2009 + AC:2010 (in extracts) IEC 61508 Parts 1-7:2010

Intended application

The safety function "Safe Torque Off" complies with the requirements of the relevant standards (PL d acc. to EN ISO 13849-1, SIL CL 2 acc. to EN 61800-5-2/ EN 62061/ IEC 61508) and can be used in applications up to PL d acc. to EN ISO 13849-1 and SIL 2 acc. to EN 62061/ IEC 61508.

Specific requirements The instructions of the associated Installation and Operating Manual shall be considered.

It is confirmed, that the product under test complies with the requirements for machines defined in Annex I of the EC Directive 2006/42/EC.

This certificate is valid until 2017-02-28.



The test report-no.: 968/M 342.00/12 dated 2012-02-28 is an integral part of this certificate.

The holder of a valid licence certificate for the product tested is authorized to affix the test mark shown opposite to products, which are identical with the product testage in the

Berlin, 2012-02-28

Wied B Certification Body for Machinery, NB 0035

Dipl.-Ing. Eberhard Freino



ZERTIFIKAT CERTIFICATE

Nr./No. 968/EL 612.00/09

Prüfgegenstand Product tested	Safety Logic Module for combination with MR-J Drives		Inhaber Holder	Mitsubishi Electric Corporation Nagoya Works 1-14 Yada-Minami 5-chome, Higashi-ku Nagoya 461-8670 Japan
Typbezeichnung Type designation	MR-J3-D05		Verwendungs- zweck Intended application	Drive Applications STO / SS1 acc. to EN 61800-5-2 Safe Stop / Safe Off Stop Category 0 / Stop Category 1 acc. to EN 60204-1
	Prüfgrundlagen EN ISO 1384 Codes and standards forming EN 62061:20 the basis of testing EN 61800-5- EN 61800-5- EN 61800-5-		005 -2:2007	EN 61800-3:2004 EN 60204-1:2006 EN 50178:1997 EN 61508-1 to -7:2000-2002
Prüfungsergebnis Test results		The MR-J3-D05 Safety Logic Module in combination with the MR-J3 series servo drives is suitable for the basic safety functions "STO" and "SS1" (Type C) according to EN 61800-5-2 as well as "Safe Stop" (Stop category 0 and Stop category 1) and "Safe Off" according to EN 60204-1. It can be used within safety related applications up to Safety Category 3 / PL d and SIL 2 / SIL CL 2 according to EN ISO 13849-1 and EN 62061.		
Specific requirements documer		documentati	on must be obs	product the instructions in the user served. For "Safe Off" two suitable s must be used additionally.

Der Prüfbericht-Nr.: 968/EL 612.00/09 vom 21.04.2009 ist Bestandteil dieses Zertifikates.

Dieses Zertifikat ist nur gültig für Erzeugnisse, die mit dem Prüfgegenstand übereinstimmen. Es wird ungültig bei jeglicher Änderung der Prüfgrundlagen für den angegebenen Verwendungszweck.

The test report-no.: 968/EL 612.00/09 dated 2009-04-21 is an integral part of this certificate.

This certificate is valid only for products which are identical with the product tested. It becomes invalid at any change of the codes and standards forming the basis of testing for the intended application.

TÜV Rheinland Industrie Service GmbH Geschäftsfeld ASI

Geschäftsfeld ASI Automation, Software und Informationstechnologie Am Grauen Stein, 51105 Köln Postfach 91 09 51, 51101 Köln

2009-04-21

Datum/Date Firmenstempel/Company stamp

Dipl.-Ing. Heinz Gall

H. Gall

App. 7 Analog monitor

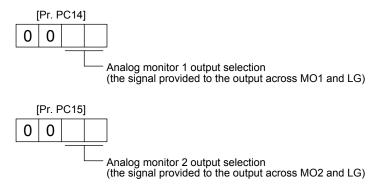
POINT

●A voltage of analog monitor output may be irregular at power-on.

The servo status can be output to two channels in terms of voltage.

App. 7.1 Setting

Change the following digits of [Pr. PC14] and [Pr. PC15].



[Pr. PC39] and [Pr. PC40] can be used to set the offset voltages to the analog output voltages. The setting range is between -9999 mV and 9999 mV.

Parameter	Description	Setting range [mV]
PC39	This is used to set the offset voltage of MO1 (Analog monitor 1).	-9999 to 9999
PC40	This is used to set the offset voltage of MO2 (Analog monitor 2).	-9999 10 9999

App. 7.2 Set content

POINT

When you use a linear servo motor, replace the following left words to the right words.

(servo motor) speed →(linear servo motor) speed

CCW direction →Positive direction

CW direction →Negative direction

Torque →Thrust

The servo amplifier is factory-set to output the servo motor speed to MO1 (Analog monitor 1) and the torque to MO2 (Analog monitor 2). The setting can be changed as listed below by setting the [Pr. PC14] and [Pr. PC15] value.

Refer to App. 7.3 for the detection point.

(1) MR-J4-_A_(-RJ) 100 W or more

Setting value	Output item	Description	Setting value	Output item	Description
00	Servo motor speed/ Linear servo motor speed	Maximum speed O Maximum speed CW direction A [V] CCW direction Maximum speed	01	Torque/Thrust	Power running in CCW direction Maximum torque O Maximum torque Power running in -8 [V] CW direction
02	Servo motor speed/ Linear servo motor speed	CW direction CCW direction A CCW direction Maximum speed 0 Maximum speed	03	Torque/Thrust	Power running in CCW direction CCW direction Maximum torque Power running in CCW direction Maximum torque Maximum torque
04	Current command	8 [V] - CCW direction Maximum current command (Maximum torque command) Maximum current command (Maximum torque command) Maximum current command (Maximum torque command) CW direction	05	Command pulse frequency (±10 V/±4 Mpulses/s)	4 [Mpulse/s] 0 4 [Mpulse/s] CW direction
06	Servo motor-side droop pulses (Note 1, 3, 5, 6) (±10 V/100 pulses)	10 [V] - CCW direction 100 [pulse] 0 100 [pulse] CW direction	07	Servo motor-side droop pulses (Note 1, 3, 5, 6) (±10 V/1000 pulses)	10 [V] - CCW direction 1000 [pulse] 0 1000 [pulse] CW direction

Setting value	Output item	Description	Setting value	Output item	Description
08	Servo motor-side droop pulses (Note 1, 3, 5, 6) (±10 V/10000 pulses)	10 [V] 10000 [pulse] 0 10000 [pulse] CW direction	09	Servo motor-side droop pulses (Note 1, 3, 5, 6) (±10 V/100000 pulses)	10 [V] 100000 [pulse] 0 100000 [pulse] CW direction
0A	Feedback position (Note 1, 2, 3) (±10 V/1 Mpulse)	10 [V] 1 CCW direction 1 M [pulse] 0 1 M [pulse] CW direction	0B	Feedback position (Note 1, 2, 3) (±10 V/10 Mpulse)	10 [V] 10 M [pulse] 10 M [pulse] 0 10 M [pulse] CW direction
0C	Feedback position (Note 1, 2, 3) (±10 V/100 Mpulse)	10 [V] - CCW direction 100 M [pulse] 0 100 M [pulse] CW direction	0D	Bus voltage (Note 7)	8 [V] 1 400 [V]
0E	Speed command 2 (Note 3)	Maximum speed O Maximum speed CW direction Maximum speed CW direction	10	Load-side droop pulses (Note 3, 4, 5, 6) (±10 V/100 pulses)	10 [V] 100 [pulse] 0 100 [pulse] CW direction
11	Load-side droop pulses (Note 3, 4, 5, 6) (±10 V/1000 pulses)	10 [V] - CCW direction 1000 [pulse] 0 1000 [pulse] CW direction	12	Load-side droop pulses (Note 3, 4, 5, 6) (±10 V/10000 pulses)	10 [V] - CCW direction 10000 [pulse] 0 10000 [pulse] CW direction
13	Load-side droop pulses (Note 3, 4, 5, 6) (±10 V/100000 pulses)	10 [V] 100000 [pulse] 0 100000 [pulse] CW direction	14	Load-side droop pulses (Note 3, 4, 5, 6) (±10 V/1 Mpulse)	10 [V] 1 CCW direction 1 [Mpulse] 0 1 [Mpulse] CW direction
15	Motor-side/load-side position deviation (Note 3, 4, 5, 6) (±10 V/100000 pulses)	10 [V] 100000 [pulse] 0 100000 [pulse] CW direction	16	Servo motor-side/load- side speed deviation (Note 4)	Maximum speed Maximum speed Maximum speed Maximum speed CW direction

Setting value	Output item	Description
17	Internal temperature of encoder (±10 V/±128 °C)	10 [V] 10 [V] 128 [°C] 128 [°C]

Note 1. Encoder pulse unit.

- 2. Available in position control mode
- 3. This cannot be used in the torque control mode.
- 4. This can be used with MR Configurator2 with software version 1.19V or later.
- 5. This cannot be used in the speed control mode.
- 6. Output in the load-side encoder unit for the fully closed loop control. Output in the servo motor encoder unit for the semi closed loop control.
- 7. For 400 V class servo amplifier, the bus voltage becomes +8 V/800 V.

(2) MR-J4-03A6(-RJ)

Setting value	Output item	Description	Setting value	Output item	Description
00	Servo motor speed (5 V ± 3 V/max. speed)	8 [V] — CCW direction 5 [V] CW direction — 2 [V] Maximum speed 0 Maximum speed	01	Torque (5 V ± 3 V/max. torque)	Power running in CCW direction 5 [V] Power running in CW direction Aximum torque Maximum torque
02	Servo motor speed (5 V + 3 V/max. speed)	CW direction 8 [V] CCW direction 5 [V]	03	Torque (5 V + 3 V/max. torque)	CW direction 8 [V] CCW direction 5 [V] Maximum torque Maximum torque
04	Current command (5 V ± 3 V/max. current command)	8 [V] CW direction 5 [V] Awximum current command (Maximum torque command) Maximum torque command)	05	Command pulse frequency (5 V ± 4 V/±4 Mpulses/s)	9 [V] — CCW direction 5 [V] CW direction — — — 1 [V] 4 [Mpulse/s] 0 4 [Mpulse/s]
06	Servo motor-side droop pulses (Note 1, 2, 3) (5 V ± 4 V/100 pulses)	9 [V] CCW direction 5 [V] CW direction 1 [V] 100 [pulse] 0 100 [pulse]	07	Servo motor-side droop pulses (Note 1, 2, 3) (5 V ± 4 V/1000 pulses)	9 [V] CCW direction 5 [V] CW direction 1 [V] 1000 [pulse] 0 1000 [pulse]

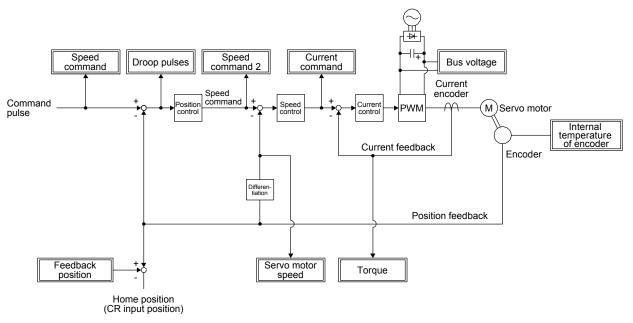
Setting value	Output item	Description	Setting value	Output item	Description
08	Servo motor-side droop pulses (Note 1, 2, 3) (5 V ± 4 V/10000 pulses)	9 [V] CCW direction 5 [V] CW direction	09	Servo motor-side droop pulses (Note 1, 2, 3) (5 V ± 4 V/100000 pulses)	9 [V] CCW direction 5 [V] CW direction 1 [V] 100000 [pulse] 0 100000 [pulse]
0A	Feedback position (Note 1, 2, 4) (5 V ± 4 V/1 Mpulses)	9 [V] CCW direction 5 [V] CW direction 1 [Mpulse] 0 1 [Mpulse]	0B	Feedback position (Note 1, 2, 4) (5 V ± 4 V/10 Mpulses)	9 [V] CCW direction 5 [V] CW direction 1 [V] 10 [Mpulse] 0 10 [Mpulse]
00	Feedback position (Note 1, 2, 4) (5 V ± 4 V/100 Mpulses)	9 [V] CCW direction 5 [V] CW direction 1 [V] 100 [Mpulse] 0 100 [Mpulse]	0D	Bus voltage (5 V + 4 V/100 V)	9 [V] 5 [V] 0 100 [V]
0E	Speed command 2 (Note 2) (5 V ± 3 V/max. speed)	8 [V] - CCW direction 5 [V] CW direction 2 [V] Maximum speed	17	Internal temperature of encoder (5 V ± 4 V/±128 °C)	9 [V] 5 [V] 1 [V]128 [°C] 0 128 [°C]

Note 1. Encoder pulse unit.

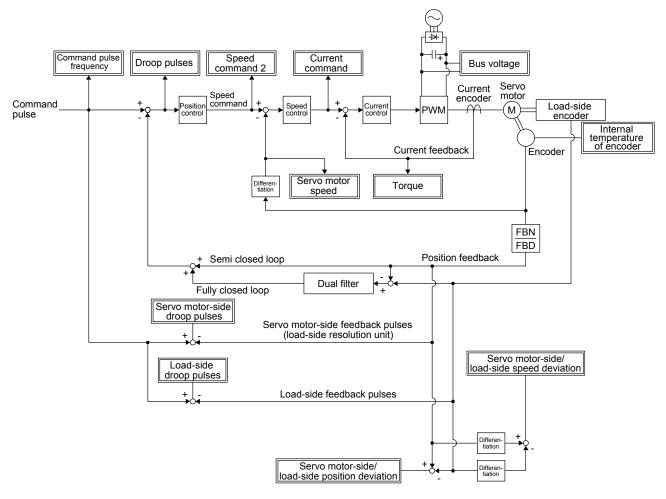
- $\boldsymbol{2}. \ \, \boldsymbol{\hat{}}$ This cannot be used in the torque control mode.
- $\ensuremath{\mathfrak{Z}}_{\text{.}}$ This cannot be used in the speed control mode.
- 4. Available in position control mode

App. 7.3 Analog monitor block diagram

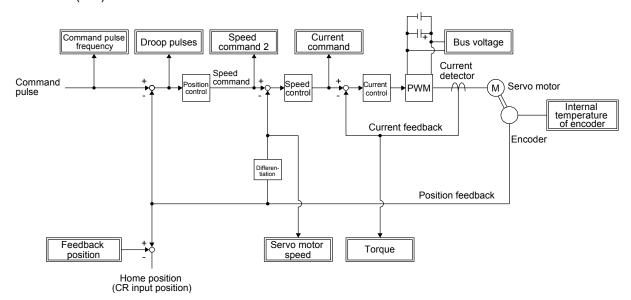
- (1) MR-J4-_A_(-RJ) 100 W or more
 - (a) Semi closed loop control



(b) Fully closed loop control



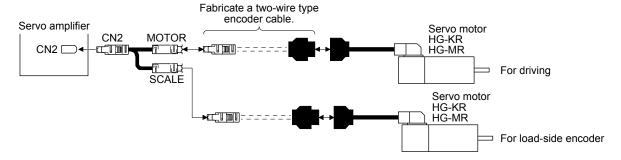
(2) MR-J4-03A6(-RJ)



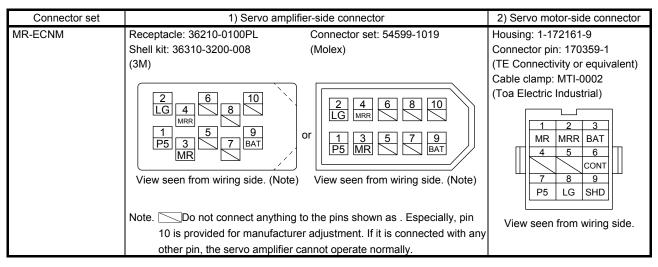
App. 8 Two-wire type encoder cable for HG-MR/HG-KR

Use a two-wire type encoder cable for the fully closed loop control by the MR-J4-_A_ servo amplifiers. For MR-EKCBL_M-_ encoder cables for HG-MR and HG-KR, up to 20 m cables are two-wire type. Therefore, when you need a longer encoder cable of two-wire type than 20 m, fabricate one using MR-ECNM connector set. Use the internal wiring diagram in the section to fabricate a cable up to 50 m.

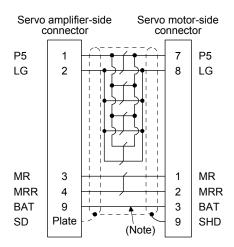
App. 8.1 Configuration diagram



App. 8.2 Connector set



App. 8.3 Internal wiring diagram



Note. Always make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

App. 9 How to replace servo amplifier without magnetic pole detection

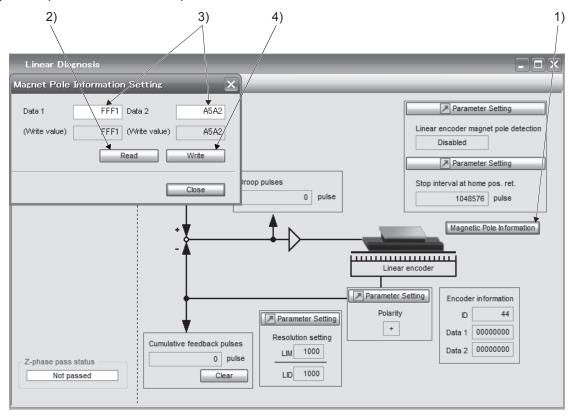


• Be sure to write the magnetic pole information of the servo amplifier before the replacement to the servo amplifier after the replacement. If the information before and after replacement are different, the servo motor may operate unexpectedly.

When replacing the servo amplifier, carry out the magnetic pole detection again. If the magnetic pole detection cannot be performed unavoidably, write the magnetic pole information from the servo amplifier before the replacement to the one after the replacement using MR Configurator2.

- (1) Procedures
 - (a) Read the magnetic pole information of the servo amplifier before the replacement.
 - (b) Write the read magnetic pole information to the servo amplifier after the replacement.
 - (c) Perform the test operation with the torque limit for ensuring the safety, and confirm that there is no trouble.
- (2) Migration method of the magnetic pole information
 - (a) How to read the magnetic pole information from the servo amplifier before the replacement
 - 1) Open the project in MR Configurator2, select "MR-J4-A" for model, and select "Linear" for operation mode.
 - 2) Check that the personal computer is connected with the servo amplifier, and select "Diagnosis" and then "Linear diagnosis".

- 3) Click "Magnetic pole information" (1) in figure) to open the magnetic pole information window.
- 4) Click "Read All" of the magnetic pole information window. (2) in figure)
- 5) Confirm the data 1 and data 2 (3) in figure) of the magnetic pole information window and take notes.
- (b) How to write the magnetic pole information to the servo amplifier after the replacement
 - 1) Open the project in MR Configurator2, select "MR-J4-A" for model, and select "Linear" for operation mode.
 - 2) Check that the personal computer is connected with the servo amplifier, and select "Diagnosis" and then "Linear diagnosis".
 - 3) Click "Magnetic pole information" (1) in figure) to open the magnetic pole information window.
 - 4) Input the value of the magnetic pole information taken notes to the data 1 and data 2 (3) in figure) of the magnetic pole information window.
 - 5) Click "Write All" (4) in figure) of the magnetic pole information window.
 - 6) Cycle the power of the servo amplifier.



App. 10 Special specification

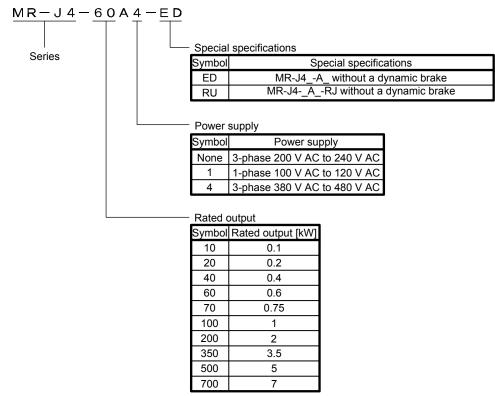
App. 10.1 Amplifiers without dynamic brake

App. 10.1.1 Summary

This section explains servo amplifiers without a dynamic brake. The things not explained in this section will be the same as MR-J4-_A_(-RJ).

App. 10.1.2 Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.



App. 10.1.3 Specifications

Dynamic brake which is built in 7 kW or smaller servo amplifiers is removed.

Take safety measures such as making another circuit for an emergency stop, alarm occurrence, and power shut-off.

The following servo motors may function an electronic dynamic brake at an alarm occurrence.

Series	Servo motor
HG-KR	HG-KR053/HG-KR13/HG-KR23/HG-KR43
HG-MR	HG-MR053/HG-MR13/HG-MR23/HG-MR43
HG-SR	HG-SR51/HG-SR52

Setting the following parameter disables the electronic dynamic brake.

Servo amplifier	Parameter	Setting value
MR-J4AED MR-J4ARU	[Pr. PF06]	2

When [Pr. PA04] is "2 $_$ " (default), the motor can be a state of forced stop deceleration at an alarm occurrence. Setting "0 $_$ " in [Pr. PA04] disables the forced stop deceleration function.

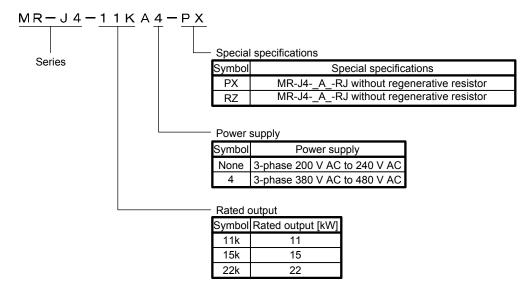
App. 10.2 Without regenerative resistor

App. 10.2.1 Summary

This section explains servo amplifiers without a regenerative resistor. The things not explained in this section will be the same as MR-J4-_A_(-RJ).

App. 10.2.2 Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.



App. 10.2.3 Specifications

Indicates a servo amplifier of 11 kW to 22 kW that does not use a regenerative resistor as standard accessory. When using any of these servo amplifiers, always use the MR-RB5R, MR-RB9F, MR-RB9T, MR-RB5K-4, or MR-RB6K-4 regenerative option.

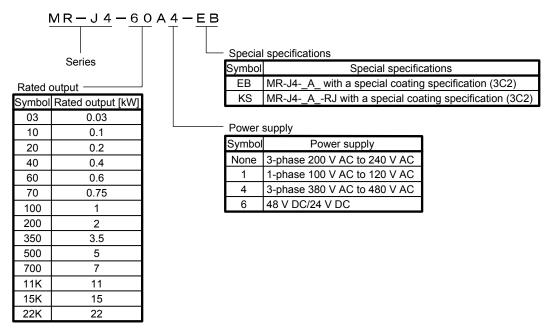
App. 10.3 Special coating-specification product (IEC 60721-3-3 Class 3C2)

App. 10.3.1 Summary

This section explains servo amplifiers with a special coating specification. Items not given in this section will be the same as MR-J4-_A_(-RJ).

App. 10.3.2 Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.



App. 10.3.3 Specifications

(a) Special coating

Using the MR-J4 series in an atmosphere containing a corrosive gas may cause its corrosion with time, resulting in a malfunction. For the printed circuit board of the servo amplifiers with a special coating specification, a urethane coating agent is applied to some parts capable of being coated technically (except LEDs, connectors, terminal blocks, etc.) to improve the resistance to corrosive gases. Use a servo amplifier with a special coating specification specifically for applications susceptible to corrosive gases, including tire manufacturing and water treatment. Although the special coating-specification products have the improved resistance to corrosive gases, proper operations in environments mentioned above are not guaranteed. Therefore, perform periodic inspections for any abnormality.

(b) Standard for corrosive gases

In IEC 60721-3-3, corrosive gases refer to sea salt, sulfur dioxide, hydrogen sulfide, chlorine, hydrogen chloride, hydrogen fluoride, ammonia, ozone, and nitrogen oxides shown in the environmental parameter column of the table below.

The table also shows the corrosive gas concentrations defined in IEC 60721-3-3, Class 3C2.

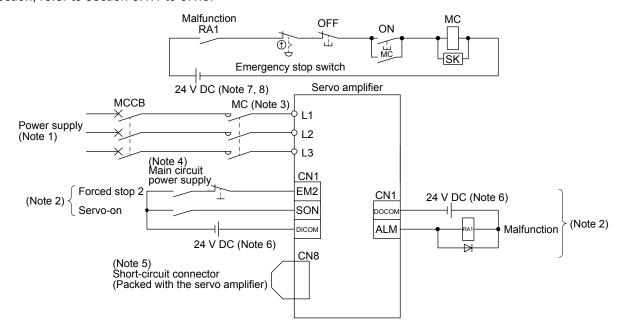
Environmental parameter	Unit	3C2		
Environmental parameter	Offic	Mean value	Maximum value	
a) Sea salt	None	Salt mist		
b) Sulfur dioxide	cm ³ /m ³	0.11	0.37	
c) Hydrogen sulfide	cm ³ /m ³	0.071	0.36	
d) Chlorine	cm ³ /m ³	0.034	0.1	
e) Hydrogen chloride	cm ³ /m ³	0.066	0.33	
f) Hydrogen fluoride	cm ³ /m ³	0.012	0.036	
g) Ammonia	cm ³ /m ³	1.4	4.2	
h) Ozone	cm ³ /m ³	0.025	0.05	
i) Nitrogen oxides	cm ³ /m ³	0.26	0.52	

The special coating-specification products have the improved corrosion resistance in environments with corrosive gas concentrations conforming to IEC 60721-3-3, Class 3C2. We tested typical models and confirmed that their corrosive gas resistance was improved, compared with the standard models.

App. 11 Driving on/off of main circuit power supply with DC power supply

App. 11.1 Connection example

The power circuit is common to all capacity type of servo amplifiers. For the signal and wirings not given in this section, refer to section 3.1.1 to 3.1.3.



Note 1. For the power supply specifications, refer to section 1.3.

- 2. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 3. 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 main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, slow the time to turn off the magnetic contactor.
- 4. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 5. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 6. 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.
- 7. Driving the on switch and off switch with the DC power supply meets IEC/EN 60204-1 requirements.
- 8. Do not use the 24 V DC interface power supply for the magnetic contactor DC power supply. Always use the power supply designed exclusively for the magnetic contactor.

App. 11.2 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-J4-10A(-RJ)	
MR-J4-20A(-RJ)	
MR-J4-40A(-RJ)	SD-N11
MR-J4-60A(-RJ)	SD-NTT
MR-J4-70A(-RJ)	
MR-J4-100A(-RJ)	
MR-J4-200A(-RJ)	SD-N21
MR-J4-350A(-RJ)	SD-INZ I
MR-J4-500A(-RJ)	SD-N35
MR-J4-700A(-RJ)	SD-N50
MR-J4-11KA(-RJ)	2D-N20
MR-J4-15KA(-RJ)	SD-N65
MR-J4-22KA(-RJ)	SD-N95

Servo amplifier	Magnetic contactor	
MR-J4-60A4(-RJ)		
MR-J4-100A4(-RJ)	SD-N11	
MR-J4-200A4(-RJ)		
MR-J4-350A4(-RJ)		
MR-J4-500A4(-RJ)	SD-N21	
MR-J4-700A4(-RJ)		
MR-J4-11KA4(-RJ)	SD-N25	
MR-J4-15KA4(-RJ)	SD-N35	
MR-J4-22KA4(-RJ)	SD-N50	
MR-J4-10A1(-RJ)		
MR-J4-20A1(-RJ)	SD-N11	
MR-J4-40A1(-RJ)		

App. 12 STO function with SIL 3 certification

The MR-J4 series general-purpose AC servo amplifiers now comply with safety integrity level 3 (SIL 3) of the IEC 61508:2010 functional safety standard.

App. 12.1 Target models

MR-J4 series AC servo amplifiers (excluding MR-J4-03A6(-RJ) and MR-J4W2-0303B6)

App. 12.2 Change of the compliance

The target MR-J4 servo amplifiers now comply with SIL 3 (Table app. 3).

Table app. 3 Compliance with SIL 3

	Before change	After change
Safety performance	EN ISO 13849-1 category 3 PL d,	EN ISO 13849-1 category 3 PL e,
(Standards certified by CB)	IEC 61508 SIL 2,	IEC 61508 SIL 3,
	EN 62061 SIL CL 2,	EN 62061 SIL CL 3,
	EN 61800-5-2 STO function	EN 61800-5-2 STO function

App. 12.3 Schedule

For the products manufactured in Japan, this change has been made sequentially from the June 2015 production.

For the products manufactured and sold in China, this change has been made sequentially from the December 2015 production.

There may be cases where both the former and new products exist in the distribution stage.

App. 12.4 Use with SIL 3

Set the safety level with [Pr. PF18 STO diagnosis error detection time].

To use the servo amplifier with SIL 3, set [Pr. PF18 STO diagnosis error detection time] within the range of 1 to 60, connect the TOFB output (CN8) of the servo amplifier to the input of a SIL 3-certified controller and execute the diagnosis. SIL 3 functional safety of the servo amplifiers is certified by TÜV SÜD.

App. 12.5 Use with SIL 2 (as conventional)

The servo amplifiers are still capable of SIL 2 as before regardless of whether the STO diagnosis function is enabled or not.

Either of the conventionally-used TÜV Rheinland certification or the new TÜV SÜD certification may be used.

App. 12.6 How to check the country of origin, and the year and month of manufacture

The country of origin, and the year and month of manufacture are indicated on the packaging box (Fig. app. 2) and the rating plate (Fig. app. 3).



Fig. app. 2 Indication example on the packaging box

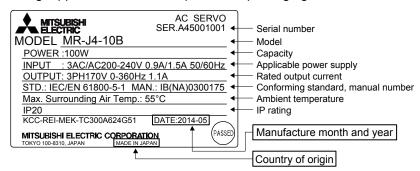


Fig. app. 3 Indication example on the rating plate

App. 13 When using the servo amplifier with the DC power supply input

POINT

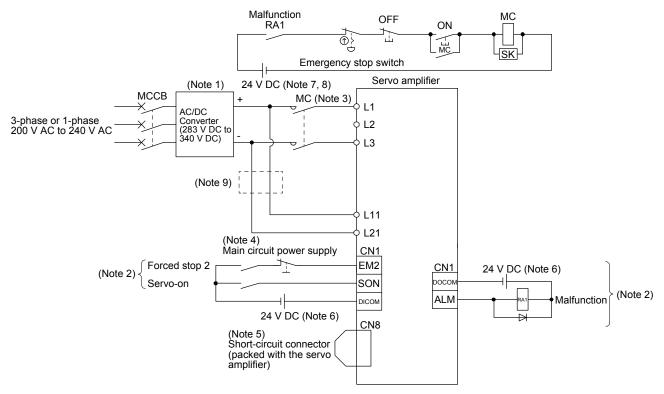
- ●The DC power supply input is available only with the MR-J4-_A-RJ servo amplifiers.
- ●When using the MR-J4-_A-RJ servo amplifier with the DC power supply input, set [Pr. PC27] to "_ _ _ 1".

App. 13.1 Connection example

↑ CAUTION ●Ensure that polarity (+/-) is correct. Otherwise, a burst, damage, etc. may occur.

For the signal and wirings not given in this section, refer to section 3.1.1 to 3.1.3.

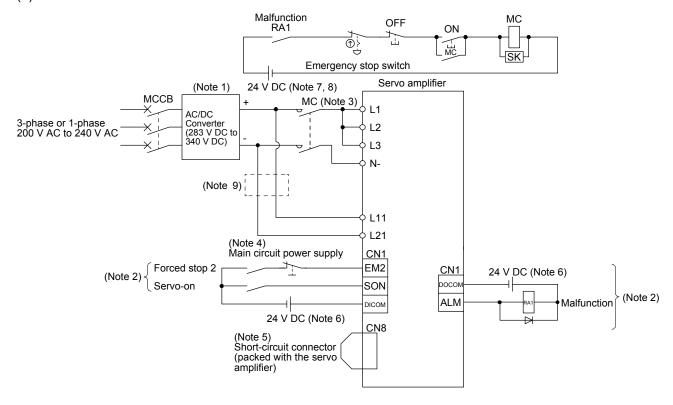
(1) MR-J4-10A-RJ to MR-J4-100A-RJ



Note 1. For the power supply specifications, refer to section 1.3.

- 2. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 3. 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 main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, delay the time to turn off the magnetic contactor.
- 4. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 5. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 6. 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.
- 7. Driving the on switch and off switch with the DC power supply meets IEC/EN 60204-1 requirements.
- 8. Do not use the 24 V DC interface power supply for the magnetic contactor DC power supply. Always use the power supply designed exclusively for the magnetic contactor.
- 9. When wires used for L11 and L21 are thinner than wires used for L1 and L3, use a fuse. (Refer to app. 13.4.)

(2) MR-J4-200A-RJ to MR-J4-22KA-RJ



Note 1. For the power supply specifications, refer to section 1.3.

- 2. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.9.3.
- 3. 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 (160 ms or less for 5 kW or more). Depending on the main circuit voltage and operation pattern, bus voltage decreases, and that may cause the forced stop deceleration to shift to the dynamic brake deceleration. When dynamic brake deceleration is not required, delay the time to turn off the magnetic contactor.
- 4. Configure a circuit to turn off EM2 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
- 5. When not using the STO function, attach the short-circuit connector came with a servo amplifier.
- 6. 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.
- 7. Driving the on switch and off switch with the DC power supply meets IEC/EN 60204-1 requirements.
- 8. Do not use the 24 V DC interface power supply for the magnetic contactor DC power supply. Always use the power supply designed exclusively for the magnetic contactor.
- 9. When wires used for L11 and L21 are thinner than wires used for L1, L2, L3, and N-, use a fuse. (Refer to app. 13.4.)

App. 13.2 Power supply capacity

The power supply capacity is the same as that for the AC power supply input. Refer to section 10.2 for details.

App. 13.3 Selection example of wires

POINT

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.

(1) Example of selecting the wire sizes

Use the 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire) for wiring. The following shows the wire size selection example.

0 116	Wire [mm ²] (Note 1)		
Servo amplifier	L1/L2/L3/N-/	L11/L21	
MR-J4-10A-RJ			
MR-J4-20A-RJ			
MR-J4-40A-RJ	2 (AWG 14)		
MR-J4-60A-RJ	2 (AVVG 14)	1.25 to 2	
MR-J4-70A-RJ		(AWG 16 to 14)	
MR-J4-100A-RJ			
MR-J4-200A-RJ MR-J4-350A-RJ	3.5 (AWG 12)		
MR-J4-500A-RJ (Note 2)	5.5 (AWG 10): a	1.25 (AWG 16): a	
MR-J4-700A-RJ (Note 2)	8 (AWG 8): b	2 (AWG 14): d	
MR-J4-11KA-RJ (Note 2)	14 (AWG 6): e	4.05 (AMO 40).	
MR-J4-15KA-RJ (Note 2)	22 (AWG 4): f	1.25 (AWG 16): c 2 (AWG 14): c	
MR-J4-22KA-RJ (Note 2)	38 (AWG 2): g	2 (AVVO 17). C	

Note 1. Alphabets in the table indicate crimping tools. For crimp terminals and applicable tools, refer to (2) in this section.

2. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.

(2) Selection example of crimp terminals

	Servo amplifier-side crimp terminal					
Symbol	(Note 2)	Applicable tool			Manufacturer	
	Crimp terminal	Body	Head	Dice	Manuacturei	
а	FVD5.5-4	YNT-1210S				
b (Note 1)	8-4NS	YHT-8S				
С	FVD2-4	YNT-1614				
d	FVD2-M3	1111-1014				
е	FVD14-6	VE 1	FVD14-6 YF-1	YNE-38	DH-122	JST
C	T VD 14-0	11-1	TF-1 TINE-30		001	
f	FVD22-6	YF-1	YNE-38	DH-123		
'	T VD22-0	11-1	TINE-30	DH-113		
a	FVD38-8	YF-1	YNE-38	DH-124		
g	1 4 5 30 - 3	11 -1	TIVE-00	DH-114		

Note 1. Coat the crimping part with an insulation tube.

2. Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended ones or equivalent ones.

App. 13.4 Molded-case circuit breakers, fuses, magnetic contactors

(1) For main circuit power supply



- ■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.

Molded-case circuit breaker (Note 1)			1)				
	Frame, rated current						Magnetic
Servo amplifier	Power factor improving reactor is not used	Power factor improving reactor is used	Voltage AC [V]	Class	Current [A]	Voltage DC [V]	contactor (Note 2)
MR-J4-10A-RJ	30 A frame 5 A	30 A frame 5 A			10		
MR-J4-20A-RJ	30 A frame 5 A	30 A frame 5 A			10		
MR-J4-40A-RJ	30 A frame 10 A	30 A frame 5 A			15		
MR-J4-60A-RJ	30 A frame 15 A	30 A frame 10 A					
MR-J4-70A-RJ	30 A frame 15 A	30 A frame 10 A					
MR-J4-100A-RJ (3-phase power supply input)	30 A frame 15 A	30 A frame 10 A			20		DUD-N30
MR-J4-100A-RJ (1-phase power supply input)	30 A frame 15 A	30 A frame 15 A	240	Т		400	
MR-J4-200A-RJ	30 A frame 20 A	30 A frame 20 A			30]	
MR-J4-350A-RJ	30 A frame 30 A	30 A frame 30 A			40		
MR-J4-500A-RJ	50 A frame 50 A	50 A frame 50 A			60]	DUD-N60
MR-J4-700A-RJ	100 A frame 75 A	60 A frame 60 A			80]	חסטו-מסט
MR-J4-11KA-RJ	100 A frame 100 A	100 A frame 100 A			125		DUD-N120
MR-J4-15KA-RJ	125 A frame 125 A	125 A frame 125 A			175		DOD-N 120
MR-J4-22KA-RJ	225 A frame 175 A	225 A frame 175 A			300		DUD-N180

Note 1. Use a molded-case circuit breaker which has the same or more operation characteristics than our lineup.

^{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.

(2) For control circuit power supply

When the wiring for the control circuit power supply (L11/L21) is thinner than that for the main circuit power supply (L1/L2/L3/N-), install an overcurrent protection device (fuse, etc.) to protect the branch circuit.

Sorve amplifier	Fuse (0	Class T)	Fuse (Class K5)	
Servo amplifier	Current [A]	Voltage DC [V]	Current [A]	Voltage DC [V]
MR-J4-10A-RJ				
MR-J4-20A-RJ				
MR-J4-40A-RJ				
MR-J4-60A-RJ				
MR-J4-70A-RJ				
MR-J4-100A-RJ				
MR-J4-200A-RJ	1	400	1	400
MR-J4-350A-RJ				
MR-J4-500A-RJ				
MR-J4-700A-RJ				
MR-J4-11KA-RJ			İ	
MR-J4-15KA-RJ				
MR-J4-22KA-RJ				

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Data	*Manual Number	1110 11101	nual number is given on the bottom left of the back cover Revision
Mar. 2012	SH(NA)030107-A	First edition	
Jun. 2012	SH(NA)030107-A	4. Additional instructions (2)	The sentences are added.
Juli. 2012	5. I(I II I) 300 IOI -D	Wiring	SSGrisos are added.
		4. Additional instructions (3)	The sentences are added.
		Test run and adjustment	
		COMPLIANCE WITH CE	The reference is changed.
		MARKING	
		COMPLIANCE WITH	The reference is changed.
		UL/CSA STANDARD	
		COMPLIANCE WITH KC	Added.
		MARK	
		Section 1.2 (1)	The diagram is changed.
		Section 1.2 (2)	The diagram is changed.
		Section 1.3	The table and Note are changed.
		Section 1.5	The item of detailed explanation is changed.
		Section 1.8	Note is changed.
		Chapter 2	CAUTION is changed.
		Section 2.4	POINT is changed to CAUTION.
		Section 2.5	The explanation of relay lifetime is changed.
		Chapter 3	The sentences are added to CAUTION.
		Section 3.1	The sentences are added to CAUTION.
			The sentences are changed.
		Section 3.1 (1)	Note 10 is added.
		Section 3.1 (2)	Note 10 is added.
		Section 3.1 (3)	Note 10 is added.
		Section 3.1 (4)	Note 10 is added.
		Section 3.2.1 (1)	Note 9, 12, 13, 14, and 15 are changed and added.
		Section 3.2.1 (2)	The diagram is added.
		Section 3.2.2 (1) Section 3.2.2 (2)	Note 9, 12, 13, and 14 are changed and added.
		Section 3.2.2 (2)	Added. Note 7, 10, 11, and 12 are changed and added.
		Section 3.2.3 (1)	Added.
		Section 3.3.1	The sentences of N- are changed.
		Section 3.3.3 (2) (a)	The ferrule is added.
		Section 3.5 (2)	The sentences are added to TLA, TC, VC, VLA, PP, NP, PG, and
		(-)	NG.
		Section 3.5 (4)	"Available in the future" is deleted.
		Section 3.9.1	The part of diagram is changed.
		Section 3.9.2 (1)	The sentences are changed.
		Section 3.9.2 (2)	The sentences are added.
		Section 3.9.3 (1)	The sentences are added.
		Section 3.9.3 (2)	The sentences are added.
		Section 4.1.2 (1) (b) 4)	Added.
		Section 4.2.2	Note is added.
		Section 4.3.2	Note is added.
		Section 4.4.2	"EM2 (Forced stop 2) off" in the table is changed. Note is added.
		Section 4.5.6	POINT is deleted.
		Section 4.5.9 (4)	(a) is deleted
		Section 5.1.1	PA25 is changed from "For manufacturer setting".
		Section 5.1.3	PC21 is changed from "For manufacturer setting".
		Section 5.1.6	PF09 and PF15 are changed from "For manufacturer setting".
		Section 5.2.1	The setting value is added to PA03, the diagram of PA06 is
			changed, and PA25 is added.

Jun. 2012 SH(NA)030107-B Section 5.2.3 The sentences are added to PC12 and PC13, the sentences are added to the initial value in I Section 5.2.6 PF09 and PF15 are added. Section 7.3.1 The sentences are added to POINT. Chapter 8 The sentences are added to POINT. Chapter 8 The sentences of the electronic dynamic brake The serial communication is added to [AL. 8A] The name of [AL. E1] is changed. Section 10.3 POINT is added. Section 11.3 The sentences are changed. Section 11.4 The sentences are changed. Section 11.5 The sentences are changed. Section 11.5 (3) The diagram is changed. Section 11.7 (1) CAUTION is changed. Section 11.7 (2) Note is added. Section 12.8.4 The sentences are added to POINT. The sentences are added to POINT. The sentences are added to POINT. The sentences are changed. The sentences are changed. The sentences are added to POINT. The sentences are changed.	PC37. e are added. l and [AL. 8E].
Section 5.2.6 Section 7.3.1 The sentences are added to POINT. Chapter 8 The serial communication is added to [AL. 8A] The name of [AL. E1] is changed. Section 10.3.2 Section 11.3 The sentences are changed. Section 11.4 The sentences are changed. Section 11.5 The sentences are changed. Section 11.5 The sentences are changed. Section 11.7 (1) Section 11.7 (2) Section 12.3 Section 12.8.4 Section 13.1.5 Section 13.3.2 (1) The sentences are added to POINT. The sentences are changed. The connection destination of the servo amplification of the servo amplification 12. The sentences are added to POINT. The sentences are changed. The value in table is changed.	e are added. I and [AL. 8E].
Section 7.3.1 Chapter 8 The sentences are added to POINT. The sentences of the electronic dynamic brake The serial communication is added to [AL. 8A] The name of [AL. E1] is changed. Section 10.3 Section 10.3.2 The table is changed. Section 11.3 The sentences are changed. Section 11.4 The sentences are changed. Section 11.5 The sentences are changed. Section 11.5 (3) Section 11.5 (4) Section 11.7 (1) CAUTION is changed. Section 12.3 The sentences are added to POINT. The sentences are changed. Section 12.3 The sentences are changed. Section 12.3 The sentences are changed.	and [AL. 8E].
Chapter 8 The sentences of the electronic dynamic brake The serial communication is added to [AL. 8A] The name of [AL. E1] is changed. Section 10.3 POINT is added. Section 11.3 The sentences are changed. Section 11.4 The sentences are changed. Section 11.5 The sentences are changed. Section 11.5 (3) The diagram is changed. Section 11.7 (1) CAUTION is changed. Section 12.3 The sentences are added to POINT. The sentences are changed. The connection destination of the servo amplification	and [AL. 8E].
The serial communication is added to [AL. 8A] The name of [AL. E1] is changed. Section 10.3 POINT is added. Section 11.3 The sentences are changed. Section 11.4 The sentences are changed. Section 11.5 The sentences are changed. Section 11.5 (3) The diagram is changed. Section 11.5 (4) The connection destination of the servo amplification	and [AL. 8E].
The name of [AL. E1] is changed. Section 10.3 POINT is added. Section 10.3.2 The table is changed. Section 11.3 The sentences are changed. Section 11.4 The sentences are changed. Section 11.5 The sentences are changed. Section 11.5 (3) The diagram is changed. Section 11.7 (1) CAUTION is changed. Section 11.7 (2) Note is added. Section 12.3 The sentences are added to POINT. Section 12.8.4 The sentences are changed. Section 13.1.5 The value in table is changed. Section 13.3.2 (1) The diagram is changed.	
Section 10.3 Section 10.3.2 The table is changed. Section 11.3 The sentences are changed. Section 11.4 The sentences are changed. Section 11.5 The sentences are changed. Section 11.5 (3) Section 11.5 (4) Section 11.7 (1) Section 11.7 (2) Section 12.3 Section 12.8.4 Section 13.1.5 The value in table is changed. The value in table is changed. The value in table is changed. The diagram is changed. The value in table is changed.	ïer is changed.
Section 10.3.2 The table is changed. Section 11.3 The sentences are changed. Section 11.4 The sentences are changed. Section 11.5 The sentences are changed. Section 11.5 (3) The diagram is changed. Section 11.5 (4) The connection destination of the servo amplification of the servo ampl	ïer is changed.
Section 11.3 Section 11.4 Section 11.5 The sentences are changed. Section 11.5 The sentences are changed. Section 11.5 (3) Section 11.5 (4) Section 11.5 (4) Section 11.7 (1) Section 11.7 (2) Section 12.3 Section 12.8 Section 12.8.4 Section 13.1.5 Section 13.3.2 (1) The sentences are changed. The sentences are added to POINT. The value in table is changed. The diagram is changed.	ïer is changed.
Section 11.4 Section 11.5 The sentences are changed. Section 11.5 (3) The diagram is changed. Section 11.7 (1) Section 11.7 (2) Section 12.3 Section 12.8.4 Section 13.1.5 Section 13.3.2 (1) The sentences are changed. The sentences are added to POINT. The sentences are changed. The value in table is changed.	ïer is changed.
Section 11.5 Section 11.5 (3) Section 11.5 (4) Section 11.7 (1) Section 11.7 (2) Section 12.3 Section 12.8.4 Section 13.1.5 Section 13.3.2 (1) The sentences are changed. The diagram is changed. The diagram is changed. Section destination of the servo amplification of the servo a	ïer is changed.
Section 11.5 (3) Section 11.5 (4) Section 11.7 (1) Section 11.7 (2) Section 12.3 Section 12.8.4 Section 13.1.5 Section 13.1.5 Section 13.3.2 (1) The diagram is changed. CAUTION is changed. CAUTION is changed. The sentences are added to POINT. The value in table is changed. The diagram is changed.	ier is changed.
Section 11.5 (4) Section 11.7 (1) CAUTION is changed. Section 11.7 (2) Note is added. Section 12.3 The sentences are added to POINT. Section 12.8.4 The sentences are changed. Section 13.1.5 The value in table is changed. Section 13.3.2 (1) The diagram is changed.	ier is changed.
Section 11.5 (4) Section 11.7 (1) CAUTION is changed. Section 11.7 (2) Note is added. Section 12.3 The sentences are added to POINT. Section 12.8.4 The sentences are changed. Section 13.1.5 The value in table is changed. Section 13.3.2 (1) The diagram is changed.	fier is changed.
Section 11.7 (1) CAUTION is changed. Section 11.7 (2) Note is added. Section 12.3 The sentences are added to POINT. Section 12.8.4 The sentences are changed. Section 13.1.5 The value in table is changed. Section 13.3.2 (1) The diagram is changed.	-
Section 11.7 (2) Note is added. Section 12.3 The sentences are added to POINT. Section 12.8.4 The sentences are changed. Section 13.1.5 The value in table is changed. Section 13.3.2 (1) The diagram is changed.	
Section 12.3 The sentences are added to POINT. Section 12.8.4 The sentences are changed. Section 13.1.5 The value in table is changed. Section 13.3.2 (1) The diagram is changed.	
Section 13.1.5 The value in table is changed. Section 13.3.2 (1) The diagram is changed.	
Section 13.1.5 The value in table is changed. Section 13.3.2 (1) The diagram is changed.	
Section 13.3.2 (1) The diagram is changed.	
7.630	
Section 13.3.3 The part of diagram is changed.	
Section 13.4.1 (1) The sentences are changed.	
Section 13.4.1 (2) The sentences are added.	
Section 13.4.1 (2) (a) Note is changed.	
Section 13.4.2 (1) The sentences are added.	
Section 13.4.2 (2) The sentences are added.	
Chapter 14 Added.	
Appendix. 4 The sentences are changed.	
Appendix. 5 The sentences are changed.	
Appendix. 6 The sentences are changed.	
Appendix. 7.7.3 (2) The diagram is changed.	
Appendix, 7.7.3 (3) Deleted.	
Appendix. 7.7.3 (4) Deleted.	.a
Appendix. 7.8.1 (1) The pin number is changed and Note is delete	90.
Appendix. 7.8.1 (2) CAUTION is deleted.	
Appendix, 7.8.2 The sentences are changed.	
Appendix. 7.12 The diagram is added.	
Appendix. 7.14 POINT is changed.	
Appendix. 8 TUV certificate of MR-J4 series is added.	
Jul. 2012 SH(NA)030107-C Section 3.2.1 (2) The part of diagram is changed.	
Section 3.2.2 (2) The part of diagram is changed.	
Section 3.2.3 (2) The part of diagram is changed.	
Sep. 2012 SH(NA)030107-D Section 3.2.1 The diagram is changed.	
Section 3.2.2 The diagram is changed.	
Section 3.10.2 (1) (b) The diagram is changed.	
Section 13.3.1 The sentences are changed.	
Section 13.4.1 (1) The diagram is changed.	
Section 13.4.2 (1) The diagram is changed.	
Feb. 2013 SH(NA)030107-E HG-JR, HG-UR, HG-RR servo motor, 11 kW to 22 kW servo amplifier, and M amplifier are added.	IR-J4A-RJ servo
Safety 4 (1) Two items are added to CAUTION.	
Safety Instructions 4 (2) The diagram in CAUTION is changed.	
COMPLIANCE WITH CE The reference is changed.	
MARKING	

Print Data	*Manual Number		Revision
Feb. 2013	SH(NA)030107-E	COMPLIANCE WITH	The reference is changed.
Feb. 2013	3H(NA)030107-E	UL/CSA STANDARD	The reference is changed.
		COMPLIANCE WITH KC	The reference is changed.
		MARK	
		Section 1.1	The sentences and table of combination are added.
		Section 1.2	POINT is added.
		Section 1.2 (1)	CN2L connector, Note 5 and 6 are added.
		Section 1.2 (2)	CN2L connector, Note 3 and 4 are added.
		Section 1.2 (3)	11 kW to 22 kW and Note 5 are added.
		Section 1.3	Note 3 is changed. Note 10 and 11 kW to 22 kW are added. A part
		Section 1.4	of specifications is added and changed. POINT is added. The table of combination is changed.
		Section 1.5	Function item is added.
		Section 1.6 (2)	Table is changed and added.
		Section 1.7.1 (1)	Table item (17), (18), and Note are added. The diagram is changed.
		Section 1.7.1 (1) to (4)	The diagram is changed.
		Section 1.7.1 (5), (6)	11 kW to 22 kW are added.
		Section 1.7.2	The sentences are added.
		Section 1.8 (1) to (4)	CN2L connector and Note 4 are added.
		Section 1.8 (5), (4)	11 kW to 22 kW are added.
		Chapter 2	Two items are added to CAUTION.
		Section 2.1 (1) (a), (b)	Note 1 and 2 are added.
		Section 2.4 (1) to (6)	Note 5 is added.
		Chapter 3	The diagram of CAUTION is changed. POINT is added.
		Section 3.1	CAUTION is added.
		Section 3.1 (1) to (4)	The connection diagram is changed. Note 11 is added.
		Section 3.1 (5)	Newly added.
		Section 3.2.1 (1)	The connection diagram is changed. Note 3 and 4 are changed.
		Section 3.2.1 (2) Section 3.2.2 (1)	The connection diagram is changed. The connection diagram is changed. Note 3 and 4 are changed.
		Section 3.2.2 (1)	The connection diagram is changed. Note 3 and 4 are changed.
		Section 3.2.3 (1)	The connection diagram is changed. Note 3 and 4 are changed.
		Section 3.2.3 (2)	The connection diagram is changed.
		Section 3.3.1	The table is changed.
		Section 3.3.2	POINT is added.
		Section 3.3.2 (2)	Note is added.
		Section 3.4	Note 1, 2, and CN2L are added.
		Section 3.5 (1) (a)	The content is added. The sentences are added.
		Section 3.5 (1) (b)	The item is added.
		Section 3.6.1 (5)	The connection diagram is changed.
		Section 3.6.2 (1)	The connection diagram is changed.
		Section 3.6.3 (1), (3) Section 3.6.4 (3) (a)	The connection diagram is changed. The connection diagram is changed.
		Section 3.6.5 (4) (a)	The connection diagram is changed. The connection diagram is changed.
		Section 3.6.6 (1)	Note is added.
		Section 3.7.3	The content is added.
		Section 3.9.1	Note 4 and 5 are added. The connection diagram is changed.
		Section 3.10.1 (1)	The connection diagram is changed.
		Section 3.10.2 (1) (b)	The content is changed.
		Section 4.1.2 (1) (b) 5)	Newly added.
		Section 4.1.2 (1) (c)	4) is added.
		Section 4.5.1	The explanation is added.
		Section 4.5.2	The display content is added.
		Section 4.5.3 (1)	The display content is added.
		Section 4.5.3 (3)	The display content is added.
		Section 4.5.4	Note is added.
		Section 4.5.6 Section 4.5.9 (2) (b)	The display content is added. The sentences are changed.
		Section 4.5.9 (2) (b)	The sentences are changed. The sentences are changed.
		Section 4.5.9 (3) (a) d)	The sentences are changed. The sentences are changed.
		Section 4.5.9 (4)	The sentences are changed.
		Chapter 5	CAUTION is added. POINT is added.

Print Data	*Manual Number		Revision
Feb. 2013	SH(NA)030107-E	Section 5.1.1	[Pr. PA17], [Pr. PA18], and [Pr. PA26] are added. [Pr. PA27] is
			changed. The operation mode is added.
		Section 5.1.3	[Pr. PC44] and [Pr. PC45] are added. The operation mode is added.
		Section 5.1.1 to 5.1.6	The operation mode is added.
		Section 5.1.6	The name of [Pr. PF25] is changed.
		Section 5.2.1	The content of [Pr. PA01] is added. The sentences of [Pr. PA05] are
			added. [Pr. PA02], [Pr. PA13] and [Pr. PA19] are changed. The
			name of [Pr. PA20] is changed.
		Section 5.2.2	The sentences of [Pr. PB17] is changed.
		Section 5.2.3	The setting of [Pr. PC19] is changed. The sentences of [Pr. PC20] is
			changed. The explanation of [Pr. PC22] is changed. The sentences of [Pr. PC35], [Pr. PC43], and [Pr. PC60] are added. [Pr. PC36] and
			[Pr. PC27] are changed. [Pr. PC44] and [Pr. PC45] are added. The
			contents of Note 3 and 4 are added.
		Section 5.2.4	The content of [Pr. PD01] is added. [Pr. PD03], Note 3, and content
		Section 5.2.4	are added. The content of [Pr. PD23] is added. The content of [Pr.
			PD30] is changed.
		Section 5.2.5	[Pr. PE01], [PR. PE03] to [Pr.PE08], [Pr. PE10], [Pr. PE34], [Pr.
			PE35], and [Pr. PE39] are added.
		Section 5.2.6	The name of [Pr. PF25] is changed.
		Section 5.2.7	Newly added.
		Section 6.2.2	The display of MR Configurator2 is changed.
		Section 6.2.2 (1) (b)	POINT is added.
		Section 6.2.2 (1) (d)	The table is changed.
		Section 6.2.2 (1) (e)	The sentences are added.
		Section 6.2.2 (2)	POINT is added.
		Section 6.2.2 (2) (b)	POINT is added.
		Section 6.3.1 (1)	The content of POINT is changed.
		Section 6.3.4	The table is changed.
		Section 7.1.5 (4)	The content of POINT is changed.
		Section 7.3.2	CAUTION is deleted.
		Section 7.4	Newly added.
		Chapter 8	The operation mode is added. [AL. 93] and [AL. 96.4] are added.
		Section 8.1	The name of [AL. F0.1] is changed.
		Section 9.1	POINT is added.
		Section 9.1 (1) to (7)	The connection diagram is changed.
		Section 9.1 (8), (9)	Newly added.
		Chapter 10	POINT is added.
		Section 10.1	The table is added. The graph is changed and added. Note 3 is added.
		Section 10.2 (1)	Note 3 and content are added to the table. Partially changed.
		Section 10.3.1 (1)	The appended sentence is added.
		Section 10.3.1 (2)	The content is added.
		Section 10.3.2	Note 2 and content are added to the table.
		Section 10.5	The sentences are added. The content of the table is added.
		Chapter 11	POINT is added.
		Section 11.1.1	The diagram is changed and added.
		Section 11.2.1	The content of the table is added. Note 2 is added.
		Section 11.2.2 (1) (b)	The content of the table is added.
		Section 11.2.3	[Pr. PA02] is changed.
		Section 11.2.4 (3), (4)	Newly added.
	2	Section 11.2.5 (5), (6)	Newly added.
Aug. 2013	SH(NA)030107-F	Safety Instructions 4 (1)	A sentence is changed. An item is deleted.
		Section 1.1	Table 1.1 is changed.
		Section 1.6 (1)	The content is changed.
		Section 1.7.1	The content of the table is changed. Note 2 is added.
		Chapter 2	A sentence is changed. An item is deleted.
		Section 3.1 (1) to (5)	Note 1 is changed.
		Section 3.4	Note 2 is changed. The conteness are added to Function and application of forward
		Section 3.5 (2)	The sentences are added to Function and application of forward
			rotation pulse train/reverse rotation pulse train.

Print Data	*Manual Number		Revision
Aug. 2013	SH(NA)030107-F	Section 3.9.1	Note 6 is added.
· ingi = c · c		Section 5.1.3	Analog torque/thrust limit maximum output of [Pr. PC13] is deleted.
		Section 5.2.1	The sentences are added to [Pr. PA13].
		Section 5.2.3	Analog torque/thrust limit maximum output of [Pr. PC13] is deleted.
		Section 5.2.6	[Pr. PF23] is partly added.
		Section 7.1.4 (4)	POINT is deleted. Table is added.
		Section 7.3.2	POINT is added.
		Section 7.4 (3)	Newly added.
		Section 9.1 (6) to (9)	A dimension is changed.
		Section 11.2.4 (3)	CAUTION is added.
		Section 11.3.3 (1) (a)	Note 3 is changed.
		Section 11.3.3 (1) (b)	Note 3 is changed.
		Section 11.3.3 (2) (a)	Note 3 is changed.
		Section 11.4	Note 4 is partly changed. POINT is added.
		Section 11.4 (2)	Model of Power factor improving reactor is deleted. Note 4 is
		0 " 44 5 (5) ()	changed. Note 10 is added.
		Section 11.5 (5) (a)	The sentences are changed.
		Section 11.7 (2) (a)	The content is added.
		Section 11.7.3	Newly added.
		Section 11.10 (1)	Table and Note 3 are changed.
		Section 11.17 (2)	Note 6 is added.
		Section 14.1.1 (2) (b)	Note 1 is partly added.
		Section 15.1.2 (1)	Note 6 is added.
		Section 15.1.2 (2)	The content is changed.
		Section 15.1.2 (3)	Newly added.
		Section 16.3.2	POINT is added.
		Section 17.1.3 (2) (a)	Note is added.
		Section 17.1.3 (2) (b)	The diagram is changed.
		App. 4.2.1 (1)	The title is changed.
		App. 4.2.3 (4)	The sentences are added.
		App. 4.3	CAUTION is added.
Oct. 2013	SH(NA)030107-G	400 V class is added.	
		Safety Instructions 4 (1)	One item is added.
		About the manuals	The content of the table is added.
		Section 1.2 (1)	The diagram is changed.
		Section 1.2 (2)	Newly added.
		Section 1.3 (2)	Newly added.
		Section 1.4 (2)	Newly added.
		Section 1.5	The content of the table is added.
		Section 1.6 (2)	A combination is added.
		Section 1.7.1 (1) (a)	The content of the table is changed.
		Section 1.7.1 (2)	Newly added.
		Section 1.8 (2)	Newly added.
		Section 3.1.2	Newly added.
		Section 3.3.1	The content of the 400 V class is added.
		Section 3.3.3 (1) (c)	Newly added.
		Section 3.3.3 (2) (a)	The content of the table is added.
		Section 3.10.2 (1) (a)	The content of the diagram is changed.
		Section 4.1	POINT is added.
		Section 4.1.2 (1) (c) 1) c)	The content is added.
		Section 4.1.2 (1) (c) 2)	Newly added.
		Section 4.1.2 (2) (c) 1) c)	The content is added.
		Section 5.2.1	A sentence is added to [Pr. PA01].
			[Pr. PA02] The content is changed.
			[Pr. PA17] The content is added.
			[Pr. PA20] The content is added.
	l	l	[i i. i Azu] The content is changed.

Print Data	*Manual Number		Revision
Oct. 2013	SH(NA)030107-G	Section 5.2.3	[Pr. PC14] The content is changed.
001. 2010	011(14/7)030107-0	Chapter 6	POINT is added.
		Section 6.2	POINT is added.
		Chapter 7	POINT is added.
		·	
		Section 7.1.1 (1)	The content of the table is changed.
		Section 7.1.3	POINT is added.
		Section 7.1.4 (1)	The sentences are added.
		Section 7.3.1 (2)	The content of the table is changed.
		Section 7.3.2 (1)	Note is added.
		Section 7.3.2 (2) (a), (d)	The sentences are changed and note is added.
		Chapter 8	The POINT is added. The content of the table is changed. Note 2 of
			alarm table is changed.
		0 4' 0 4 (0)	Note 2 of warning table is changed.
		Section 9.1 (2)	Newly added.
		Section 10.1	The table is newly added.
		Section 10.2 (1)	The content of the table is added.
		Section 10.3.1 (2) (b)	Newly added.
		Section 10.3.2 (2)	Newly added.
		Section 10.5	The content of the table is added. POINT is added.
		Section 11.1.1	The content of the table is added.
		Section 11.2.1 (2)	Newly added.
		Section 11.2.2 (1) (b)	The content of the table is added.
		Section 11.2.3	The content is added.
		Section 11.2.4	The content of POINT is changed.
		Section 11.2.4 (1) to (4)	The content is added.
		Section 11.2.5 (2), (3), (5)	The content is added.
		Section 11.2.5 (6)	Newly added.
		Section 11.2.5 (7)	The content is added.
		Section 11.3	POINT is added.
		Section 11.3.1	The content of the table is added. Note is added.
		Section 11.3.3 (1) (a) 2)	Newly added.
		Section 11.3.3 (1) (b)	POINT is added.
		Section 11.3.3 (2) (b)	Newly added.
		Section 11.3.3 (4)	The content of the table is added.
		Section 11.3.3 (5)	The content of the table is added.
		Section 11.3.4 (1) to (3)	The content is added.
		Section 11.4 (1)	The content of the table is added.
		Section 11.4 (2) (b)	Newly added.
		Section 11.4 (3), (4)	The content of the table is added.
		Section 11.5.1	The content is changed.
		Section 11.5.2 (2)	Newly added.
		Section 11.5.2 (3) (b)	Newly added.
		Section 11.5.2 (4) (a) 1), 2)	The content is added.
		Section 11.5.2 (4) (b) 2)	Newly added.
		Section 11.5.2 (6)	The content is added.
		Section 11.8	POINT is added.
		Section 11.9	The content of POINT is changed.
		Section 11.9 (1) (a)	Note 4 is changed.
		Section 11.9 (1) (b)	The content is added. The content of Note 4 is changed.
		Section 11.9 (2) (b)	Newly added.
		Section 11.10 (1), (2)	The content of the table is added. The content of Note 1 is changed.
		Section 11.11 (2)	Newly added.
		Section 11.12 (2)	Newly added.
		Section 11.14 (2) (e)	The content is added.
		Section 11.14 (2) (f)	The content is added.

Print Data	*Manual Number		Revision
Oct. 2013	SH(NA)030107-G	Section 11.15 (1)	The graph is added.
000. 2010	011(101)000101	Section 11.16	The sentences are added.
		Section 11.16 (1)	The content of the table is added.
		Section 11.16 (2) (b)	Newly added.
		Section 11.16 (3) (a)	The content is added.
		Section 11.17	POINT is added.
		Section 11.17 (1)	The content of the table is added.
		Section 11.17 (2) (b)	Newly added.
		Section 11.17 (4) (b)	Newly added.
		Section 11.18	The content of the table is added.
		Chapter 12	Note is added. POINT is added. The content is changed. The
			configuration is changed.
		Section 15.1.2 (1) to (3)	The sentences are added.
		Section 15.4.1	The sentences are added.
		Section 15.4.2	The content of the table is added.
		Section 15.4.3	The content of the table is added.
		Section 17.1.1	The diagram is changed.
		App. 4.2.3 (1)	The sentences are added.
		App. 4.2.3 (1) (a)	The content of the table is changed.
		App. 4.2.3 (1) (a) 2)	Newly added.
		App. 4.2.3 (1) (b) 2)	Newly added.
		App. 4.2.3 (4)	The sentences are changed.
		App. 4.3	Note 2 is added.
		App. 4.4 (1) (a)	Note is added.
		App. 4.4 (1) (b)	Newly added.
		App. 4.4 (2)	Note is added.
		App. 4.4 (3)	Note is added.
		App. 4.6.1 (1) (b)	Newly added.
		App. 4.6.2	The content of the table is added. The contents of Note 1 and Note 2
			are changed. Note 5 is added.
		App. 4.8.1 (2)	Newly added.
		App. 4.8.2	The content of the table is added.
		App. 4.8.2 (2)	Newly added.
		App. 4.8.3	The content of the table is added.
		App. 4.8.3 (2)	Newly added.
M-= 0044	011/NA\000407.11	App. 11 (2)	Note 7 is added.
Mar. 2014	SH(NA)030107-H	100 V class MR-J4 series se	
		Section 1.2 (3)	Newly added.
		Section 1.3 (1)	Note 11 is added.
		Section 1.3 (3)	Newly added. Newly added.
		Section 1.4 (3) Section 1.5	The content is added. Note is added.
		Section 1.6 (2)	The content is added. Note is added. The content is added.
		Section 1.7.1 (3)	Newly added.
		Section 1.8 (3)	Newly added.
		Chapter 2	POINT is changed.
		Section 3.1.3	Newly added.
		Section 3.3.1	The content is added.
		Section 3.3.3 (1) (d)	Newly added.
ĺ		Section 3.3.3 (1) (d)	The content is added.
		Section 3.7.1	The title is changed.
		Section 3.11	The content of the note is changed.
ĺ		Section 4.1.2 (1) (a) 2)	Newly added.
		Section 4.1.2 (1) (b) 5)	Deleted.
		Section 4.1.2 (1) (c) 3)	Newly added.
		Section 5.2.1	The content of [Pr. PA13] is added.
		Section 5.2.3	The content of [Pr. PC14] is added.
		Section 5.2.5	[Pr. PE39] is deleted.
		Section 7.1.1 (1)	Caution for the table is changed.
ĺ		Section 7.2.3 (1)	The title is changed.

Print Data	*Manual Number		Revision
Mar. 2014	SH(NA)030107-H	Section 7.3	The sentences are added.
-		Section 7.3.1 (2)	Caution for the table is changed.
		Section 7.4	POINT is changed. Sentences are added.
		Chapter 8	POINT is added.
		Section 9.1 (3)	Newly added.
		Section 10.2 (1)	The content of the table is added.
		Section 10.3.2	Sentences are added. (1) and (2) are combined. Note 1 and 2 are
			deleted.
		Section 10.5	POINT is added. (2) and (3) are added.
		Section 11.1.1	Use of 1) in the table is changed.
		Section 11.2.1 (3)	Newly added.
		Section 11.2.2 (1) (b)	The content of the table is added.
		Section 11.4 (2) (a)	The sentences are added to Note 4.
		Section 11.4 (2) (b)	The sentences are added to Note 4.
		Section 11.7.2 (1)	Note 1 is deleted.
		Section 11.9 (1) (c)	Newly added.
		Section 11.10 (1)	The content of the table is added.
		Section 11.12 (1)	Figure is added. The content of the table is added.
		Section 11.14 (2) (e)	The content is added.
		Section 11.14 (2) (f)	The content is added.
		Section 11.15 (1)	Note is added. The content is added to table 11.6.
		Section 11.16 (1)	The content of the table is added.
		Section 11.16 (2) (a)	The title and content of the Note 1 are changed.
		App. 1	The content of the table is added.
		App. 4.2.3 (1) (a)	The sentences are changed.
		App. 4.2.3 (1) (a) 1)	The title is changed. The content of the table is changed.
		App. 4.2.3 (1) (a) 2)	The content of the table is changed.
		App. 4.2.3 (1) (b)	The sentences are changed.
		App. 4.2.3 (1) (b) 1)	The title is changed. The content of the table is changed.
		App. 4.2.3 (1) (b) 3)	Newly added.
		App. 4.4 (2)	Note 1 and 2 are added.
		App. 4.6.1 (1) (a)	The title is changed. The content of the table is changed.
		App. 4.8.1 (1)	The title is changed. The content of the table is changed.
		App. 4.8.2 App. 4.8.3	The content of the table is changed. The content of the table is changed.
		App. 4.6.3 App. 10	Newly added.
Jan. 2015	SH(NA)030107-J	- ' '	disabled, lost motion compensation function, super trace control,
Jan. 2013	311(1 1 /A)030107-3	MR-BT6VCASE, and HG-JR servo motor are added.	
		Safety Instructions 2	The sentences are changed.
		Safety Instructions 4 (6)	The sentences are added.
		About the manuals	The content of the table is changed.
		Section 1.2	Note is added.
		Section 1.3	The content of the table is changed.
			Note is added.
		Section 1.4	The content of the table is changed.
		Section 1.5	The content of the table is changed.
		Section 1.6 (1)	The diagram is changed.
		Section 1.6 (2)	The content of the table is changed.
		Section 1.8	Note is added.
		Section 3.1	The sentences are added.
		Section 3.1.1 (5)	Note is added.
		Section 3.1.2	The diagram is changed.
			Note is added.
		Section 3.2	Note is changed.
		Section 3.4	The content of the table is changed.
		Section 3.5	The content of the table is changed.
		Section 3.9.1	The diagram is changed.
			Note is added.
		Section 3.10.1	CAUTION is added.
		Section 4.5.4	The content of the table is changed.

Print Data	*Manual Number		Revision
Jan. 2015	SH(NA)030107-J	Section 4.5.7	POINT is changed.
	, ,,,,,,,,,,	Section 4.5.7 (2)	The diagram is changed.
		, ,	Note is added.
		Section 4.5.7 (2) (a)	The content of the table is changed.
			Note is added.
		Section 4.5.8	The diagram is changed.
			Note is added.
		Section 5.1	POINT is added.
			The content of the table is changed.
		Section 5.2	The content of the table is changed.
		Section 7.2.3 (1) (a)	The sentences are added.
		Section 7.2.4 (3)	Newly added.
		Section 7.3.2	POINT is added.
		Section 7.4	POINT is added.
		Section 7.5 to 7.7	Newly added.
		Chapter 8	The content of the chapter is changed.
		Section 10.1	The sentences are changed.
			The content of the table is changed.
		Section 10.2 (1)	The content of the table is changed.
		Section 10.3.1 (2)	The diagram is changed.
		Section 10.3.2	The content of the table is changed.
		Section 11.1.1	The diagram is changed.
			The content of the table is changed.
		Section 11.1.3	Newly added.
		Section 11.2.4 (3)	CAUTION is changed.
		Section 11.3.3	The diagram is changed.
		Section 11.4 (2)	The diagram is changed.
		Section 11.5.2 (3)	The diagram is changed.
		Section 11.7.2 (1)	The content of the table is changed.
		Section 11.8	POINT is added.
		Section 11.8.1 (3)	Newly added.
		Section 11.8.3	Newly added.
		Section 11.10	CAUTION is added.
		Section 11.10 (1)	Note 4 is added.
		Section 11.17	CAUTION is added.
		Section 11.17 (2)	Note is added.
		Chapter 12	POINT is changed.
		Section 12.2.2 (2) (c)	Newly added.
		Section 12.2.3	Newly added.
		Section 13.3.3	The diagram is changed.
		Section 14.5.4 (4) (b)	Note is added.
		Section 14.5.9 (2)	Note is added.
		Section 15.1.2	The sentences are changed.
		Section 15.3.2	POINT is added.
		Section 15.4.2	The content of the table is changed.
		Section 16.1.2 Section 16.3.2	The sentences are changed. POINT is added.
		Section 16.3.2 Section 16.5.1	
			The content of the table is changed.
		Section 16.5.2	The content of the section is changed.
Apr 2015	CH(NIA)020407 V	App. 4	The content of the section is changed.
Apr. 2015	SH(NA)030107-K	MR-J4-03A6(-RJ) servo amp	
		Safety Instructions About the manuals	Partially changed.
		Section 1.2	Partially added.
		Section 1.3	Partially changed. Partially added and partially changed.
		Section 1.5	
			Partially added.
		Section 1.6 (2) Section 1.7	Partially changed.
			Partially added and partially changed.
		Section 1.8 Section 3.2.1	Partially changed. Partially changed.
		Section 3.2.2	Partially changed.

Print Data	*Manual Number	Revision	
Apr. 2015	SH(NA)030107-K	Section 3.2.3	Partially changed.
· .	,	Section 3.3.3	Partially changed.
		Section 3.4	Partially added and partially changed.
		Section 3.5	Partially added and partially changed.
		Section 3.6.1	POINT is partially changed.
		Section 3.6.1 (1)	Partially added and partially changed.
		Section 3.6.3 (3)	Partially added and partially changed.
		Section 3.7	POINT is partially added.
		Section 3.8.1	Partially added and partially changed.
		Section 3.9.1	Partially changed.
		Section 3.9.2	Partially added and partially changed.
		Section 3.9.3	Partially added and partially changed.
		Section 4.2.6	Partially changed.
		Section 4.3.6	Partially changed.
		Section 4.4.6	Partially changed.
		Section 4.5.3 (3)	Partially changed.
		Section 4.5.4	Partially changed.
ĺ		Section 4.5.7	Partially added and partially changed.
ĺ		Chapter 5	POINT is added.
ĺ		Section 5.1	POINT is added. POINT is partially added.
ĺ		Section 5.1.3	Pr. PC28 is added.
		Section 5.1.4	Pr. PD43 to Pr. PD46 are added.
		Section 5.2.1	Pr. PA01 to Pr. PA02 are partially added and partially changed.
		Section 5.2.1	Pr. PA06 to Pr. PA07 are partially added.
			• •
			Pr. PA12 to Pr. PA13 are partially changed. Pr. PA17 to Pr. PA21 are partially added.
			Pr. PA26 is partially added.
		Section 5.2.3	Pr. PC14 is partially added and partially changed.
		Section 3.2.3	Pr. PC14 is partially changed.
			Pr. PC19 to Pr. PC20 are partially changed.
			Pr. PC22 is partially added.
			Pr. PC27 is partially added and partially changed.
			Pr. PC28 is added.
			Pr. PC36 is partially added and partially changed.
			Pr. PC44 to Pr. PC45 are partially added.
			Pr. PC60 is partially added and partially changed.
		Section 5.2.4	Pr. PD01 is partially added.
		Section 3.2.4	Pr. PD03 to Pr. PD28 are partially added and partially changed.
			Pr. PD43 to Pr. PD46 are added.
			Pr. PD47 is partially added and partially changed.
ĺ		Section 5.2.5	Pr. PE01 is partially added.
ĺ		0000011 0.Z.J	Pr. PE03 to Pr. PE10 are partially added.
			Pr. PE34 to Pr. PE35 are partially added.
ĺ		Section 5.2.6	Pr. PF09 is partially added.
ĺ		0300011 0.Z.0	Pr. PF25 is partially added.
ĺ			Pr. PF34 is partially added.
ĺ		Section 5.2.7	POINT is added.
		0000011 0.2.7	Pr. PL17 is partially changed.
ĺ		Section 7.3.2	POINT is partially added.
ĺ		Section 7.4	POINT is partially added and partially changed.
		Section 8.2	Partially added.
ĺ		Section 8.3	Partially added.
ĺ		Section 9.1	POINT is partially changed.
		Section 9.1 (1) (a) to (e)	The dimensions are changed.
ĺ		Section 9.1 (1) (a) to (e)	The dimensions are changed. The dimensions are changed.
		Section 9.1 (2) (a) to (b)	The dimensions are changed. The dimensions are changed.
ĺ		Section 10.1	Partially changed.
		Section 10.3.1 (2)	Partially changed.
		Section 11.1.1	Partially changed.
ĺ		Section 11.3.2	Partially changed.
ĺ		Section 11.6 (4)	Partially added and partially changed.
	<u> </u>	Jection 11.0 (4)	r arriany added and partially changed.

Print Data	*Manual Number	Revision	
Apr. 2015	SH(NA)030107-K	Section 11.7	Partially changed.
7,01.2010	011(101)000101111	Section 11.8	The contents are entirely changed.
		Section 11.9 (1)	Partially changed.
		Section 11.12	Partially changed.
		Section 11.14 (2) (b)	Partially changed.
		Section 12.1	The contents are entirely changed.
		Section 12.2	The contents are entirely changed.
		Chapter 13	POINT is partially added.
		Section 13.3.3	Partially changed.
		Chapter 14	The title is changed.
		·	Partially changed.
		Section 14.3.3	Partially changed.
		Section 14.4.1	Partially added.
		Section 14.4.2	Partially added.
		Section 14.5.2	Partially changed.
		Section 14.5.3	Partially changed.
		Section 14.5.4	Partially added and partially changed.
		Section 14.5.5	Partially added.
		Section 14.5.7	Partially added.
		Section 14.5.9	Partially changed.
		Section 14.5.10	Partially changed.
		Section 14.5.11	Partially changed.
		Section 14.5.12	Partially changed.
		Chapter 15	POINT is partially added.
		Section 15.1.1	Partially changed.
		Section 15.1.2	Partially changed.
		Chapter 16	POINT is partially added.
		Section 16.1.1	Partially changed.
		Section 16.1.2	Partially changed.
		Section 16.5.1	Partially changed.
		Chapter 17	Partially added.
		Section 17.3.1	Partially changed.
		Section 17.3.2	Partially changed.
		Section 17.3.6	Partially changed.
		Section 17.3.7	Partially changed.
		Chapter 18	Newly added as MR-J4-03A6 servo amplifier.
		App. 4	The contents are entirely changed.
		App. 7	Partially added and partially changed.
		App. 11	Newly added.
Sep. 2015	SH(NA)030107-L		DA(-RJ) are compatible with a 1-phase 200 V AC input, the contents of
			nged, and operable environment is changed to maximum altitude of
		2000 m above sea level.	
		Safety Instructions	Partially changed.
		«About the manual»	Partially added and partially changed.
		Chapter 1	POINT is partially changed.
		Section 1.3	Partially added and partially changed.
		Section 1.4	POINT is added.
		Section 1.5 Section 1.6 (2)	Partially added and partially changed.
		Section 1.7	Partially added.
		Section 1.7 Section 1.8 (1)	Partially changed. Partially changed.
		Section 1.6 (1)	Partially changed.
		Section 2.6	Newly added.
		Chapter 3	CAUTION is partially changed.
		Section 3.1	POINT is partially changed.
		Section 3.1.1 (2)	Partially changed.
		Section 3.2.1	Partially changed.
		Section 3.2.1	Partially changed.
		Section 3.2.3	Partially changed.
		Section 3.3.1	Partially changed.
		0000011 0.0.1	i artiary orlanged.

Print Data	*Manual Number		Revision
Sep. 2015	SH(NA)030107-L	Section 3.4	POINT is partially added.
	, ,		Partially added and partially changed.
		Section 3.5	Partially added and partially changed.
		Section 3.6.1	Partially added and partially changed.
		Section 3.9.1	Partially changed.
		Section 3.9.2	Partially changed.
		Section 3.9.3	Partially added and partially changed.
		Section 4.5.3	Partially changed.
		Section 4.5.7	Partially added and partially changed.
		Chapter 5	POINT is partially changed.
		Section 5.1	POINT is partially changed.
		Section 5.1.2	Partially changed.
		Section 5.1.6	[Pr. PF18] is added.
		Section 5.1.8	Newly added.
		Section 5.2.1	Partially added and partially changed.
		Section 5.2.2	Partially added and partially changed.
		Section 5.2.3	Partially changed.
		Section 5.2.4	Partially added and partially changed.
		Section 5.2.5	Partially changed.
		Section 5.2.6	[Pr. PF18] is added.
			Partially added and partially changed.
		Section 5.2.7	POINT is partially changed.
		0	Partially changed.
		Section 5.2.8	Newly added.
		Section 6.2	The contents are entirely changed.
		Section 6.3.1	Partially changed.
		Section 6.4 Section 6.5	Partially changed.
		Section 7.1.1	Partially changed. Partially changed.
		Section 7.1.5	Partially changed.
		Section 7.2.3	Partially added.
		Section 7.3.2	POINT is partially added and partially changed.
		Section 7.4	POINT is partially changed.
		Chapter 8	Partially changed.
		Section 8.1	Partially added.
		Section 8.2	Partially added and partially changed.
		Section 8.3	Partially changed.
		Section 9.1	POINT is partially changed.
		Section 10.2	Partially changed.
		Section 10.5	Partially changed.
		Section 11.1.1	Partially changed.
		Section 11.2.2	Partially changed.
		Section 11.2.3	Partially changed.
		Section 11.3.3	Partially changed.
		Section 11.4	Partially changed.
		Section 11.5.2	Partially added and partially changed.
		Section 11.6	Partially changed.
		Section 11.7	Partially changed.
		Section 11.7.2	Partially changed.
		Section 11.8.3	POINT is partially changed.
		Section 11.8.4	POINT is partially changed.
		Section 11.8.5	POINT is partially changed.
		Section 11.9	Partially changed.
		Section 11.10	Partially added and partially changed.
		Section 11.11	Partially ended and partially changed
		Section 11.12	Partially added and partially changed.
		Section 11.14 Section 11.15	Partially changed
		Section 11.16	Partially changed.
			Partially changed
	l	Section 12.2.3	Partially changed.

Print Data	*Manual Number		Revision
Sep. 2015	SH(NA)030107-L	Section 12.3	Partially changed.
334. 23.3	(,	Chapter 13	POINT is partially changed.
		Section 13.1.1	Partially changed.
		Section 13.1.5	Partially added and partially changed.
		Section 13.3.1	Partially added.
		Section 13.3.2	Partially changed.
		Section 13.3.3	Partially changed.
		Chapter 14	The title is changed.
		Section 14.1.1	Partially changed.
		Section 14.3	Partially changed.
		Section 14.4	Partially changed.
		Section 14.5	Partially changed.
		Chapter 15	POINT is partially changed.
		Section 15.1.1	Partially changed.
		Section 15.1.2	Partially changed.
		Section 15.3.3	Partially added.
		Chapter 16	POINT is partially changed.
		Section 16.1.2	Partially changed.
		Chapter 17	POINT is partially changed.
		Section 17.1.2	Partially changed.
		Chapter 18	The title is changed.
		Section 18.1.1	Partially changed.
		Section 18.1.3	Partially changed.
		Section 18.1.4	Partially changed.
		Section 18.1.5	Partially changed.
		Section 18.1.6	Partially added.
		Section 18.2.1	Partially changed.
		Section 18.3.1	Partially added and partially changed.
		Section 18.3.2	Partially changed.
		Section 18.3.5	Partially changed.
		Section 18.3.6	Partially added and partially changed.
		Section 18.3.7	Partially changed.
		Section 18.3.9	Partially changed.
		Section 18.4.1	Partially changed.
		Section 18.5.1	
		Section 18.5.4	Partially changed.
			Partially changed. Partially added and partially changed.
		Section 18.5.8 Section 18.7.3	, , ,
			Partially changed.
		Section 18.7.4	Partially changed.
		Section 18.8.3	Partially changed.
		Section 18.9	The title is changed.
		Chapter 19	Newly added.
		App. 1	Partially added and partially changed.
		App. 2	The contents are entirely changed.
		App. 4	The contents are entirely changed.
		App. 5	Partially changed.
		App. 8	Partially changed.
F 1 2212	011/11/1000 (0= ::	App. 11	Partially added.
Feb. 2016	SH(NA)030107-M	I	nce with safety integrity level 3 (SIL 3) of the IEC 61508:2010
		functional safety standard is a	
		STO function of the servo	Partially added.
		amplifier	ON TOWN
		Chapter 14	CAUTION is added.
		Section 18.3.6	Partially changed.
		App. 6	Partially added.
		App. 12	Newly added.
May 2016	SH(NA)030107-N		ed, and the DC power supply input is added.
		3. To prevent injury, note the	Partially changed.
		following	
		4. Additional instructions	

Print Data	*Manual Number		Revision
May 2016	SH(NA)030107-N	(2)Wiring	Partially added.
	, ,	(5)Corrective actions	Partially added.
		(6)Maintenance, inspection	Partially added and partially changed.
		and parts replacement	
		About the manuals	Partially added.
		Section 1.3 (1)	Partially added and partially changed.
		Section 1.5	Partially added and partially changed.
		Section 1.7	Partially changed.
		Section 1.8	Partially added.
		Section 2.4	Partially added.
		Section 3.1	Partially added and partially changed.
		Section 3.3.1	Partially added.
		Section 3.3.3	Partially added.
		Section 3.5 (1) (b)	Partially changed.
		Chapter 4	Partially changed.
		Section 5.1.2	Partially changed.
		Section 5.1.3	Partially changed.
		Section 5.2.1	[Pr. PA25] is partially changed.
		Section 5.2.2	[Pr. PB01] is partially added.
		Section 5.2.3	[Pr. PC03], [Pr. PC18], [Pr. PC26] and [Pr. PC27] are partially
			changed.
		Section 5.2.5	Partially added and partially changed.
		Section 6.2.2 (1) (c)	POINT is partially changed.
		Section 7.1.2	Partially added and the diagrams are partially changed.
		Section 7.2.3 (1) (b)	Partially changed.
		Section 7.3.2	POINT is added.
		Section 7.6	Partially changed.
		Chapter 8	Partially added and partially changed.
		Section 10.5	POINT is changed.
		Section 11.1.1	Partially added.
		Section 11.2.2	Partially changed.
		Section 11.3.3	Partially changed.
		Section 11.4	Partially changed. The diagrams are partially changed.
		Section 11.5.2 Section 11.8.3	The diagrams are partially changed.
		Section 11.8.6	Partially changed. Partially changed.
		Section 11.9	Partially changed.
		Section 11.10	POINT is added.
		Section 11.14	Partially changed.
		Section 11.16	The contents are entirely changed.
		Section 13.1.5	Partially changed.
		Section 13.3.2	The diagram is partially changed.
		Section 14.5.3	Partially changed.
		Section 18.4	Partially changed.
		Chapter 19	Partially added and partially changed.
		Section 19.3	Partially changed.
		Section 19.5	Partially changed.
		Section 19.8.1	Partially changed.
		App. 4	The contents are entirely changed.
		App. 5.7.3 (2)	The diagram is partially changed.
		App. 13	Newly added.

This manual confers no industrial property rights or any rights of any other kind, nor does it confer any patent licenses. Mitsubishi Electric Corporation cannot be held responsible for any problems involving industrial property rights which may occur as a result of using the contents noted in this manual.

Country/Region USA	Sales office Mitsubishi Electric Automation, Inc. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A.	Tel/Fax Tel : +1-847-478-2100 Fax : +1-847-478-2253
Mexico	Mitsubishi Electric Automation, Inc. Mexico Branch Mariano Escobedo #69, Col. Zona Industrial, Tlalnepantla Edo. Mexico, C.P.54030	Tel: +52-55-3067-7500 Fax: -
Brazil	Mitsubishi Electric do Brasil Comercio e Servicos Ltda. Avenida Adelino Cardana, 293, 21 andar, Bethaville, CEP 06401-147, Barueri SP, Brazil	Tel: +55-11-4689-3000 Fax: +55-11-4689-3016
Germany	Mitsubishi Electric Europe B.V. German Branch Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany	Tel: +49-2102-486-0 Fax: +49-2102-486-1120
UK	Mitsubishi Electric Europe B.V. UK Branch Travellers Lane, UK-Hatfield, Hertfordshire, AL10 8XB, U.K.	Tel: +44-1707-28-8780 Fax: +44-1707-27-8695
Italy	Mitsubishi Electric Europe B.V. Italian Branch Centro Direzionale Colleoni - Palazzo Sirio, Viale Colleoni 7, 20864 Agrate Brianza (Milano), Italy	Tel: +39-039-60531 Fax: +39-039-6053-312
Spain	Mitsubishi Electric Europe B.V. Spanish Branch Carretera de Rubi, 76-80-Apdo. 420, 08190 Sant Cugat del Valles (Barcelona), Spain	Tel: +34-935-65-3131 Fax: +34-935-89-1579
France	Mitsubishi Electric Europe B.V. French Branch 25, Boulevard des Bouvets, 92741 Nanterre Cedex, France	Tel: +33-1-55-68-55-68 Fax: +33-1-55-68-57-57
Czech Republic	Mitsubishi Electric Europe B.V. Czech Branch Avenir Business Park, Radlicka 751/113e, 158 00 Praha 5, Czech Republic	Tel: +420-251-551-470 Fax: +420-251-551-471
Poland	Mitsubishi Electric Europe B.V. Polish Branch ul. Krakowska 50, 32-083 Balice, Poland	Tel: +48-12-347-65-00 Fax: +48-12-630-47-01
Russia	Mitsubishi Electric (Russia) LLC St. Petersburg Branch Piskarevsky pr. 2, bld 2, lit "Sch", BC "Benua", office 720; 195027 St. Petersburg, Russia	Tel:+7-812-633-3497 Fax:+7-812-633-3499
Sweden	Mitsubishi Electric Europe B.V. (Scandinavia) Fjelievagen 8, SE-22736 Lund, Sweden	Tel: +46-8-625-10-00 Fax: +46-46-39-70-18
Turkey	Mitsubishi Electric Turkey A.S. Umraniye Branch Serifali Mahallesi Nutuk Sokak No:5, TR-34775 Umraniye / Istanbul, Turkey	Tel: +90-216-526-3990 Fax: +90-216-526-3995
UAE	Mitsubishi Electric Europe B.V. Dubai Branch Dubai Silicon Oasis, P.O.BOX 341241, Dubai, U.A.E.	Tel: +971-4-3724716 Fax: +971-4-3724721
South Africa	Adroit Technologies 20 Waterford Office Park, 189 Witkoppen Road, Fourways, South Africa	Tel: +27-11-658-8100 Fax: +27-11-658-8101
China	Mitsubishi Electric Automation (China) Ltd. Mitsubishi Electric Automation Center, No.1386 Hongqiao Road, Shanghai, China	Tel: +86-21-2322-3030 Fax: +86-21-2322-3000
Taiwan	SETSUYO ENTERPRISE CO., LTD. 6F, No.105, Wugong 3rd Road, Wugu District, New Taipei City 24889, Taiwan	Tel: +886-2-2299-2499 Fax: +886-2-2299-2509
Korea	Mitsubishi Electric Automation Korea Co., Ltd. 7F-9F, Gangseo Hangang Xi-tower A, 401, Yangcheon-ro, Gangseo-Gu, Seoul 07528, Korea	Tel: +82-2-3660-9510 Fax: +82-2-3664-8372/8335
Singapore	Mitsubishi Electric Asia Pte. Ltd. 307 Alexandra Road, Mitsubishi Electric Building, Singapore 159943	Tel: +65-6473-2308 Fax: +65-6476-7439
Thailand	Mitsubishi Electric Factory Automation (Thailand) Co., Ltd. 12th Floor, SV.City Building, Office Tower 1, No. 896/19 and 20 Rama 3 Road, Kwaeng Bangpongpang, Khet Yannawa, Bangkok 10120, Thailand	Tel: +66-2682-6522 to 6531 Fax: +66-2682-6020
Indonesia	PT. Mitsubishi Electric Indonesia Gedung Jaya 11th Floor, JL. MH. Thamrin No.12, Jakarta Pusat 10340, Indonesia	Tel: +62-21-3192-6461 Fax: +62-21-3192-3942
Vietnam	Mitsubishi Electric Vietnam Company Limited Unit 01-04, 10th Floor, Vincom Center, 72 Le Thanh Ton Street, District 1, Ho Chi Minh City, Vietnam	Tel: +84-8-3910-5945 Fax: +84-8-3910-5947
India	Mitsubishi Electric India Pvt. Ltd. Pune Branch Emerald House, EL-3, J Block, M.I.D.C., Bhosari, Pune - 411026, Maharashtra, Indi	Tel : +91-20-2710-2000 iaFax : +91-20-2710-2100
Australia	Mitsubishi Electric Australia Pty. Ltd. 348 Victoria Road, P.O. Box 11, Rydalmere, N.S.W 2116, Australia	Tel: +61-2-9684-7777 Fax: +61-2-9684-7245

MELSERVO is a trademark or registered trademark of Mitsubishi Electric Corporation in Japan and/or other countries.

Microsoft, Windows, Internet Explorer, and Windows Vista are registered trademarks or trademarks of Microsoft Corporation in the United States, Japan, and/or other countries.

Intel, Pentium, and Celeron are trademarks of Intel Corporation in the United States and/or other countries.

Modbus is registered trademark of SCHNEIDER ELECTRIC USA, INC.

Ethernet is a trademark of Xerox Corporation.

All other product names and company names are trademarks or registered trademarks of their respective companies.

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 are repaired or replaced.

[Term]

The term of warranty for Product is twelve (12) months after your purchase or delivery of the Product to a place designated by you or eighteen (18) months from the date of manufacture whichever comes first ("Warranty Period"). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[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;
 - a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
 - (ii) a failure caused by any alteration, etc. to the Product made on your side without our approval
 - (iii) 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
 - (iv) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
 - (v) any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
 - (vi) 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
 - (vii) 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
 - (viii) 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 General-Purpose AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in General-Purpose AC Servo, and a backup or fail-safe function should operate on an external system to General-Purpose AC Servo when any failure or malfunction occurs.
- (2) Our General-Purpose 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.

MODEL	MR-J4-A INSTRUCTIONMANUAL
MODEL CODE	1CW804

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BLDG MARUNOUCHI TOKYO 100-8310