MITSUBISHI
ELECTRIC

General-Purpose AC Servo

MELSERVO-J3 Series

Built-in Positioning Function

MODEL

MR-J3-□T
MR-J3-D01

SERVO AMPLIFIER
INSTRUCTION MANUAL
(General-Purpose Interface)

E

● Safety Instructions ●

(Always read these instructions before using the equipment.)

Do not attempt to install, operate, maintain or inspect the servo amplifier and servo motor until you have read through this Instruction Manual, Installation guide, Servo motor Instruction Manual and appended documents carefully and can use the equipment correctly. Do not use the servo amplifier and servo motor until you have a full knowledge of the equipment, safety information and instructions.

In this Instruction Manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠ WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight injury to personnel or may cause physical damage.

Note that the CAUTION level may lead to a serious consequence according to conditions. Please follow the instructions of both levels because they are important to personnel safety.

What must not be done and what must be done are indicated by the following diagrammatic symbols:

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

: Indicates what must be done. For example, grounding is indicated by .

In this Instruction Manual, instructions at a lower level than the above, instructions for other functions, and so on are classified into "POINT".

After reading this installation guide, always keep it accessible to the operator.

1. To prevent electric shock, note the following:

⚠ WARNING

- Before wiring 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, always confirm from the front of the servo amplifier, whether the charge lamp is off or not.
- Connect the servo amplifier and servo motor to ground.
- 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, you may get an electric shock.
- Operate the switches with dry hand to prevent an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, you may get an electric shock.
- During power-on or operation, do not open the front cover of the servo amplifier. You may get 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 or periodic inspection, do not remove the front cover even of the servo amplifier if the power is off. The servo amplifier is charged and you may get an electric shock.

2. To prevent fire, note the following:

⚠ CAUTION

- Install the servo amplifier, servo motor and regenerative resistor on incombustible material. Installing them directly or close to combustibles will lead to a fire.
- Always connect a magnetic contactor (MC) between the main circuit power supply and L_1, L_2, and L_3 of the servo amplifier, and configure the wiring to be able to shut down the power supply on the side of the servo amplifier’s power supply. If a magnetic contactor (MC) is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.
- When a regenerative resistor is used, use an alarm signal to switch main power off. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

3. To prevent injury, note the follow

⚠ CAUTION

- Only the voltage specified in the Instruction Manual should be applied to each terminal, Otherwise, a burst, damage, etc. may occur.
- Connect the terminals correctly to prevent a burst, damage, etc.
- Ensure that polarity (+, −) is correct. Otherwise, a burst, damage, etc. may occur.
- Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with the servo amplifier heat sink, regenerative resistor, servo motor, etc. since they may be hot while power is on or for some time after power-off. Their temperatures may be high and you may get burnt or a parts may damaged.
- During operation, never touch the rotating parts of the servo motor. Doing so can cause injury.

4. Additional instructions

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

(1) Transportation and installation

⚠ CAUTION

- Transport the products correctly according to their weights.
- Stacking in excess of the specified number of products is not allowed.
- Do not carry the servo motor by the cables, shaft or encoder.
- Do not hold the front cover to transport the servo amplifier. The servo amplifier may drop.
- Install the servo amplifier in a load-bearing place in accordance with the Instruction Manual.
- Do not climb or stand on servo equipment. Do not put heavy objects on equipment.
- The servo amplifier and servo motor must be installed in the specified direction.
- Leave specified clearances between the servo amplifier and control enclosure walls or other equipment.
- Do not install or operate the servo amplifier and servo motor which has been damaged or has any parts missing.
- Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier and servo motor.
- Do not drop or strike servo amplifier or servo motor. Isolate from all impact loads.
- When you keep or use it, please fulfill the following environmental conditions.

<table>
<tr><th colspan="3" rowspan="2">Environment</th><th colspan="4">Conditions</th></tr>
<tr><th>Servo amplifier</th><th colspan="3">Servo motor</th></tr>
<tr><td rowspan="4">Ambient temperature</td><td rowspan="2">In operation</td><td>[°C]</td><td>0 to +55 (non-freezing)</td><td colspan="3">0 to +40 (non-freezing)</td></tr>
<tr><td>[°F]</td><td>32 to 131 (non-freezing)</td><td colspan="3">32 to 104 (non-freezing)</td></tr>
<tr><td rowspan="2">In storage</td><td>[°C]</td><td>−20 to +65 (non-freezing)</td><td colspan="3">−15 to +70 (non-freezing)</td></tr>
<tr><td>[°F]</td><td>−4 to 149 (non-freezing)</td><td colspan="3">5 to 158 (non-freezing)</td></tr>
<tr><td rowspan="2">Ambient humidity</td><td colspan="2">In operation</td><td>90%RH or less (non-condensing)</td><td colspan="3">80%RH or less (non-condensing)</td></tr>
<tr><td colspan="2">In storage</td><td colspan="4">90%RH or less (non-condensing)</td></tr>
<tr><td colspan="3">Ambience</td><td colspan="4">Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt</td></tr>
<tr><td colspan="3">Altitude</td><td colspan="4">Max. 1000m (3280 ft) above sea level</td></tr>
<tr><td rowspan="8">(Note) Vibration</td><td colspan="2" rowspan="8">[m/s²]</td><td rowspan="8">5.9 or less</td><td>HF-MP series</td><td>HF-KP series</td><td>X・Y: 49</td></tr>
<tr><td>HF-SP51・81
HF-SP524 to 1524
HC-UP72・152</td><td>HF-SP52 to 152
HC-RP Series</td><td>X・Y: 24.5</td></tr>
<tr><td>HF-SP121・201
HF-SP2024・3524</td><td>HF-SP202・352
HC-UP202 to 502</td><td>X: 24.5 Y: 49</td></tr>
<tr><td>HF-SP301・421
HF-SP5024・7024</td><td>HF-SP502・702</td><td>X: 24.5 Y: 29.4</td></tr>
<tr><td colspan="2">HC-LP52 to 152</td><td>X: 9.8 Y: 24.5</td></tr>
<tr><td colspan="2">HC-LP202 to 302</td><td>X: 19.6 Y: 49</td></tr>
<tr><td>HA-LP601 to 12K1
HA-LP502 to 22K2
HA-LP701M4 to 15K1M4</td><td>HA-LP701M to 15K1M
HA-LP6014 to 12K14
HA-LP11K24 to 22K24</td><td>X: 11.7 Y: 29.4</td></tr>
<tr><td>HA-LP15K1 to 25K1
HA-LP15K14 to 20K14</td><td>HA-LP37K1M
HA-LP22K1M4</td><td>X・Y: 9.8</td></tr>
</table>

Note. Except the servo motor with reduction gear.

- Securely attach the servo motor to the machine. If attach insecurely, the servo motor may come off during operation.
- The servo motor with reduction gear must be installed in the specified direction to prevent oil leakage.
- Take safety measures, e.g. provide covers, to prevent accidental access to the rotating parts of the servo motor during operation.

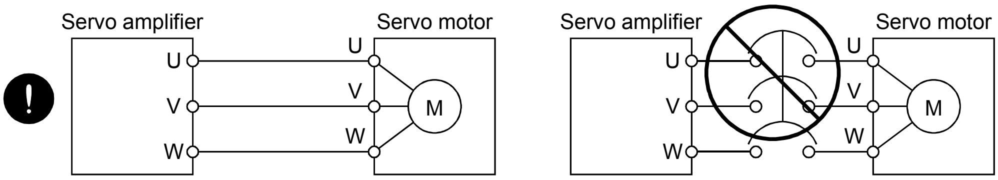
⚠ CAUTION

- Never hit the servo motor or shaft, especially when coupling the servo motor to the machine. The encoder may become faulty.
- Do not subject the servo motor shaft to more than the permissible load. Otherwise, the shaft may break.
- When the equipment has been stored for an extended period of time, consult Mitsubishi.

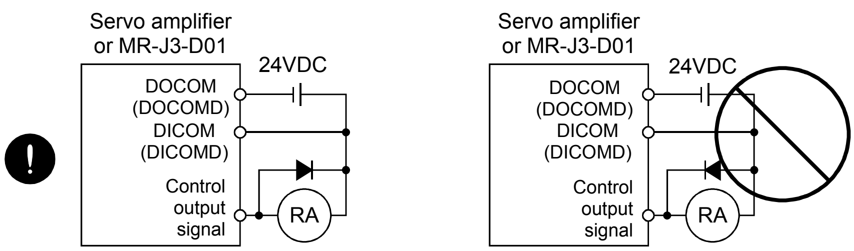
(2) Wiring

⚠ CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly.
- Do not install a power capacitor, surge absorber or radio noise filter (FR-BIF-(H) option) between the servo motor and servo amplifier.
- Connect the wires to the correct phase terminals (U, V, W) of the servo amplifier and servo motor. Otherwise, the servo motor does not operate properly.
- Connect the servo motor power terminal (U, V, W) to the servo motor power input terminal (U, V, W) directly. Do not let a magnetic contactor, etc. intervene.



- Do not connect AC power directly to the servo motor. Otherwise, a fault may occur.
- The surge absorbing diode installed on the DC output signal relay of the servo amplifier must be wired in the specified direction. Otherwise, the forced stop (EMG) and other protective circuits may not operate.



- When the cable is not tightened enough to the terminal block (connector), the cable or terminal block (connector) may generate heat because of the poor contact. Be sure to tighten the cable with specified torque.

(3) Test run adjustment

⚠ CAUTION

- Before operation, check the parameter settings. Improper settings may cause some machines to perform unexpected operation.
- The parameter settings must not be changed excessively. Operation will be insatiable.
- Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately.

(4) Usage

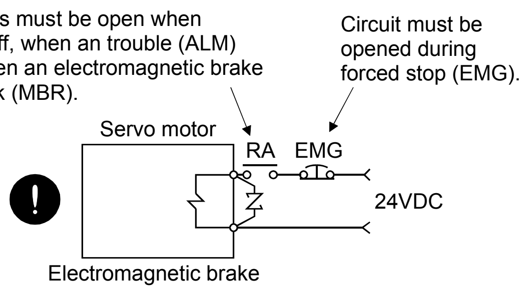
⚠ CAUTION

- Any person who is involved in disassembly and repair should be fully competent to do the work.
- Before resetting an alarm, make sure that the run signal of the servo amplifier is off to prevent an accident. A sudden restart is made if an alarm is reset with the run signal on.
- Do not modify the equipment.
- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be caused by electronic equipment used near the servo amplifier.
- Burning or breaking a servo amplifier may cause a toxic gas. Do not burn or break a servo amplifier.
- 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

- When it is assumed that a hazardous condition may take place at the occur due to a power failure or a product fault, use a servo motor with electromagnetic brake or an external brake mechanism for the purpose of prevention.
- Configure the electromagnetic brake circuit so that it is activated not only by the servo amplifier signals but also by an external forced stop (EMG).



- When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation.
- When power is restored after an instantaneous power failure, keep away from the machine because the machine may be restarted suddenly (design the machine so that it is secured against hazard if restarted).

(6) Maintenance, inspection and parts replacement

⚠ CAUTION

- With age, the electrolytic capacitor of the servo amplifier will deteriorate. To prevent a secondary accident due to a fault, it is recommended to replace the electrolytic capacitor every 10 years when used in general environment.
  Please consult our sales representative.

(7) General instruction

- To illustrate details, the equipment in the diagrams of this Specifications and 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.

● About processing of waste ●

When you discard servo amplifier, a battery (primary battery), and other option articles, please follow the law of each country (area).

⚠ FOR MAXIMUM SAFETY

- These products have been manufactured as a general-purpose part for general industries, and have not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the products for special purposes such as nuclear power, electric power, aerospace, medicine, passenger movement vehicles or under water relays, contact Mitsubishi.
- These products have been manufactured under strict quality control. However, when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

⚠ EEP-ROM life

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

- Write to the EEP-ROM due to parameter setting changes
- Home position setting in the absolute position detection system
- Write to the EEP-ROM due to device changes
- Write to the EEP-ROM due to point table changes

Precautions for Choosing the Products

Mitsubishi will not be held liable for damage caused by factors found not to be the cause of Mitsubishi; machine damage or lost profits caused by faults in the Mitsubishi products; damage, secondary damage, accident compensation caused by special factors unpredictable by Mitsubishi; damages to products other than Mitsubishi products; and to other duties.

COMPLIANCE WITH EC DIRECTIVES

1. WHAT ARE EC DIRECTIVES?

The EC directives were issued to standardize the regulations of the EU countries and ensure smooth distribution of safety-guaranteed products. In the EU countries, the machinery directive (effective in January, 1995), EMC directive (effective in January, 1996) and low voltage directive (effective in January, 1997) of the EC directives require that products to be sold should meet their fundamental safety requirements and carry the CE marks (CE marking). CE marking applies to machines and equipment into which servo amplifiers have been installed.

(1) EMC directive

The EMC directive applies not to the servo units alone but to servo-incorporated machines and equipment. This requires the EMC filters to be used with the servo-incorporated machines and equipment to comply with the EMC directive. For specific EMC directive conforming methods, refer to the EMC Installation Guidelines (IB(NA)67310).

(2) Low voltage directive

The low voltage directive applies also to servo units alone. Hence, they are designed to comply with the low voltage directive.

This servo is certified by TUV, third-party assessment organization, to comply with the low voltage directive.

(3) Machine directive

Not being machines, the servo amplifiers need not comply with this directive.

2. PRECAUTIONS FOR COMPLIANCE

(1) Servo amplifiers and servo motors used

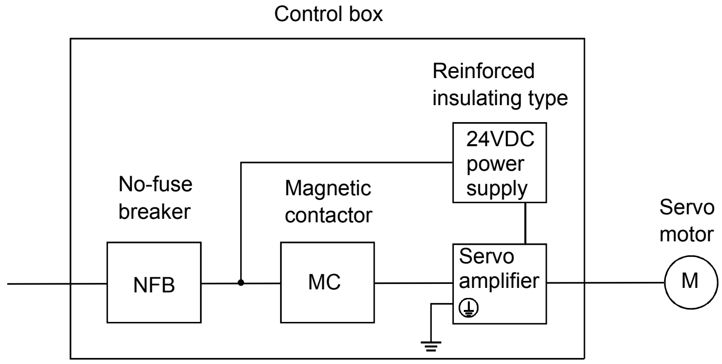
Use the servo amplifiers and servo motors which comply with the standard model.

Servo amplifier	:MR-J3-10T to MR-J3-22KT
	MR-J3-10T1 to MR-J3-40T1
	MR-J3-60T4 to MR-J3-22KT4
Servo motor	:HF-MP□
	HF-KP□
	HF-SP□ (Note)
	HF-SP□4 (Note)
	HC-RP□
	HC-UP□
	HC-LP□
	HA-LP□ (Note)
	HA-LP□4 (Note)

Note. For the latest information of compliance, contact Mitsubishi.

(2) Configuration

The control circuit provide safe separation to the main circuit in the servo amplifier.



(3) Environment

Operate the servo amplifier at or above the contamination level 2 set forth in IEC60664-1. For this purpose, install the servo amplifier in a control box which is protected against water, oil, carbon, dust, dirt, etc. (IP54).

(4) Power supply

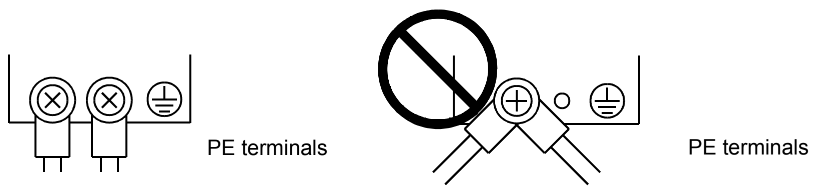
(a) This servo amplifier can be supplied from star-connected supply with earthed neutral point of overvoltage category III set forth in IEC60664-1. However, when using the neutral point of 400V class for single-phase supply, a reinforced insulating transformer is required in the power input section.

(b) When supplying interface power from external, use a 24VDC power supply which has been insulation-reinforced in I/O.

(5) Grounding

(a) To prevent an electric shock, always connect the protective earth (PE) terminals (terminal marked ⏚) of the servo amplifier to the protective earth (PE) of the control box.

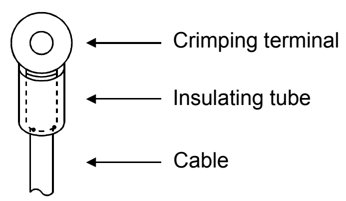
(b) Do not connect two ground cables to the same protective earth (PE) terminal (terminal marked ⏚). Always connect the cables to the terminals one-to-one.



(c) If a leakage current breaker is used to prevent an electric shock, the protective earth (PE) terminals (terminal marked ⏚) of the servo amplifier must be connected to the corresponding earth terminals.

(6) Wiring

(a) The cables to be connected to the terminal block of the servo amplifier must have crimping terminals provided with insulating tubes to prevent contact with adjacent terminals.



(b) Use the servo motor side power connector which complies with the EN Standard. The EN Standard compliant power connector sets are available from us as options. (Refer to section 13.1)

(7) Auxiliary equipment and options

(a) The no-fuse breaker and magnetic contactor used should be the EN or IEC standard-compliant products of the models described in section 13.10.
Use a type B (Note) breaker. When it is not used, provide insulation between the servo amplifier and other device by double insulation or reinforced insulation, or install a transformer between the main power supply and servo amplifier.
Note. Type A: AC and pulse detectable
Type B: Both AC and DC detectable

(b) The sizes of the cables described in section 13.9 meet the following requirements. To meet the other requirements, follow Table 5 and Appendix C in EN60204-1.

- Ambient temperature: 40 (104) [°C (°F)]
- Sheath: PVC (polyvinyl chloride)
- Installed on wall surface or open table tray

(c) Use the EMC filter for noise reduction.

(8) Performing EMC tests

When EMC tests are run on a machine/device into which the servo amplifier has been installed, it must conform to the electromagnetic compatibility (immunity/emission) standards after it has satisfied the operating environment/electrical equipment specifications.
For the other EMC directive guidelines on the servo amplifier, refer to the EMC Installation Guidelines (IB(NA)67310).

CONFORMANCE WITH UL/C-UL STANDARD

(1) Servo amplifiers and servo motors used

Use the servo amplifiers and servo motors which comply with the standard model.

Servo amplifier :MR-J3-10T to MR-J3-22KT
MR-J3-10T1 to MR-J3-40T1
MR-J3-60T4 to MR-J3-22KT4

Servo motor :HF-MP□
HF-KP□
HF-SP□ (Note)
HF-SP□4 (Note)
HC-RP□
HC-UP□
HC-LP□
HA-LP□ (Note)
HA-LP□4 (Note)

Note. For the latest information of compliance, contact Mitsubishi.

(2) Installation

Install a cooling fan of 100CFM (2.8m^3/min) air flow 4 in (10.16 cm) above the servo amplifier or provide cooling of at least equivalent capability.

(3) Short circuit rating: SCCR (Short Circuit Current rating)

This servo amplifier conforms to the circuit whose peak current is limited to 100kA or less. Having been subjected to the short-circuit tests of the UL in the alternating-current circuit, the servo amplifier conforms to the above circuit.

(4) Capacitor discharge time

The capacitor discharge time is as listed below. To ensure safety, do not touch the charging section for 15 minutes after power-off.

Servo amplifier	Discharge time [min]
MR-J3-10T・20T	1
MR-J3-40T・60T(4)・10T1・20T1	2
MR-J3-70T	3
MR-J3-40T1	4
MR-J3-100T(4)	5
MR-J3-200T(4)・350T	9
MR-J3-350T4・500T(4)・700T(4)	10
MR-J3-11KT(4)	4
MR-J3-15KT(4)	6
MR-J3-22KT(4)	8

(5) Options and auxiliary equipment

Use UL/C-UL standard-compliant products.

(6) Attachment of a servo motor

For the flange size of the machine side where the servo motor is installed, refer to “CONFORMANCE WITH UL/C-UL STANDARD” in the Servo Motor Instruction Manual (Vol.2).

(7) About wiring 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.

<<About the manuals>>

This Instruction Manual and the MELSERVO Servo Motor Instruction Manual are required if you use the General-Purpose AC servo MR-J3-T for the first time. Always purchase them and use the MR-J3-T safely.

Relevant manuals

Manual name	Manual No.
MELSERVO-J3 Series To Use the AC Servo Safely	IB(NA)0300077
MELSERVO Servo Motor Instruction Manual Vol.2	SH(NA)030041
EMC Installation Guidelines	IB(NA)67310

<<About the wires used for wiring>>

Wiring wires mentioned in this instruction manual are selected based on the ambient temperature of 40°C (104°F).

CONTENTS

1. FUNCTIONS AND CONFIGURATION

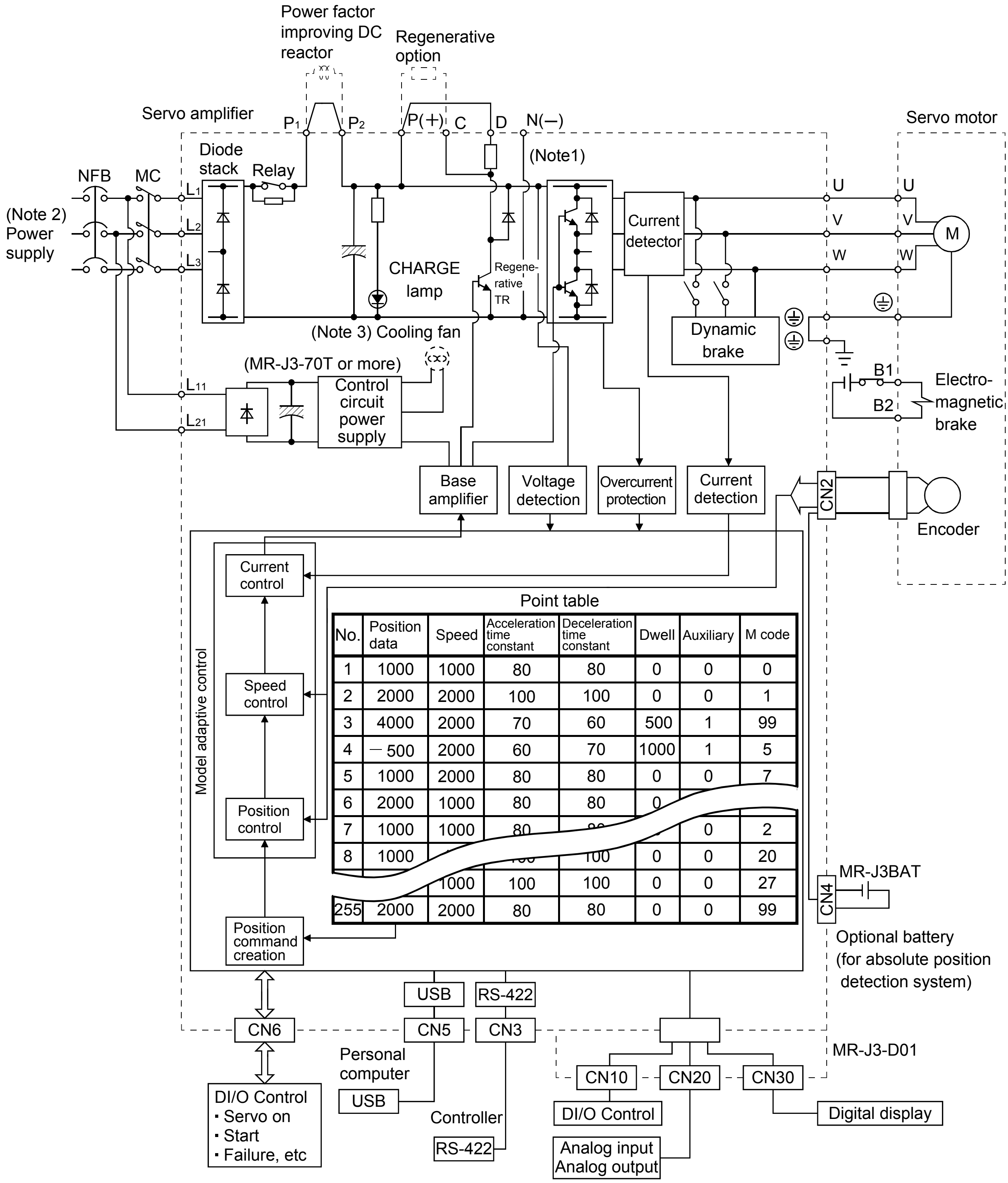
1.1 Introduction

This servo has the function to perform positioning operation by merely setting the position data (target positions), servo motor speeds, acceleration and deceleration time constants, etc. to point tables as if setting them in parameters. The servo amplifier is the most appropriate to configure a program-free, simple positioning system or to simplify a system, for example.
There are 255 points of point tables.
All servo motors are equipped with an absolute position encoder as standard. An absolute position detection system can be configured by merely adding a battery to the servo amplifier. Once the home position has been set, home position return is not required at power on, alarm occurrence, etc.
The MR-J3-T is made easier to use and higher in function by using it with the MR Configurator.

1.1.1 Function block diagram

The function block diagram of this servo is shown below.

(1) MR-J3-350T or less · MR-J3-200T4 or less

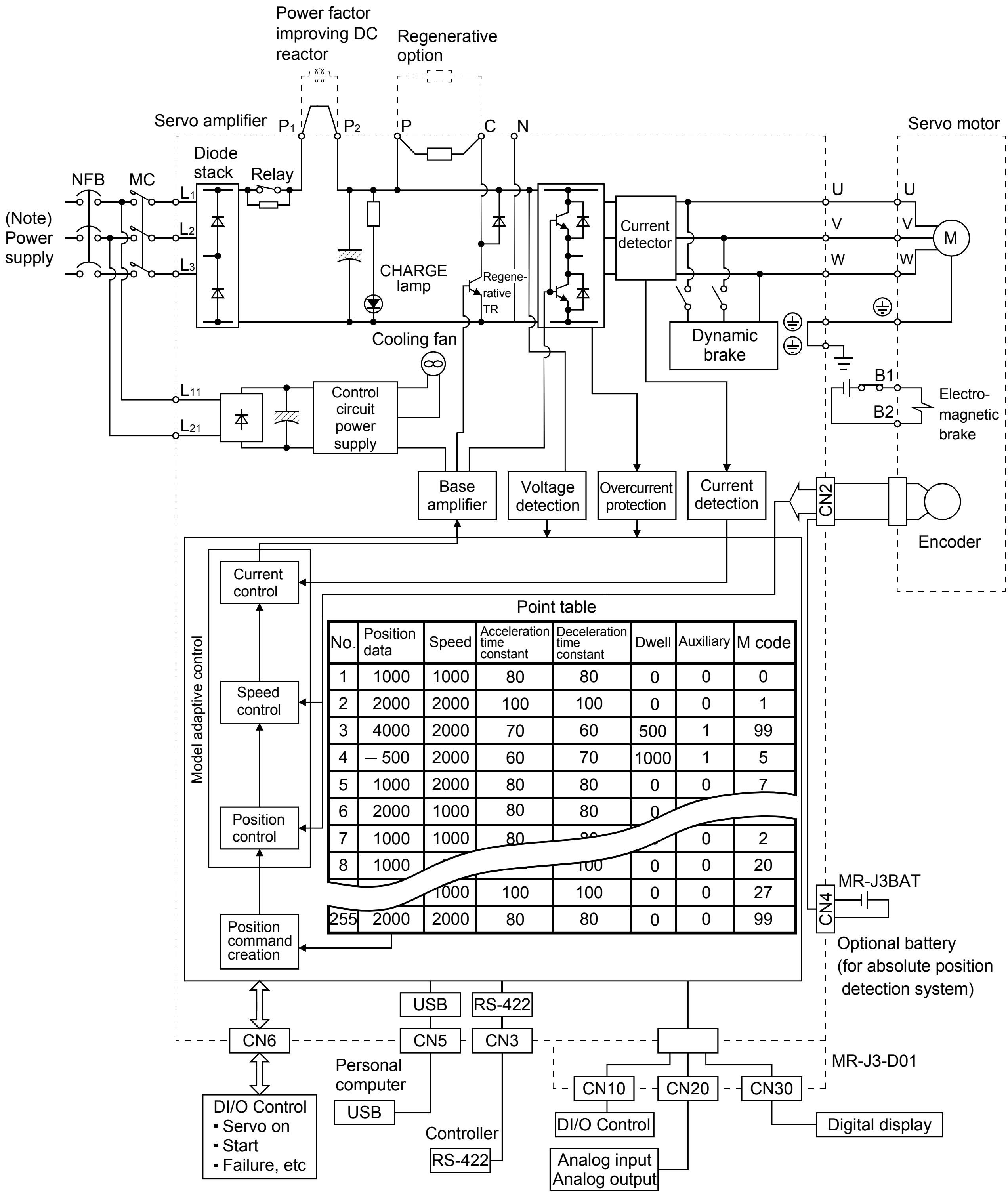


Note 1. The built-in regenerative resistor is not provided for the MR-J3-10T (1).

2. For 1-phase 200 to 230VAC, connect the power supply to L_1, L_2 and leave L_3 open.
   There is no L_3 for 1-phase 100 to 120VAC power supply. Refer to section 1.2 for the power supply specification.

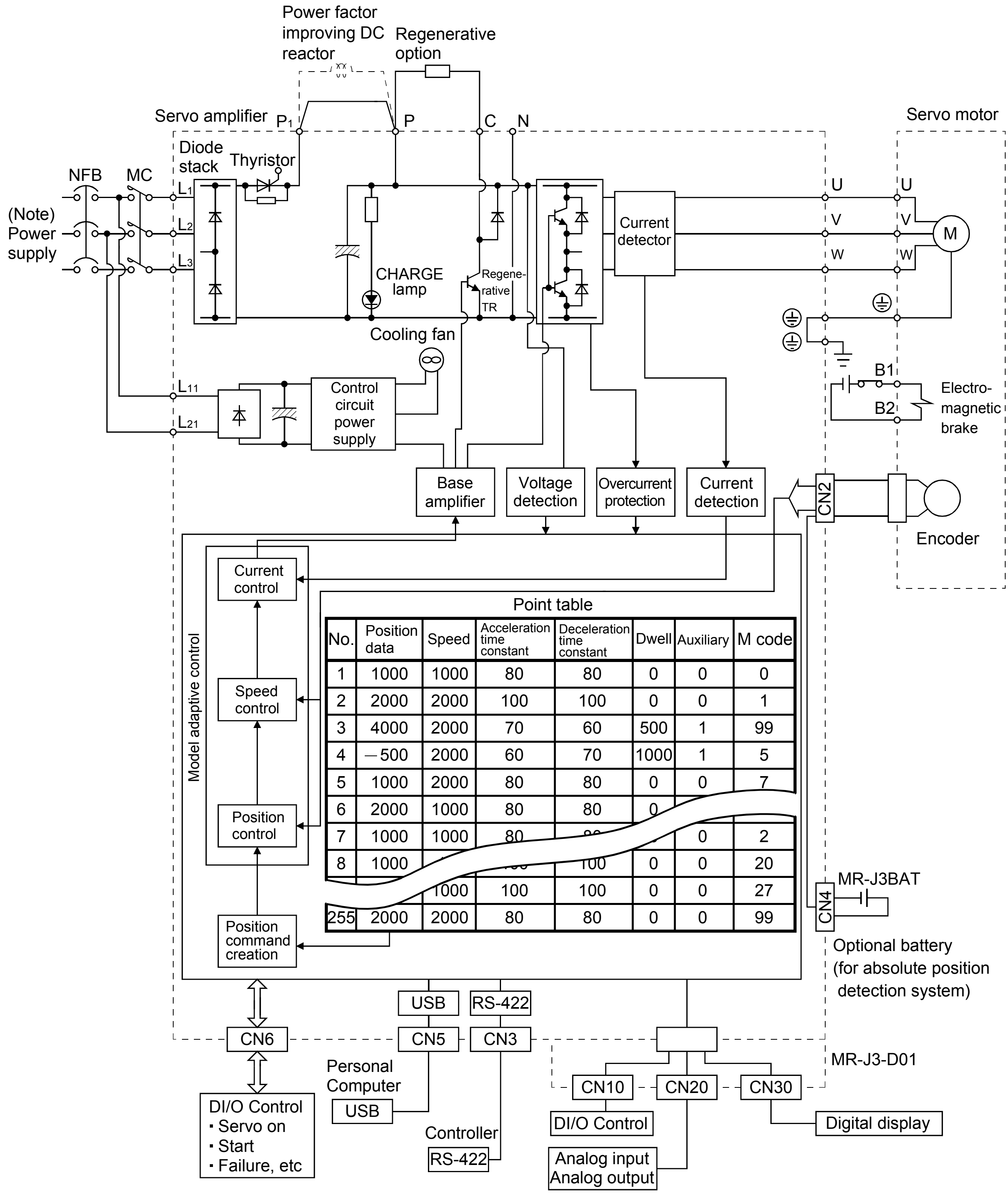
3. Servo amplifiers MR-J3-70T or greater have a cooling fan.

(2) MR-J3-350T4 · MR-J3-500T(4) · MR-J3-700T(4)



Note. Refer to section 1.2 for the power supply specification.

(3) MR-J3-11KT(4) to MR-J3-22KT(4)



No.	Position data	Speed	Acceleration time constant	Deceleration time constant	Dwell	Auxiliary	M code
1	1000	1000	80	80	0	0	0
2	2000	2000	100	100	0	0	1
3	4000	2000	70	60	500	1	99
4	−500	2000	60	70	1000	1	5
5	1000	2000	80	80	0	0	7
6	2000	1000	80	80	0		
7	1000	1000	80			0	2
8	1000			100	0	0	20
		1000	100	100	0	0	27
255	2000	2000	80	80	0	0	99

Note. Refer to section 1.2 for the power supply specification.

1.1.2 System configuration

This section provides operations using this servo.
The configuration can be freely arranged as any system from a single axis system to an up to 32-axis system. In addition, the optimum device to each system can be assigned to the connector pin of the I/F part. (Refer to section 3.4.) To change or assign devices, it is necessary to set parameter No. PD06 to 11 and Po02 to 09. Set the following values to the point table.

Name	Setting range	Unit
Position data	−999999 to 999999	×0.001[mm] × 0.01[mm] × 0.1[mm] × 1[mm]
Servo motor speed	0 to max. speed	[r/min]
Acceleration time constant	0 to 20000	[ms]
Deceleration time constant	0 to 20000	[ms]
Dwell	0 to 20000	[ms]
Auxiliary function	0 to 3	

There are 31 points of point tables to be used when 1 station is occupied and 255 points when 2 stations are occupied.

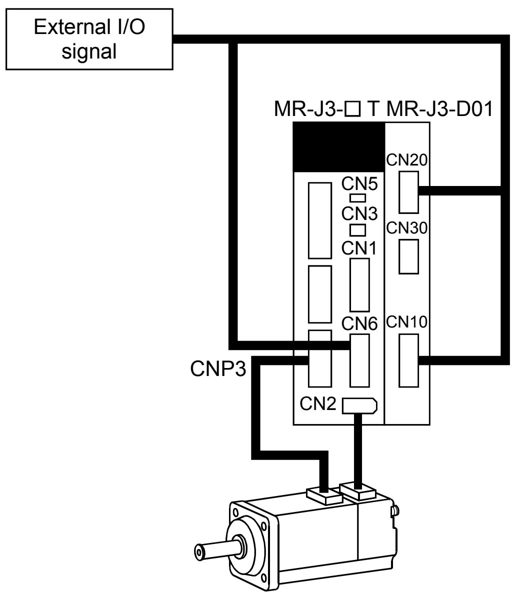
(1) Operation by external input signals

(a) Definition

The following shows a configuration example when all devices are controlled by external input signals. The signals consist of the I/O signals in the factory setting.

(b) Configuration

The following shows a configuration diagram when external I/O signals are used.



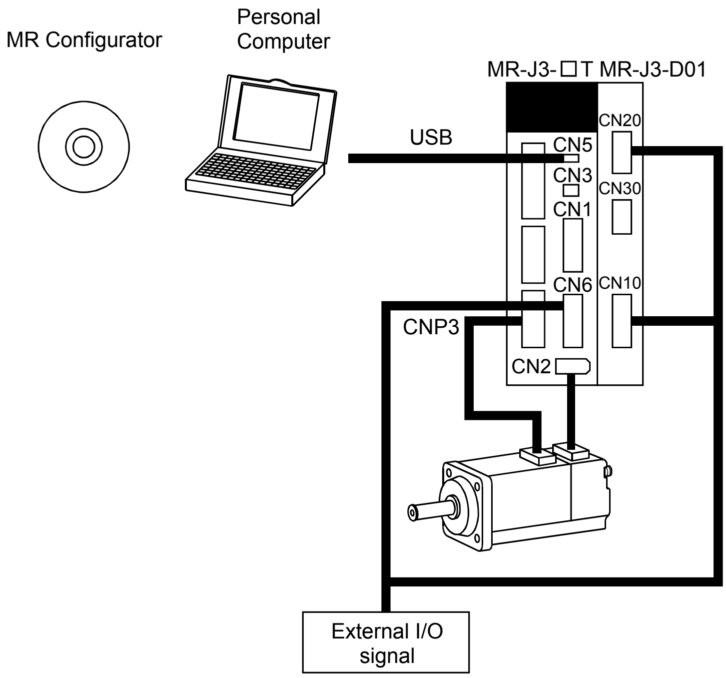
(2) Operation by external input signals and communication

(a) Definition

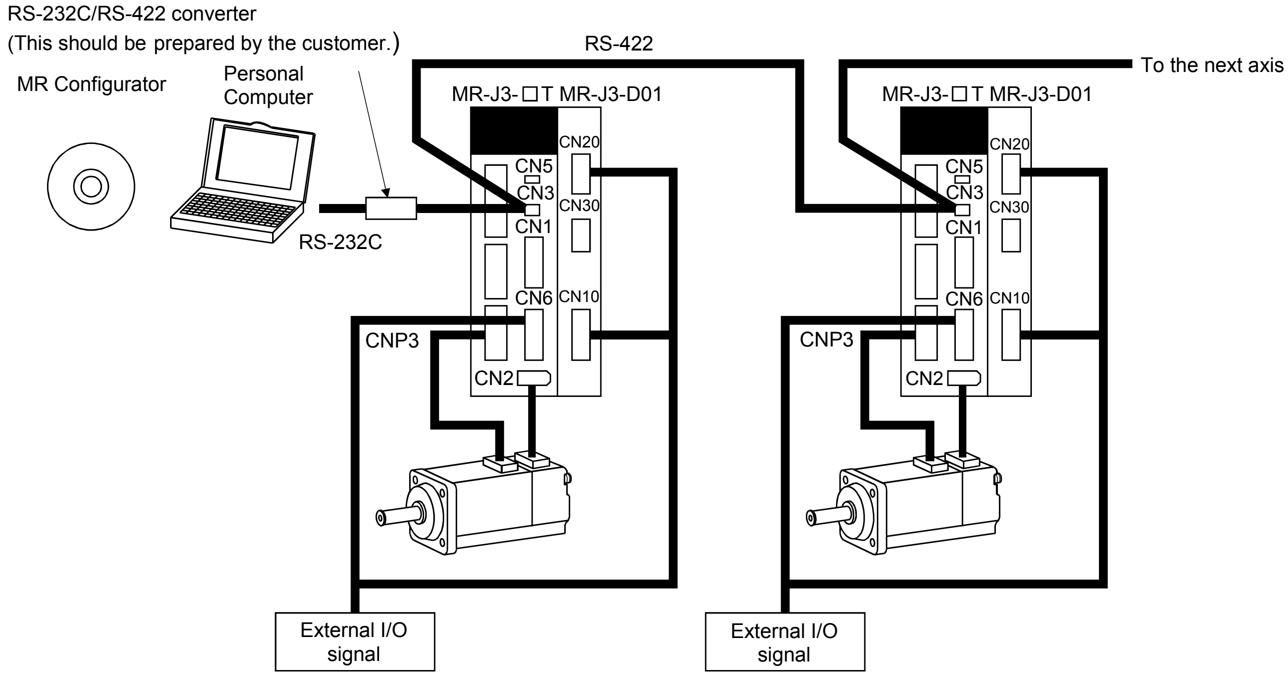
The data change and selection of point tables, change of parameters and confirmation of the monitor can be performed through communication. The forward rotation start (ST1) or reverse rotation direction (ST2) is input from the external I/O. This system is used when the position data and speed setting, the parameter change and others are performed on a host personal computer, etc.

(b) Configuration

1) Connect a servo amplifier to a personal computer with USB.



2) Connect two or more (maximum 32) servo amplifiers to a personal computer with RS-422.



1.2 Servo amplifier standard specifications

(1) 200V class, 100V class

<table>
<tr><th colspan="4">Servo amplifier MR-J3-□
Item</th><th>10T</th><th>20T</th><th>40T</th><th>60T</th><th>70T</th><th>100T</th><th>200T</th><th>350T</th><th>500T</th><th>700T</th><th>11KT</th><th>15KT</th><th>22KT</th><th>10T1</th><th>20T1</th><th>40T1</th></tr>
<tr><td rowspan="5">Power supply</td><td colspan="3">Voltage/frequency</td><td colspan="5">3-phase or 1-phase 200 to 230VAC, 50/60Hz</td><td colspan="8">3-phase 200 to 230VAC, 50/60Hz</td><td colspan="3">1-phase 100V to 120VAC, 50/60Hz</td></tr>
<tr><td colspan="3">Permissible voltage fluctuation</td><td colspan="5">3-phase or 1-phase 200 to 230VAC: 170 to 253VAC</td><td colspan="8">3-phase 170 to 253VAC</td><td colspan="3">1-phase 85 to 132VAC</td></tr>
<tr><td colspan="3">Permissible frequency fluctuation</td><td colspan="16">Within ±5%</td></tr>
<tr><td colspan="3">Power supply capacity</td><td colspan="16">Refer to section 12.2</td></tr>
<tr><td colspan="3">Inrush current</td><td colspan="16">Refer to section 12.5</td></tr>
<tr><td colspan="2" rowspan="5">Control circuit power supply</td><td colspan="2">Voltage, frequency</td><td colspan="13">1-phase 200 to 230VAC, 50/60Hz</td><td colspan="3">1-phase 100 to 120VAC, 50/60Hz</td></tr>
<tr><td colspan="2">Permissible voltage fluctuation</td><td colspan="13">1-phase 170 to 253VAC</td><td colspan="3">1-phase 85 to 132VAC</td></tr>
<tr><td colspan="2">Permissible frequency fluctuation</td><td colspan="16">Within ±5%</td></tr>
<tr><td colspan="2">Input</td><td colspan="8">30W</td><td colspan="5">45W</td><td colspan="3">30W</td></tr>
<tr><td colspan="2">Inrush current</td><td colspan="16">Refer to section 12.5</td></tr>
<tr><td colspan="2" rowspan="2">MR-J3-□T Interface power supply</td><td colspan="2">Voltage</td><td colspan="16">24VDC±10%</td></tr>
<tr><td colspan="2">Power supply capacity</td><td colspan="16">(Note 1) 150mA or more</td></tr>
<tr><td colspan="2" rowspan="2">MR-J3-D01 Interface power supply</td><td colspan="2">Voltage</td><td colspan="16">24VDC±10%</td></tr>
<tr><td colspan="2">Power supply capacity</td><td colspan="16">(Note 3) 800mA or more</td></tr>
<tr><td colspan="4">Control System</td><td colspan="16">Sine-wave PWM control, current control system</td></tr>
<tr><td colspan="4">Dynamic brake</td><td colspan="10">Built-in</td><td colspan="3">External option</td><td colspan="3">Built-in</td></tr>
<tr><td colspan="4">Protective functions</td><td colspan="16">Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal relay), servo motor overheat protection, encoder error protection, regenerative brake error protection, undervoltage, instantaneous power failure protection, overspeed protection, excessive error protection</td></tr>
<tr><td rowspan="10">Command system</td><td rowspan="4">Point table number input</td><td colspan="2">Operational specifications</td><td colspan="16">Positioning by specifying the point table No. (255 points)</td></tr>
<tr><td colspan="2">Position command input</td><td colspan="16">Set in point table. 1-point feed length setting range: ±1[μm] to ±999.999[mm]</td></tr>
<tr><td colspan="2">Speed command input</td><td colspan="16">Acceleration/deceleration time is set in point table.
S-pattern acceleration/deceleration time constant is set in parameter No. PC13.</td></tr>
<tr><td colspan="2">System</td><td colspan="16">Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system</td></tr>
<tr><td rowspan="6">Position command data input</td><td rowspan="3">BCD input</td><td>Position command input</td><td colspan="16">Digital switch or contact input of 6-digit BCD with symbol
1-point feed length setting range: ±1[μm] to ±999.999[mm].</td></tr>
<tr><td>Speed command input</td><td colspan="16">The motor speed and acceleration/deceleration time of the point table No.1 to 15 is selected by contact input.
S-pattern acceleration/deceleration time constant is set in parameter No.PC13.</td></tr>
<tr><td>System</td><td colspan="16">Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system</td></tr>
<tr><td rowspan="3">RS-422 communication</td><td>Position command input</td><td colspan="16">Positioning command data setting by RS-422 communication
1-point feed length setting range: ±1[μm] to ±999.999[mm].</td></tr>
<tr><td>Speed command input</td><td colspan="16">The motor speed and acceleration/deceleration time is set via RS-422 communication.
S-pattern acceleration/deceleration time constant is set in parameter No. PC13.</td></tr>
<tr><td>System</td><td colspan="16">Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system</td></tr>
<tr><td rowspan="4">Operation mode</td><td rowspan="2">Automatic operation mode</td><td colspan="2">Point table</td><td colspan="16">Point table number input, position data input system
Positioning operation is performed once in accordance with the position and speed commands.</td></tr>
<tr><td colspan="2">Automatic continuous operation</td><td colspan="16">Varied speed operation (2 to 255 speeds), automatic continuous positioning operation (2 to 255 points)</td></tr>
<tr><td rowspan="2">Manual operation mode</td><td colspan="2">Jog</td><td colspan="16">Jog operation is performed in accordance with the parameter-set speed command by contact input or through RS-422 communication function.</td></tr>
<tr><td colspan="2">Manual pulse generator</td><td colspan="16">Manual feed is made by manual pulse generator.
Command pulse multiplication: ×1, ×10 or ×100 is selected using parameter.</td></tr>
</table>

<table>
<tr><th colspan="4">Item \ Servo amplifier MR-J3-□</th><th>10T</th><th>20T</th><th>40T</th><th>60T</th><th>70T</th><th>100T</th><th>200T</th><th>350T</th><th>500T</th><th>700T</th><th>11KT</th><th>15KT</th><th>22KT</th><th>10T1</th><th>20T1</th><th>40T1</th></tr>
<tr><td rowspan="12">Operation mode</td><td rowspan="11">Home position return mode</td><td colspan="2">Dog type</td><td colspan="16">Home position return is made starting with Z-phase pulse after passage of proximity dog.
Home position address may be set. Home position shift distance may be set. Home position return direction may be selected.
Automatic at-dog home position return return/automatic stroke return function</td></tr>
<tr><td colspan="2">Count type</td><td colspan="16">Home position return is made by counting encoder pulses after contact with proximity dog.
Home position address may be set. Home position shift value may be set. Home position return direction may be set.
Automatic at-dog home position return return/automatic stroke return function</td></tr>
<tr><td colspan="2">Data setting type</td><td colspan="16">Home position return is made without dog.
Home position may be set at any position by manual operation, etc. Home position address may be set.</td></tr>
<tr><td colspan="2">Stopper type</td><td colspan="16">Home position return is made by pressing machine part against stroke end.
Home position address may be set. Home position return direction may be set.</td></tr>
<tr><td colspan="2">Home position ignorance (Servo-on position as home position)</td><td colspan="16">Position where servo-on (SON) is switched on is defined as home position.
Home position address may be set.</td></tr>
<tr><td colspan="2">Dog type rear end reference</td><td colspan="16">Home position return is made with respect to the rear end of a proximity dog.
Home position address may be set. Home position shift value may be set. Home position return direction may be set.
Automatic at-dog home position return return/automatic stroke return function</td></tr>
<tr><td colspan="2">Count type front end reference</td><td colspan="16">Home position return is made with respect to the front end of a proximity dog.
Home position address may be set. Home position shift value may be set. Home position return direction may be set.
Automatic at-dog home position return return/automatic stroke return function</td></tr>
<tr><td colspan="2">Dog cradle type</td><td colspan="16">Home position return is made with respect to the front end of a proximity dog by the first Z-phase pulse.
Home position address may be set. Home position shift value may be set. Home position return direction may be set.
Automatic at-dog home position return return/automatic stroke return function</td></tr>
<tr><td colspan="2">Dog type last Z-phase reference</td><td colspan="16">Home position return is made with respect to the front end of a proximity dog by the last Z-phase pulse.
Home position address may be set. Home position shift value may be set. Home position return direction may be set.
Automatic at-dog home position return return/automatic stroke return function</td></tr>
<tr><td colspan="2">Dog type front end reference</td><td colspan="16">Home position return is made to the dog front end with respect to the front end of a proximity dog.
Home position address may be set. Home position shift value may be set. Home position return direction may be set.
Automatic at-dog home position return return/automatic stroke return function</td></tr>
<tr><td colspan="2">Dogless Z-phase reference</td><td colspan="16">Home position return is made with respect to the first Z-phase to the Z-phase.
Home position address may be set. Home position shift value may be set. Home position return direction may be set.</td></tr>
<tr><td colspan="3">Automatic positioning to home position</td><td colspan="16">High-speed automatic return to a defined home position.</td></tr>
<tr><td colspan="4">Other functions</td><td colspan="16">Absolute position detection, backlash function
Overtravel prevention using external limit switch
Software stroke limit
Override by analog input</td></tr>
<tr><td colspan="4">Structure</td><td colspan="4">Self-cooled, open (IP00)</td><td colspan="9">Force-cooling, open (IP00)</td><td colspan="3">Self-cooled, open (IP00)</td></tr>
<tr><td rowspan="9">Environment</td><td rowspan="4">Ambient temperature</td><td rowspan="2">In operation</td><td>[°C]</td><td colspan="16">(Note 2) 0 to +55 (non-freezing)</td></tr>
<tr><td>[°F]</td><td colspan="16">(Note 2) 32 to +131 (non-freezing)</td></tr>
<tr><td rowspan="2">In storage</td><td>[°C]</td><td colspan="16">−20 to +65 (non-freezing)</td></tr>
<tr><td>[°F]</td><td colspan="16">−4 to +149 (non-freezing)</td></tr>
<tr><td rowspan="2">Ambient humidity</td><td colspan="2">In operation</td><td colspan="16" rowspan="2">90%RH or less (non-condensing)</td></tr>
<tr><td colspan="2">In storage</td></tr>
<tr><td colspan="3">Ambient</td><td colspan="16">Indoors (no direct sunlight)
Free from corrosive gas, flammable gas, oil mist, dust and dirt</td></tr>
<tr><td colspan="3">Altitude</td><td colspan="16">Max. 1000m above sea level</td></tr>
<tr><td colspan="3">Vibration</td><td colspan="16">5.9 [m/s^2] or less</td></tr>
<tr><td colspan="2" rowspan="2">Mass</td><td colspan="2">[kg]</td><td>0.8</td><td>0.8</td><td>1.0</td><td>1.0</td><td>1.4</td><td>1.4</td><td>2.1</td><td>2.3</td><td>4.6</td><td>6.2</td><td>18</td><td>18</td><td>19</td><td>0.8</td><td>0.8</td><td>1.0</td></tr>
<tr><td colspan="2">[lb]</td><td>1.8</td><td>1.8</td><td>2.2</td><td>2.2</td><td>3.1</td><td>3.1</td><td>4.63</td><td>50.7</td><td>10.1</td><td>13.7</td><td>39.7</td><td>39.7</td><td>41.9</td><td>1.8</td><td>1.8</td><td>2.2</td></tr>
</table>

Note 1. 150mA is the value applicable when all I/O signals of the servo amplifier are used. The current capacity can be decreased by reducing the number of I/O points.

2. When closely mounting the servo amplifier of 3.5kW or less, operate them at the ambient temperatures of 0 to 45°C (32 to 113°F) or at 75% or smaller effective load ratio.

3. 800mA is the value applicable when all I/O signals of the MR-J3-D01 are used. The current capacity can be decreased by reducing the number of I/O points.

(2) 400V class

<table>
<tr><th colspan="4">Servo amplifier MR-J3-□
Item</th><th>60T4</th><th>100T4</th><th>200T4</th><th>350T4</th><th>500T4</th><th>700T4</th><th>11KT4</th><th>15KT4</th><th>22KT4</th></tr>
<tr><td rowspan="5">Power supply</td><td colspan="3">Voltage/frequency</td><td colspan="9">3-phase 380 to 480VAC, 50/60Hz</td></tr>
<tr><td colspan="3">Permissible voltage fluctuation</td><td colspan="9">3-phase 323 to 528VAC</td></tr>
<tr><td colspan="3">Permissible frequency fluctuation</td><td colspan="9">Within ±5%</td></tr>
<tr><td colspan="3">Power supply capacity</td><td colspan="9">Refer to section 12.2</td></tr>
<tr><td colspan="3">Inrush current</td><td colspan="9">Refer to section 12.5</td></tr>
<tr><td colspan="2" rowspan="5">Control circuit power supply</td><td colspan="2">Voltage, frequency</td><td colspan="9">1-phase 380 to 480VAC, 50/60Hz</td></tr>
<tr><td colspan="2">Permissible voltage fluctuation</td><td colspan="9">1-phase 323 to 528VAC</td></tr>
<tr><td colspan="2">Permissible frequency fluctuation</td><td colspan="9">Within ±5%</td></tr>
<tr><td colspan="2">Input</td><td colspan="3">30W</td><td colspan="6">45W</td></tr>
<tr><td colspan="2">Inrush current</td><td colspan="9">Refer to section 12.5</td></tr>
<tr><td colspan="2" rowspan="2">MR-J3-□T Interface power supply</td><td colspan="2">Voltage</td><td colspan="9">24VDC ±10%</td></tr>
<tr><td colspan="2">Power supply capacity</td><td colspan="9">(Note 1) 150mA or more</td></tr>
<tr><td colspan="2" rowspan="2">MR-J3-D01 Interface power supply</td><td colspan="2">Voltage</td><td colspan="9">24VDC ±10%</td></tr>
<tr><td colspan="2">Power supply capacity</td><td colspan="9">(Note 2) 800mA or more</td></tr>
<tr><td colspan="4">Control System</td><td colspan="9">Sine-wave PWM control, current control system</td></tr>
<tr><td colspan="4">Dynamic brake</td><td colspan="6">Built-in</td><td colspan="3">External option</td></tr>
<tr><td colspan="4">Protective functions</td><td colspan="9">Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal relay), servo motor overheat protection, encoder error protection, regenerative brake error protection, undervoltage, instantaneous power failure protection, overspeed protection, excessive error protection</td></tr>
<tr><td rowspan="10">Command system</td><td rowspan="4">Point table number input</td><td colspan="2">Operational specifications</td><td colspan="9">Positioning by specifying the point table No. (255 points)</td></tr>
<tr><td colspan="2">Position command input</td><td colspan="9">Set in point table. 1-point feed length setting range: ±1[μm] to ±999.999[mm]</td></tr>
<tr><td colspan="2">Speed command input</td><td colspan="9">Acceleration/deceleration time is set in point table.
S-pattern acceleration/deceleration time constant is set in parameter No. PC13.</td></tr>
<tr><td colspan="2">System</td><td colspan="9">Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system</td></tr>
<tr><td rowspan="6">Position command data input</td><td rowspan="3">BCD input</td><td>Position command input</td><td colspan="9">Digital switch or contact input of 6-digit BCD with symbol
1-point feed length setting range: ±1[μm] to ±999.999[mm].</td></tr>
<tr><td>Speed command input</td><td colspan="9">The motor speed and acceleration/deceleration time of the point table No.1 to 15 is selected by contact input.
S-pattern acceleration/deceleration time constant is set in parameter No.PC13.</td></tr>
<tr><td>System</td><td colspan="9">Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system</td></tr>
<tr><td rowspan="3">RS-422 communication</td><td>Position command input</td><td colspan="9">Positioning command data setting by RS-422 communication
1-point feed length setting range: ±1[μm] to ±999.999[mm].</td></tr>
<tr><td>Speed command input</td><td colspan="9">The motor speed and acceleration/deceleration time is set via RS-422 communication.
S-pattern acceleration/deceleration time constant is set in parameter No. PC13.</td></tr>
<tr><td>System</td><td colspan="9">Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system</td></tr>
<tr><td rowspan="4">Operation mode</td><td rowspan="2">Automatic operation mode</td><td colspan="2">Point table</td><td colspan="9">Point table number input, position data input system
Positioning operation is performed once in accordance with the position and speed commands.</td></tr>
<tr><td colspan="2">Automatic continuous operation</td><td colspan="9">Varied speed operation (2 to 255 speeds), automatic continuous positioning operation (2 to 255 points)</td></tr>
<tr><td rowspan="2">Manual operation mode</td><td colspan="2">Jog</td><td colspan="9">Jog operation is performed in accordance with the parameter-set speed command by contact input or through RS-422 communication function.</td></tr>
<tr><td colspan="2">Manual pulse generator</td><td colspan="9">Manual feed is made by manual pulse generator.
Command pulse multiplication: ×1, ×10 or ×100 is selected using parameter.</td></tr>
</table>

Item				Servo amplifier MR-J3-□ 60T4	100T4	200T4	350T4	500T4	700T4	11KT4	15KT4	22KT4
Operation mode	Home position return mode	Dog type		Home position return is made starting with Z-phase pulse after passage of proximity dog. Home position address may be set. Home position shift distance may be set. Home position return direction may be selected. Automatic at-dog home position return return/automatic stroke return function								
		Count type		Home position return is made by counting encoder pulses after contact with proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function								
		Data setting type		Home position return is made without dog. Home position may be set at any position by manual operation, etc. Home position address may be set.								
		Stopper type		Home position return is made by pressing machine part against stroke end. Home position address may be set. Home position return direction may be set.								
		Home position ignorance (Servo-on position as home position)		Position where servo-on (SON) is switched on is defined as home position. Home position address may be set.								
		Dog type rear end reference		Home position return is made with respect to the rear end of a proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function								
		Count type front end reference		Home position return is made with respect to the front end of a proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function								
		Dog cradle type		Home position return is made with respect to the front end of a proximity dog by the first Z-phase pulse. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function								
		Dog type last Z-phase reference		Home position return is made with respect to the front end of a proximity dog by the last Z-phase pulse. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function								
		Dog type front end reference		Home position return is made to the dog front end with respect to the front end of a proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function								
		Dogless Z-phase reference		Home position return is made with respect to the first Z-phase to the Z-phase. Home position address may be set. Home position shift value may be set. Home position return direction may be set.								
	Automatic positioning to home position			High-speed automatic return to a defined home position.								
Other functions				Absolute position detection, backlash function Overtravel prevention using external limit switch Software stroke limit Override by analog input								
Structure				Self-cooled, open (IP00)	Force-cooling, open (IP00)							
Environment	Ambient temperature	In operation	[°C]	0 to +55 (non-freezing)								
			[°F]	32 to +131 (non-freezing)								
		In storage	[°C]	−20 to +65 (non-freezing)								
			[°F]	−4 to +149 (non-freezing)								
	Ambient humidity	In operation		90%RH or less (non-condensing)								
		In storage										
	Ambient			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt								
	Altitude			Max. 1000m above sea level								
	Vibration			5.9 [m/s^2] or less								
Mass			[kg]	1.7	1.7	2.1	4.6	4.6	6.2	18	18	19
			[lb]	3.75	3.75	4.63	10.1	10.1	13.7	39.7	39.7	42.9

Note 1. 150mA is the value applicable when all I/O signals of the servo amplifier are used. The current capacity can be decreased by reducing the number of I/O points.

2. 800mA is the value applicable when all I/O signals of the MR-J3-D01 are used. The current capacity can be decreased by reducing the number of I/O points.

1.3 Function list

The following table lists the functions of this servo. For details of the functions, refer to the reference field.

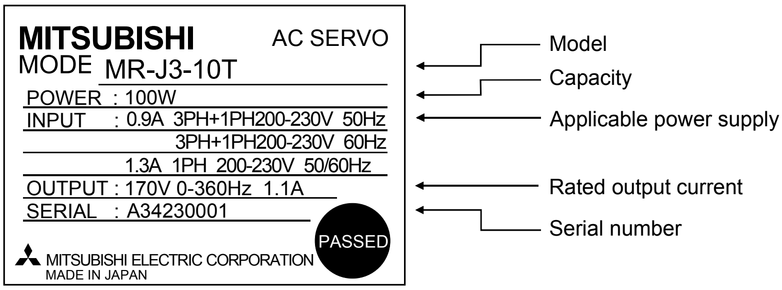
Function	Description	Reference
Positioning by automatic operation	Select the required ones from among 31 preset point tables and perform operation in accordance with the set values. Use the external input signal or communication function to choose the point tables.	Section 4.5
Varied speed operation	Servo motor speed can be varied continuously until the preset moving distance is reached. (Max. set speeds: 255 speeds)	Section 4.5.2 (2)(c)
Automatic continuous positioning operation	By merely choosing one point table and starting operation, positioning can be executed continuously in accordance with several point tables.	Section 4.5.2 (2)(c)
Home position return	Dog type, count type, data setting type, stopper type, home position ignorance, dog type rear end reference, count type front end reference, dog cradle type	Section 4.7
High-resolution encoder	High-resolution encoder of 262144 pulses/rev is used as a servo motor encoder.	
Absolute position detection system	By merely setting the home position once, home position return need not be done at each power on.	Section 4.9
Gain changing function	You can switch between gains during rotation and gains during stop or use an input device to change gains during operation.	Section 9.6
Advanced vibration suppression control	This function suppresses vibration at the arm end or residual vibration.	Section 9.4
Adaptive filter Ⅱ	Servo amplifier detects mechanical resonance and sets filter characteristics automatically to suppress mechanical vibration.	Section 9.2
Low-pass filter	Suppresses high-frequency resonance which occurs as servo system response is increased.	Section 9.5
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system by simply connecting a MR Configurator-installed personal computer and servo amplifier. MR Configurator is necessary for this function.	
Machine simulation	Can simulate machine motions on a personal computer screen on the basis of the machine analyzer results. MR Configurator is necessary for this function.	
Gain search function	Personal computer changes gains automatically and searches for overshoot-free gains in a short time. MR Configurator is necessary for this function.	
Slight vibration suppression control	Suppresses vibration of ±1 pulse produced at a servo motor stop.	Parameters No. PB24
Electronic gear	The electronic gear is used to make adjustment so that the servo amplifier setting matches the machine moving distance. Also, changing the electronic gear value allows the machine to be moved at any multiplication ratio to the moving distance using the servo amplifier.	Parameter No. PA06, PA07
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	Section 8.2
S-pattern acceleration/deceleration time constant	Acceleration/deceleration can be made smoothly.	Parameters No. PC13
Regenerative option	Used when the built-in regenerative resistor of the servo amplifier does not have sufficient regenerative capability for the regenerative power generated.	Section 13.2
Brake unit	Used when the regenerative option cannot provide enough regenerative power. Can be used with the servo amplifier of 5kW or more.	Section 13.3

Function	Description	Reference
Regeneration converter	Used when the regenerative option cannot provide enough regenerative power. Can be used with the servo amplifier of 5kW or more.	Section 13.4
Alarm history clear	Alarm history is cleared.	Parameter No. PC18
I/O signal selection (Device setting)	Any input device such as servo-on (SON) can be assigned to any pin of CN6, CN10 connectors.	Parameter No. PD06 to PD08 Po02 to Po07
Torque limit	Servo motor-torque is limited.	Section 3.6.3 Section 5.1.11
Output signal (DO) forced output	Output signal can be forced on/off independently of the servo status. Use this function for output signal wiring check, etc.	Section 6.7.4 Section 6.5.7
Test operation mode	JOG operation ・ positioning operation ・ DO forced output. In the test operation mode, a parameter unit or MR Configurator is required.	Section 6.7 Section 7.5.7
Limit switch	The servo motor travel region can be limited using the forward rotation stroke end (LSP)/reverse rotation stroke end (LSN).	Section 3.5.1
Software limit	The travel region is limited using parameters in terms of address. The function similar to that of a limit switch is limited by parameter.	Section 5.3.6

1.4 Model code definition

1.4.1 Servo amplifier

(1) Rating plate



(2) Model

MR－J3－□T□□

Series: MR－J3

With no regenerative resistor

Symbol	Description
-PX	Indicates a servo amplifier of 11k to 22kW that does not use a regenerative resistor as standard accessory.

Power supply

Symbol	Description
(Note 1) None	3-phase or 1-phase 200 to 230VAC
(Note 2) 1	1-phase 100 to 120VAC
4	3-phase 380 to 480VAC

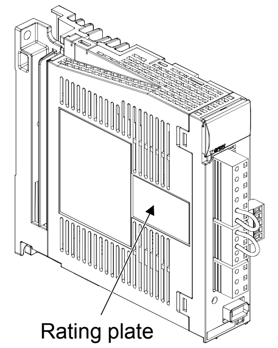
Note 1. 1-phase 200V to 230V is supported by 750W or less.
2. 1-phase 100V to 120V is supported by 400W or less.

Built-in positioning function

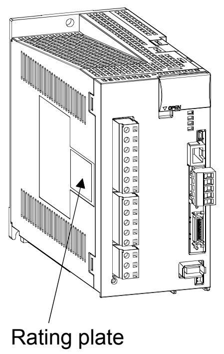
Rated output

Symbol	Rated output [kW]
10	0.1
20	0.2
40	0.4
60	0.6
70	0.75
100	1
200	2
350	3.5
500	5
700	7
11K	11
15K	15
22K	22

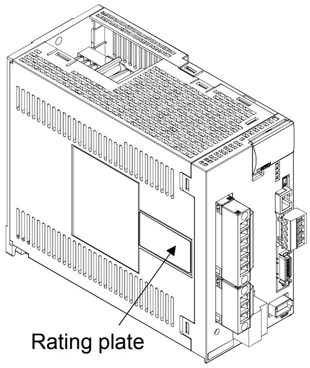
MR-J3-100T(4) or less



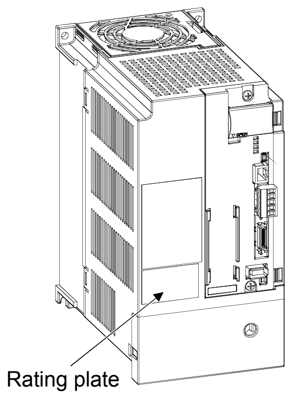
MR-J3-200T(4)



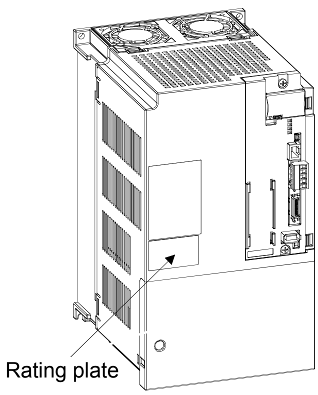
MR-J3-350T



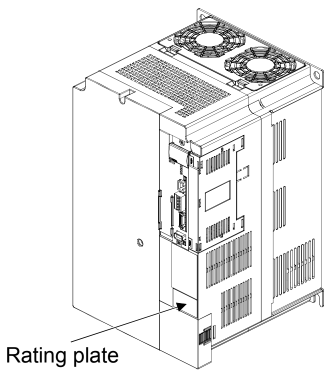
MR-J3-350T4･500T(4)



MR-J3-700T(4)

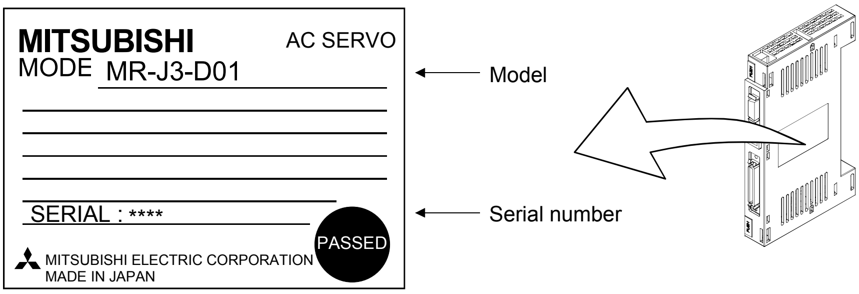


MR-J3-11KT(4) to 22KT(4)



1.4.2 MR-J3-D01 extension I/O unit

Rating plate



1.5 Combination with servo motor

The following table lists combinations of servo amplifiers and servo motors. The same combinations apply to the models with electromagnetic brakes.

Servo amplifier	Servo motors						
	HF-MP□	HF-KP□	HF-SP□		HC-RP□	HC-UP□	HC-LP□
			1000r/min	2000r/min			
MR-J3-10T (1)	053・13	053・13					
MR-J3-20T (1)	23	23					
MR-J3-40T (1)	43	43					
MR-J3-60T			51	52			52
MR-J3-70T	73	73				72	
MR-J3-100T			81	102			102
MR-J3-200T			121・201	152・202	103・153	152	152
MR-J3-350T			301	352	203	202	202
MR-J3-500T			421	502	353・503	352・502	302
MR-J3-700T				702			
MR-J3-11KT							
MR-J3-15KT							
MR-J3-22KT							

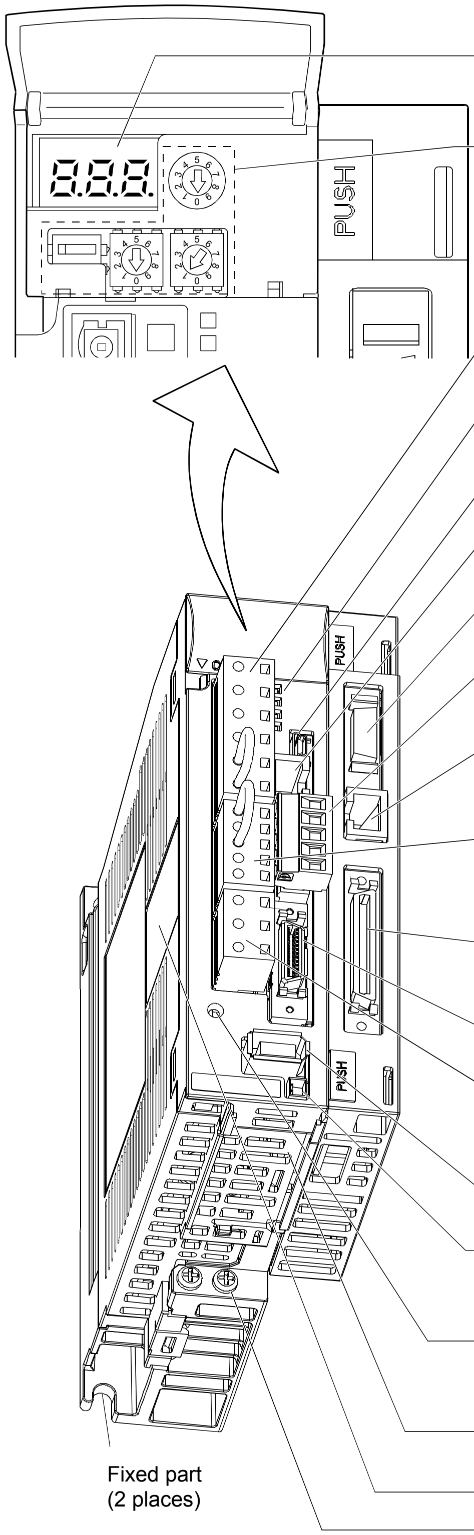
Servo amplifier	Servo motors		
	HA-LP□		
	1000r/min	1500r/min	2000r/min
MR-J3-500T			502
MR-J3-700T	601	701M	702
MR-J3-11KT	801・12K1	11K1M	11K2
MR-J3-15KT	15K1	15K1M	15K2
MR-J3-22KT	20K1・25K1	22K1M	22K2

Servo amplifier	Servo motors			
	HF-SP	HA-LP□		
		1000r/min	1500r/min	2000r/min
MR-J3-60T4	524			
MR-J3-100T4	1024			
MR-J3-200T4	1524・2024			
MR-J3-350T4	3524			
MR-J3-500T4	5024			
MR-J3-700T4	7024	6014	701M4	
MR-J3-11KT4		8014・12K14	11K1M4	11K24
MR-J3-15KT4		15K14	15K1M4	15K24
MR-J3-22KT4		20K14	22K1M4	22K24

1.6 Structure

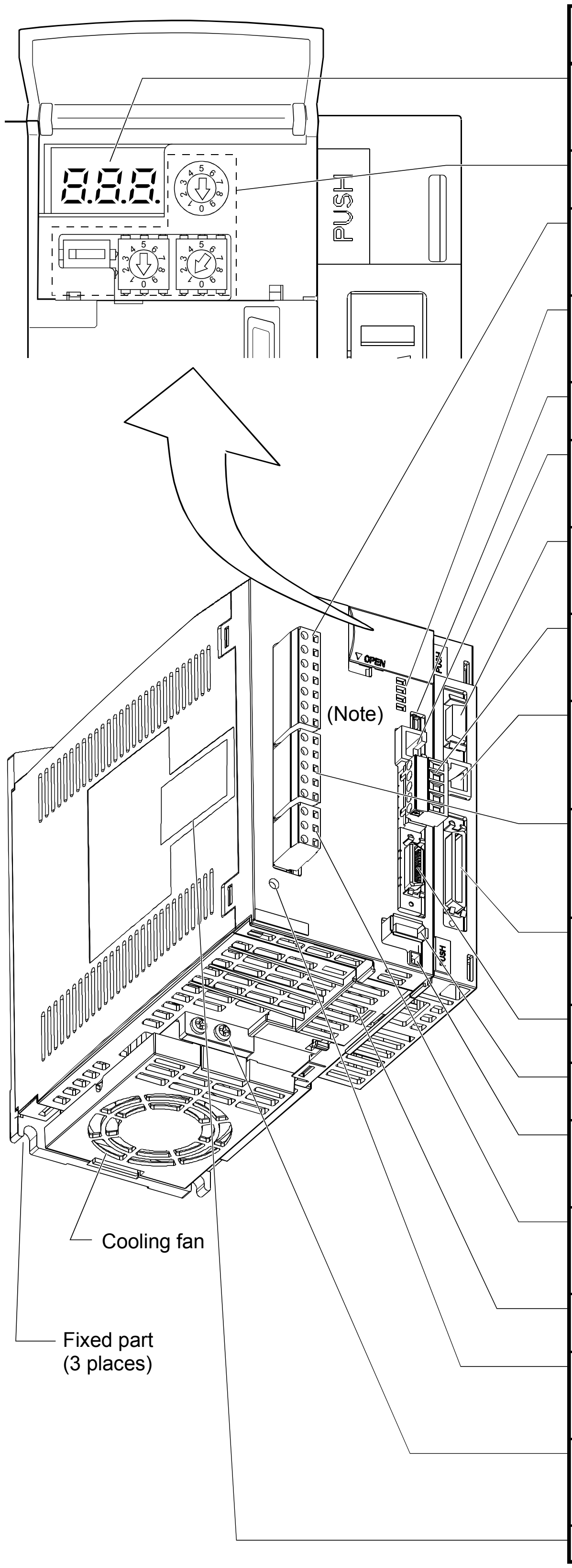
1.6.1 Parts identification

(1) MR-J3-100T(4) or less



Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 4.3 Chapter 10
When using in combination with MR-J3-D01, do not change the setting (default) shown in the figure.	
Main circuit power supply connector (CNP1) Used to connect the input power supply.	Section 3.1 Section 3.3 Section 11.1
Communication alarm display section When using in combination with MR-J3-D01, the LED display does not have any meaning.	
USB communication connector (CN5) Used to connect the personal computer.	Chapter 6
RS-422 communication connector (CN3) Used to connect the MR-PRU03 parameter unit or personal computer.	Chapter 6 Chapter 7 Chapter 14
Analog input connector (CN20) Used to connect the analog torque limit or override analog input signal.	
CC-Link connector (CN1) When using in combination with MR-J3-D01, this connector is not used. Do not connect anything to it.	
Digital display connector (CN30) Used to connect the MR-DP60 digital display. The MR-PRU03 parameter unit or a personal computer cannot be connected.	
Control circuit connector (CNP2) Used to connect the control circuit power supply/ regenerative option.	Section 3.1 Section 3.3 Section 11.1 Section 13.2
I/O signal connector (CN10) Used to connect the digital I/O signal or analog output signal.	
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 3.2 Section 3.4
Servo motor power connector (CNP3) Used to connect the servo motor.	Section 3.1 Section 3.3 Section 11.1
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.10 Section 13.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 4.9 Section 13.7
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Battery holder Contains the battery for absolute position data backup.	Section 4.9
Rating plate	Section 1.4
Protective earth (PE) terminal (⏚) Ground terminal.	Section 3.1 Section 3.3 Section 11.1

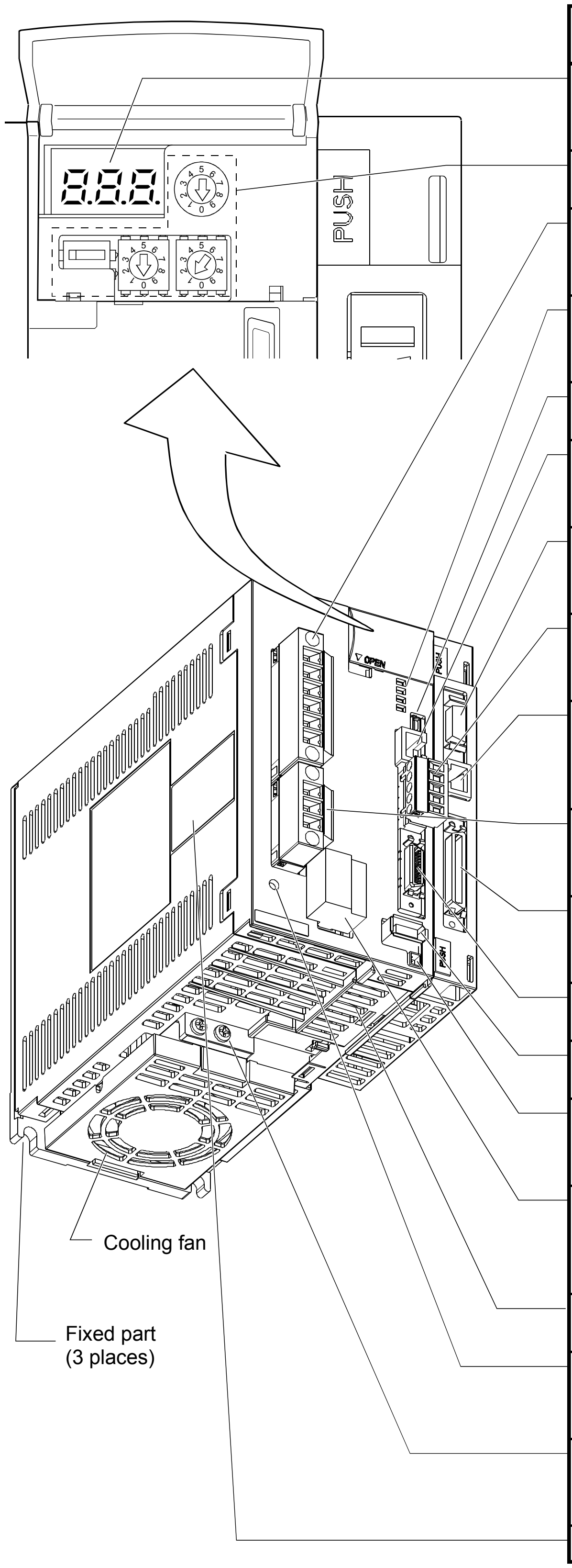
(2) MR-J3-200T(4)



Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 4.3 Chapter 10
When using in combination with MR-J3-D01, do not change the setting (default) shown in the figure.	
Main circuit power supply connector (CNP1) Used to connect the input power supply.	Section 3.1 Section 3.3 Section 11.1
Communication alarm display section When using in combination with MR-J3-D01, the LED display does not have any meaning.	
USB communication connector (CN5) Used to connect the personal computer.	Chapter 6
RS-422 communication connector (CN3) Used to connect the MR-PRU03 parameter unit or personal computer.	Chapter 6 Chapter 7 Chapter 14
Analog input connector (CN20) Used to connect the analog torque limit or override analog input signal.	
CC-Link connector (CN1) When using in combination with MR-J3-D01, this connector is not used. Do not connect anything to it.	
Digital display connector (CN30) Used to connect the MR-DP60 digital display. The MR-PRU03 parameter unit or a personal computer cannot be connected.	
Control circuit connector (CNP2) Used to connect the control circuit power supply/ regenerative option.	Section 3.1 Section 3.3 Section 11.1 Section 13.2
I/O signal connector (CN10) Used to connect the digital I/O signal or analog output signal.	
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 3.2 Section 3.4
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.10 Section 13.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 4.9 Section 13.7
Servo motor power connector (CNP3) Used to connect the servo motor.	Section 3.1 Section 3.3 Section 11.1
Battery holder Contains the battery for absolute position data backup.	Section 4.9
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Protective earth (PE) terminal (⏚) Ground terminal.	Section 3.1 Section 3.3 Section 11.1
Rating plate	Section 1.4

Note. Connectors (CNP1, CNP2, and CNP3) and appearance of MR-J3-200T servo amplifier have been changed from January 2008 production. Model name of the existing servo amplifier is changed to MR-J3-200T-RT. For MR-J3-200T-RT, refer to appendix 4.

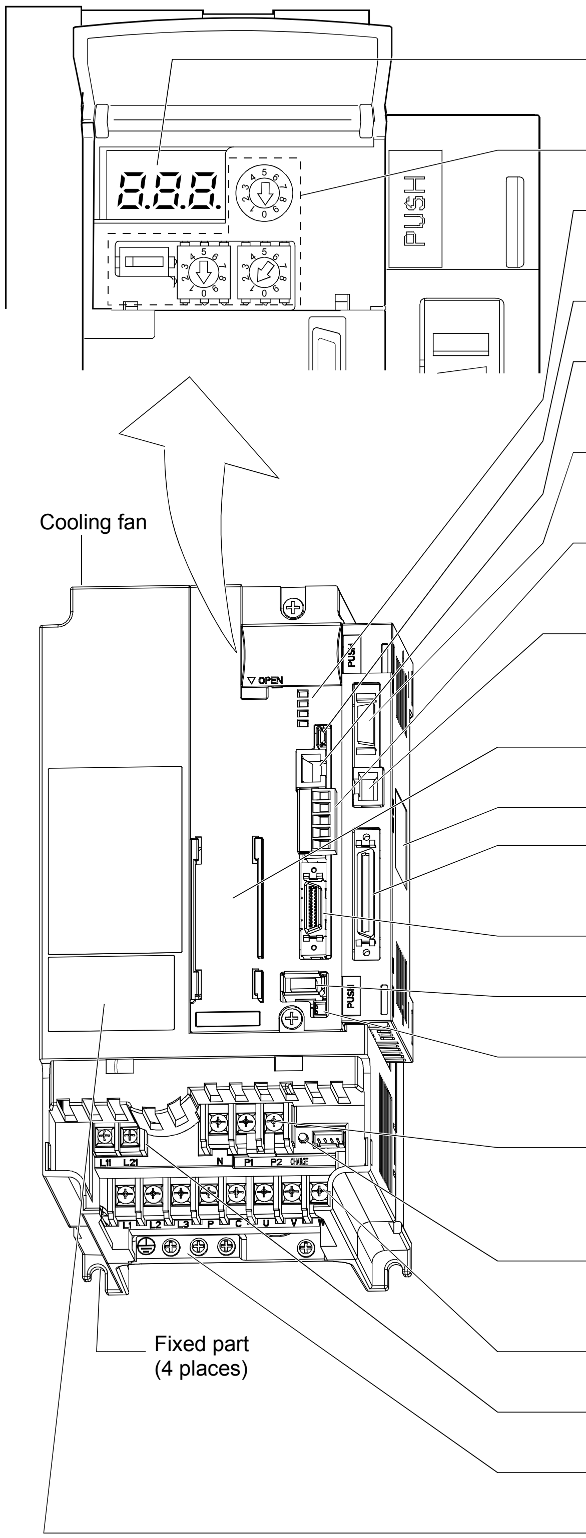
(3) MR-J3-350T



Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 4.3 Chapter 10
When using in combination with MR-J3-D01, do not change the setting (default) shown in the figure.	
Main circuit power supply connector (CNP1) Used to connect the input power supply.	Section 3.1 Section 3.3 Section 11.1
Communication alarm display section When using in combination with MR-J3-D01, the LED display does not have any meaning.	
USB communication connector (CN5) Used to connect the personal computer.	Chapter 6
RS-422 communication connector (CN3) Used to connect the MR-PRU03 parameter unit or personal computer.	Chapter 6 Chapter 7 Chapter 14
Analog input connector (CN20) Used to connect the analog torque limit or override analog input signal.	
CC-Link connector (CN1) When using in combination with MR-J3-D01, this connector is not used. Do not connect anything to it.	
Digital display connector (CN30) Used to connect the MR-DP60 digital display. The MR-PRU03 parameter unit or a personal computer cannot be connected.	
Servo motor power connector (CNP3) Used to connect the servo motor.	Section 3.1 Section 3.3 Section 11.1
I/O signal connector (CN10) Used to connect the digital I/O signal or analog output signal.	
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 3.2 Section 3.4
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.10 Section 13.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 4.9 Section 13.7
Control circuit connector (CNP2) Used to connect the control circuit power supply/ regenerative ption.	Section 3.1 Section 3.3 Section 11.1 Section 13.2
Battery holder Contains the battery for absolute position data backup.	Section 4.9
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Protective earth (PE) terminal (⏚) Ground terminal.	Section 3.1 Section 3.3 Section 11.1
Rating plate	Section 1.4

(4) MR-J3-350T4 · MR-J3-500T(4)

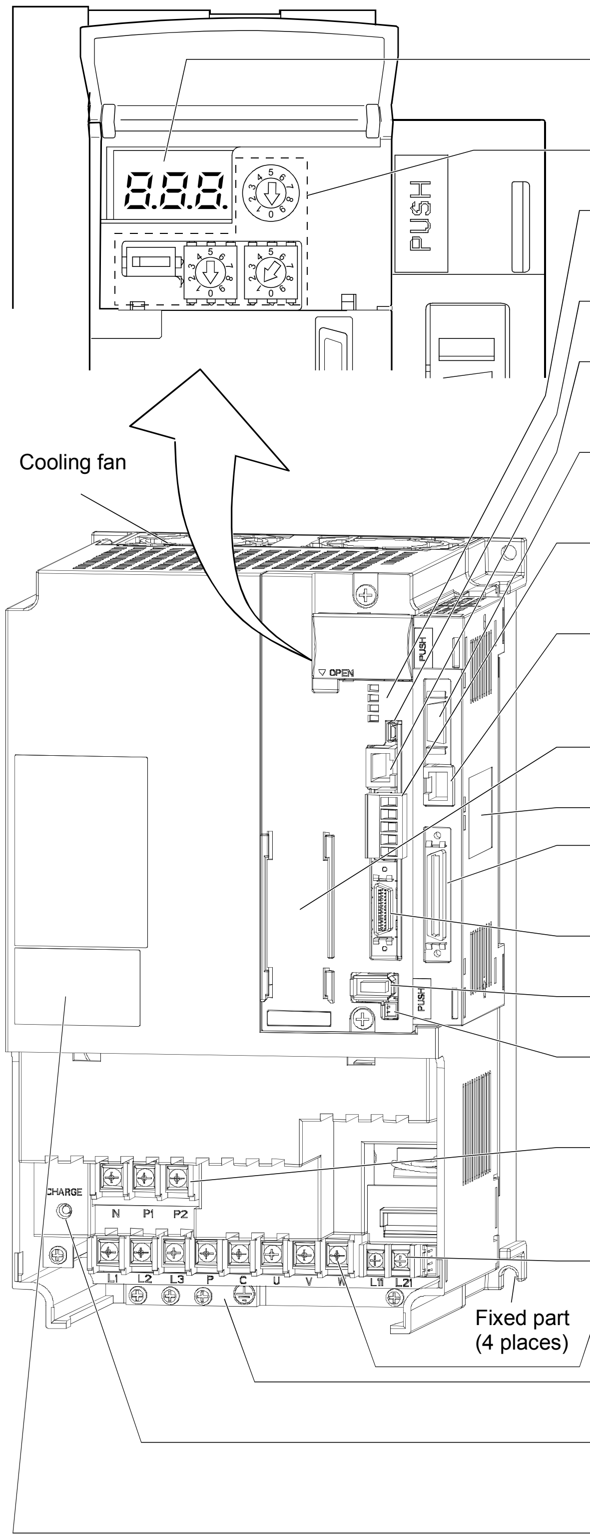
POINT
· The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.6.2.



Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 4.3 Chapter 10
When using in combination with MR-J3-D01, do not change the setting (default) shown in the figure.	
Communication alarm display section When using in combination with MR-J3-D01, the LED display does not have any meaning.	
USB communication connector (CN5) Used to connect the personal computer.	Chapter 6
RS-422 communication connector (CN3) Used to connect the MR-PRU03 parameter unit or personal computer.	Chapter 6 Chapter 7 Chapter 14
Analog input connector (CN20) Used to connect the analog torque limit or override analog input signal.	
CC-Link connector (CN1) When using in combination with MR-J3-D01, this connector is not used. Do not connect anything to it.	
Digital display connector (CN30) Used to connect the MR-DP60 digital display. The MR-PRU03 parameter unit or a personal computer cannot be connected.	
Battery holder Contains the battery for absolute position data backup.	Section 4.9
MR-J3-D01 rating plate	
I/O signal connector (CN10) Used to connect the digital I/O signal or analog output signal.	
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 3.2 Section 3.4
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.10 Section 13.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 4.9 Section 13.7
DC reactor terminal block(TE3) Used to connect the DC reactor.	Section 3.1 Section 3.3 Section 11.1 Section 13.11
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section 3.1 Section 3.3 Section 11.1
Control circuit terminal block (TE2) Used to connect the control circuit power supply.	
Protective earth (PE) terminal (⏚) Ground terminal.	
Rating plate	Section 1.4

(5) MR-J3-700T(4)

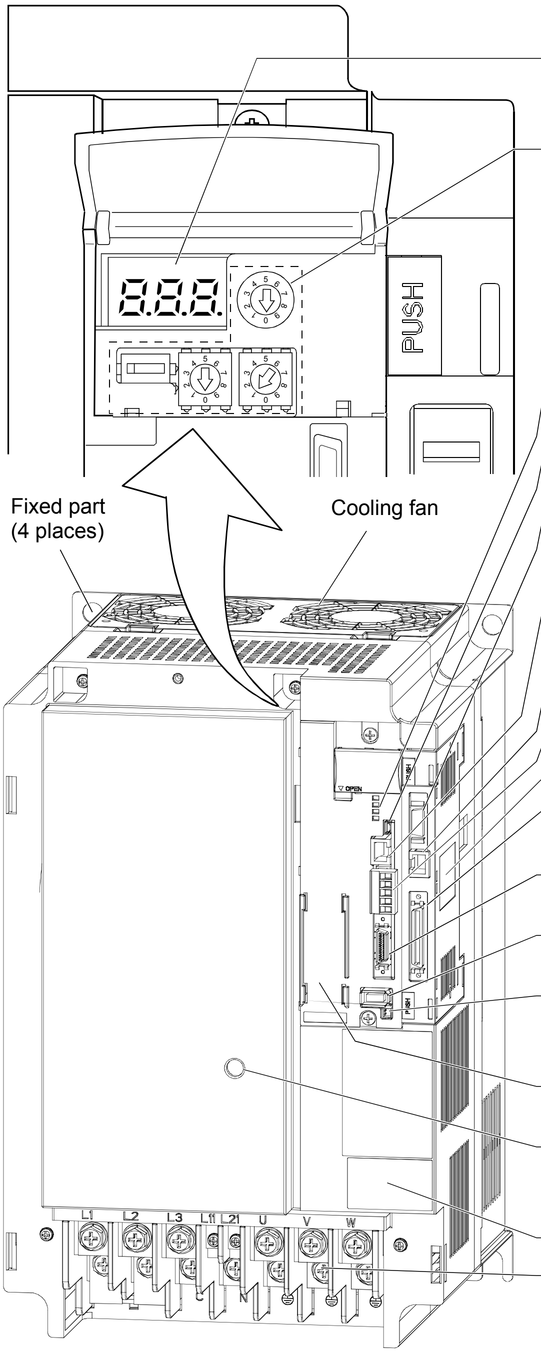
POINT
・The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.6.2.



Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 4.3 Chapter 10
When using in combination with MR-J3-D01, do not change the setting (default) shown in the figure.	
Communication alarm display section When using in combination with MR-J3-D01, the LED display does not have any meaning.	
USB communication connector (CN5) Used to connect the personal computer.	Chapter 6
RS-422 communication connector (CN3) Used to connect the MR-PRU03 parameter unit or personal computer.	Chapter 6 Chapter 7 Chapter 14
Analog input connector (CN20) Used to connect the analog torque limit or override analog input signal.	
CC-Link connector (CN1) When using in combination with MR-J3-D01, this connector is not used. Do not connect anything to it.	
Digital display connector (CN30) Used to connect the MR-DP60 digital display. The MR-PRU03 parameter unit or a personal computer cannot be connected.	
Battery holder Contains the battery for absolute position data backup.	Section 4.9
MR-J3-D01 rating plate	
I/O signal connector (CN10) Used to connect the digital I/O signal or analog output signal.	
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 3.2 Section 3.4
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.10 Section 13.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 4.9 Section 13.7
DC reactor terminal block(TE3) Used to connect the DC reactor.	Section 3.1 Section 3.3 Section 11.1 Section 13.11
Control circuit terminal block (TE2) Used to connect the control circuit power supply.	Section 3.1 Section 3.3 Section 11.1
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	
Protective earth (PE) terminal (⏚) Ground terminal.	
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Rating plate	Section 1.4

(6) MR-J3-11KT(4) to MR-J3-22KT(4)

POINT
・The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.6.2.



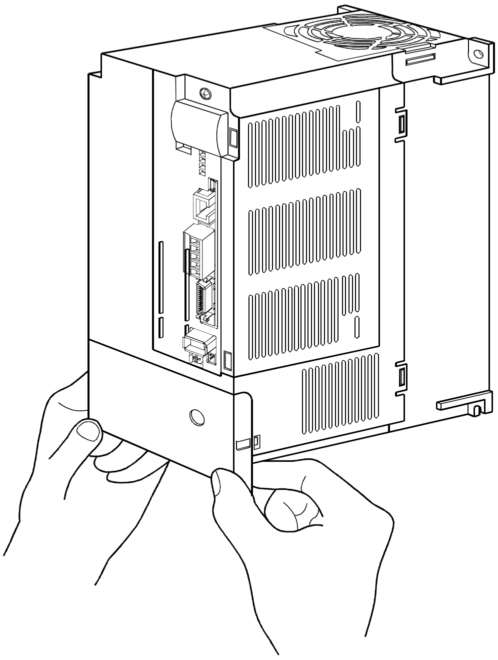
Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 4.3 Chapter 10
When using in combination with MR-J3-D01, do not change the setting (default) shown in the figure.	
Communication alarm display section When using in combination with MR-J3-D01, the LED display does not have any meaning.	
USB communication connector (CN5) Used to connect the personal computer.	Chapter 6
Analog input connector (CN20) Used to connect the analog torque limit or override analog input signal.	
RS-422 communication connector (CN3) Used to connect the MR-PRU03 parameter unit or personal computer.	Chapter 6 Chapter 7 Chapter 14
Digital display connector (CN30) Used to connect the MR-DP60 digital display. The MR-PRU03 parameter unit or a personal computer cannot be connected.	
CC-Link connector (CN1) When using in combination with MR-J3-D01, this connector is not used. Do not connect anything to it.	
MR-J3-D01 rating plate	
I/O signal connector (CN10) Used to connect the digital I/O signal or analog output signal.	
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 3.2 Section 3.4
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.10 Section 13.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 4.9 Section 13.7
Battery holder Contains the battery for absolute position data backup.	Section 4.9
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Rating plate	Section 1.4
Main circuit terminal block, Control circuit and Protective earth (TE) Used to connect the input power supply, servo motor, regenerative option, and grounding.	Section 3.1 Section 3.3 Section 11.1 Section 13.11

1.6.2 Removal and reinstallation of the front cover

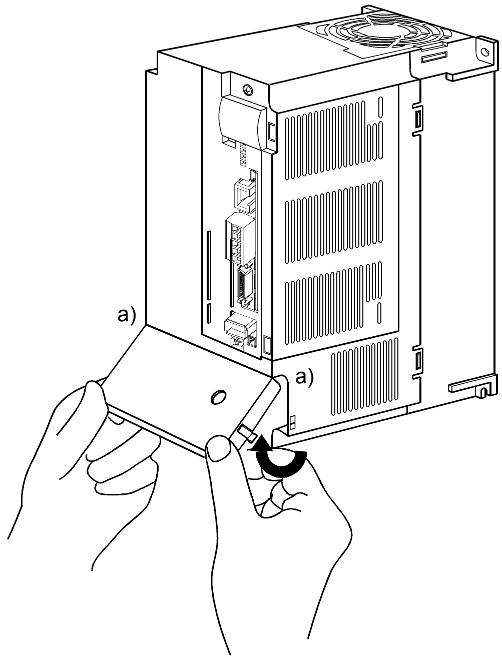
WARNING	・Before removing or installing the front cover, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P(＋) and N(－) is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, always confirm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

(1) For MR-J3-350T4・MR-J3-500T(4)・MR-J3-700T(4)

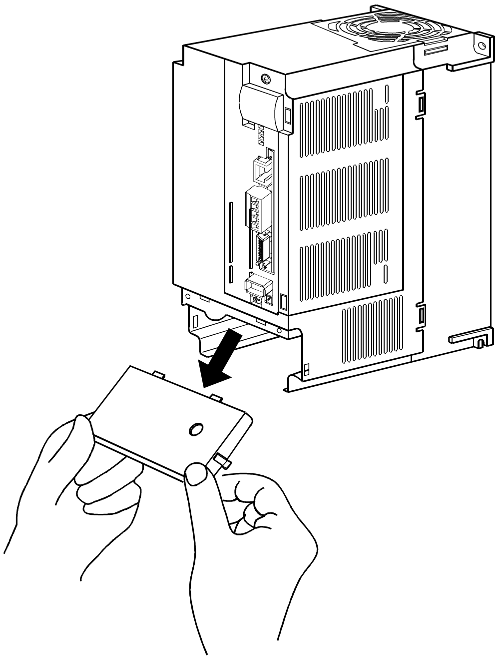
Removal of the front cover



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

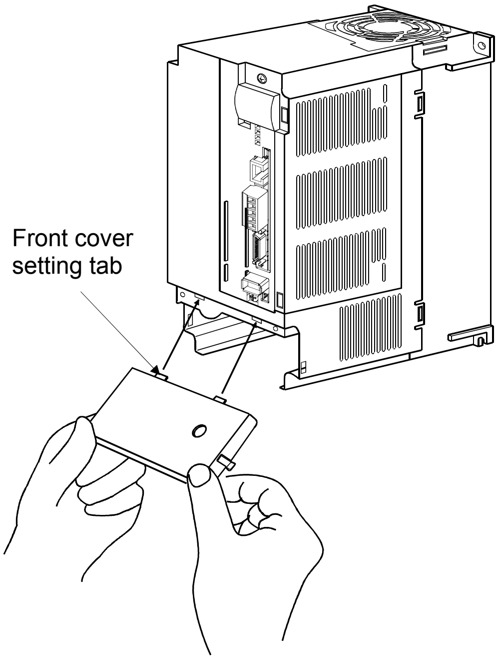


Pull up the cover, supporting at point a).

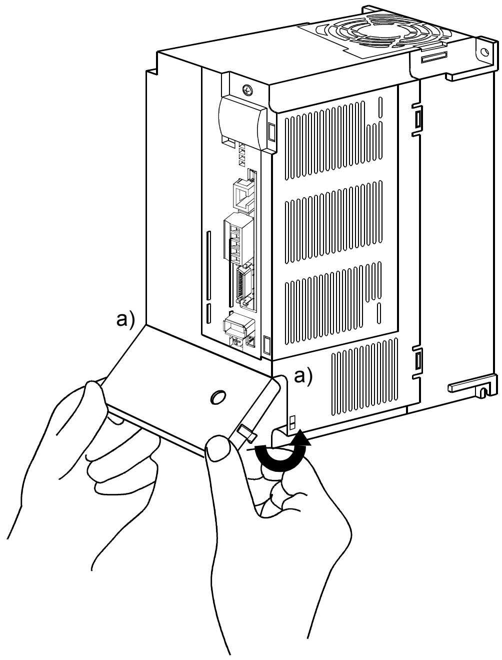


Pull out the front cover to remove.

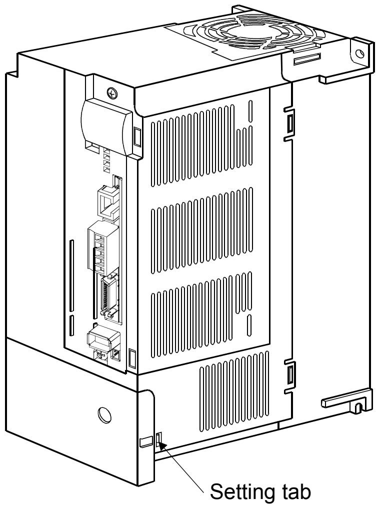
Reinstallation of the front cover



Insert the front cover setting tabs into the sockets of servo amplifier (2 places).



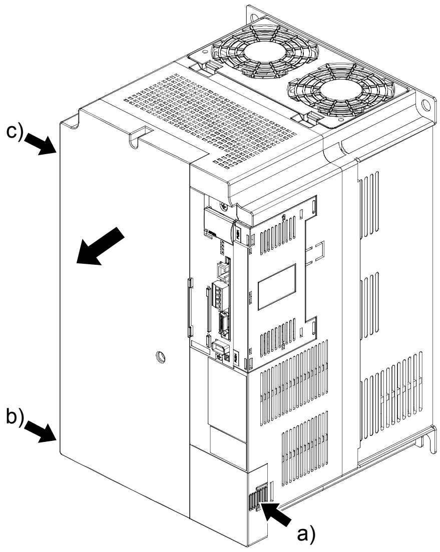
Pull up the cover, supporting at point a).

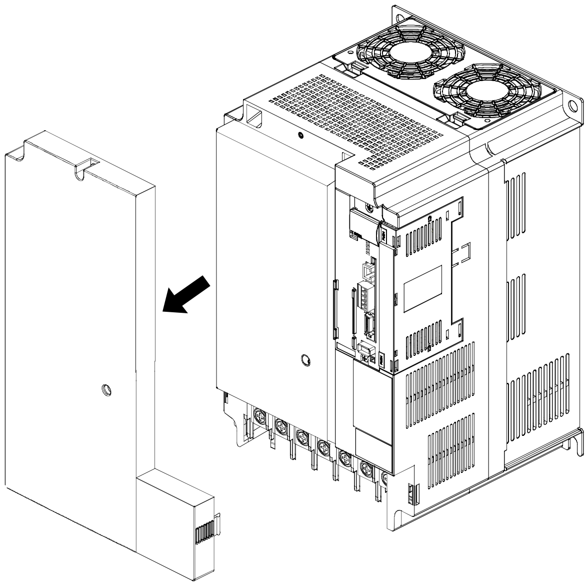


Push the setting tabs until they click.

(2) For MR-J3-11KT(4) to MR-J3-22KT(4)

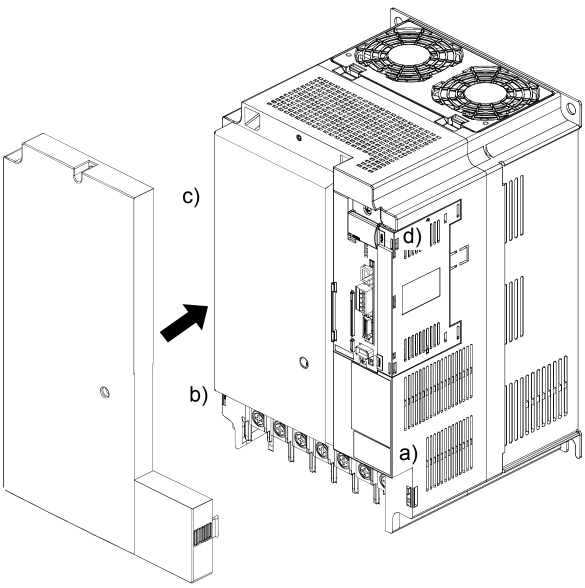
Removal of the front cover

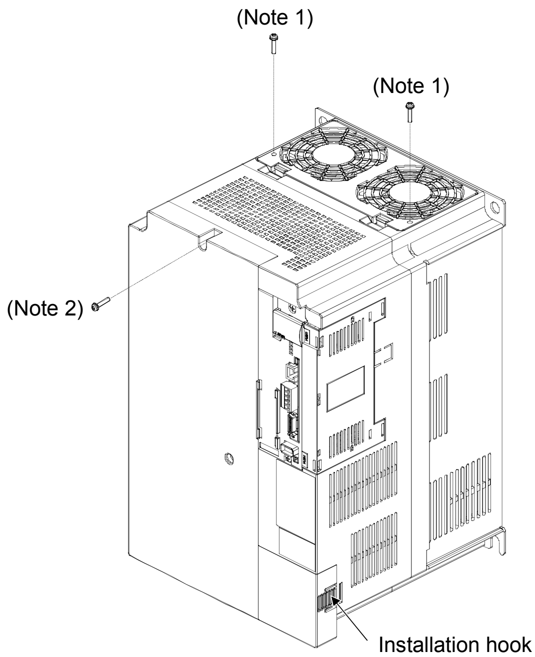




1) Press the removing knob on the lower side of the front cover (a) and b)) and release the installation hook.
2) Press the removing knob of c) and release the external hook.
3) Pull it to remove the front cover.

Reinstallation of the front cover





1) Fit the front cover installation hooks on the sockets of body cover (a) to d)) to reinstall it.
2) Push the front cover until you hear the clicking noise of the installation hook.

Note 1. The cooling fan cover can be locked with enclosed screws (M4 × 40).

2. By drilling approximately ϕ4 of a hole on the front cover, the front cover can be locked on the body with an enclosed screw (M4 × 14).

1.6.3 Installation and removal of MR-J3-D01

⚠WARNING	・Before installing or removing the MR-J3-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, always confirm from the front of the servo amplifier, whether the charge lamp is off or not.

⚠CAUTION	・Avoid installing and removing the MR-J3-D01 repeatedly. Any contact failure of the connector may be caused. ・Avoid unsealing the MR-J3-D01 to be free dust and dirt against the connector except installing. Make sure to use the pre-packing when storing. ・Avoid using the MR-J3-D01 which the hook and knobs for fixing are damaged. Any contact failure of the connector may be caused. ・When installing and removing the MR-J3-D01 to the MR-J3-500T or more, avoid dropping out the installing screw inside it. Any malfunctions of the servo motor may be caused. ・When installing and removing the MR-J3-D01 to the MR-J3-500T or more, avoid damaging the control board by the fixing plate. Any malfunctions of the servo motor may be caused. ・Make sure to tighten the MR-J3-D01 with the enclosed installing screws when installing.

POINT

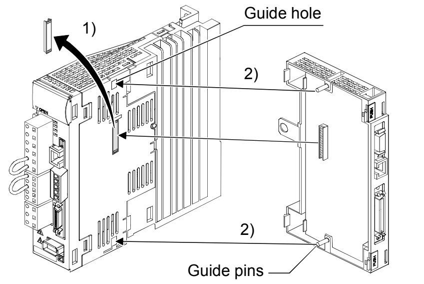
- The internal circuits of the servo amplifier may be damaged by static electricity.

  Always take the following precautions.

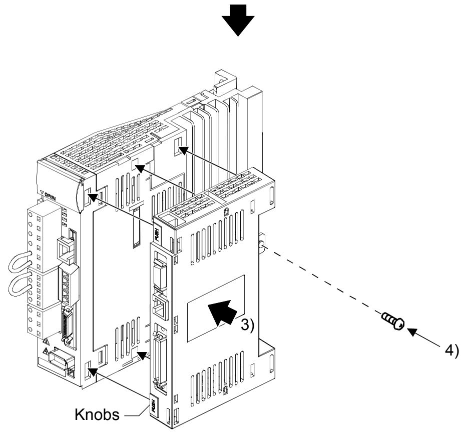
  - Ground human body and work bench.
  - Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

(1) For MR-J3-350T or less・MR-J3-200T4 or less

(a) Installation of the MR-J3-D01

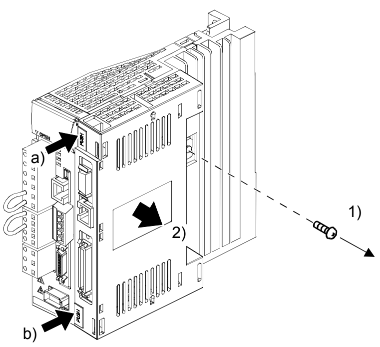


1) Remove the cover of connector for connecting an option. Make sure to storage the removed cover.
2) Insert the guide pins through the each guide hole on the side of servo amplifier.

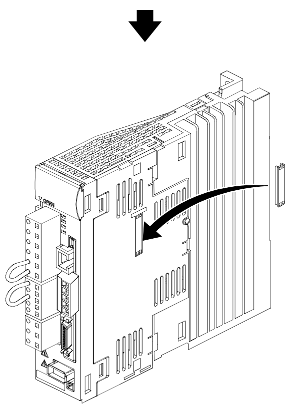


3) Push the MR-J3-D01 until the knobs click.
4) Tighten the MR-J3-D01 with the enclosed installing screw(M4).

(b) Removal of the MR-J3-D01



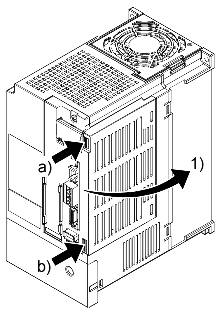
1) Loosen the installing screw.
2) Keep pushing the knobs(a) , b)) and pull out the MR-J3-D01 to the arrow direction. Avoid pulling out the MR-J3-D01 under it is tightened.



When removing the MR-J3-D01, make sure to reinstall the cover of connector for connecting an option to avoid dust and dirt.

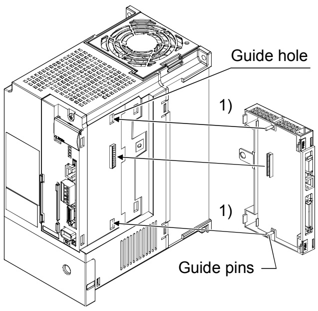
(2) For MR-J3-350T4 · MR-J3-500T(4) · MR-J3-700T(4)

(a) Removal of the side cover

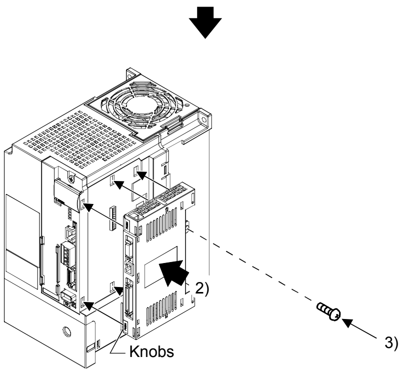


Keep pushing the knobs(a) , b)) and pull out the side cover to the arrow direction.

(b) Installation of MR-J3-D01

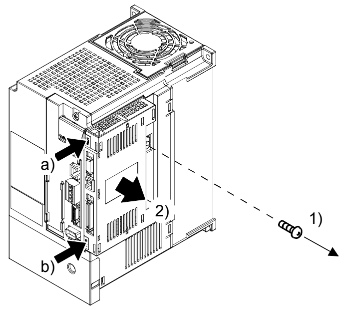


1) Insert the guide pins through the each guide hole on the side of servo amplifier.



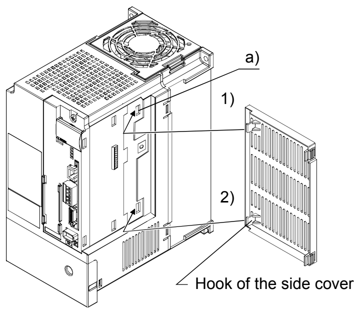
2) Push the MR-J3-D01 until the knobs click.
3) Tighten the MR-J3-D01 with the enclosed installing screw(M4).

(c) Removal of MR-J3-D01

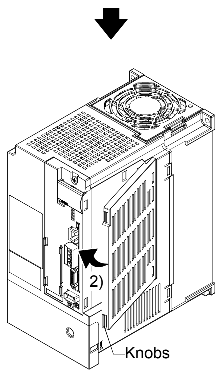


1) Loosen the installing screw.
2) Keep pushing the knobs(a) , b)) and pull out the MR-J3-D01 to the arrow direction. Avoid pulling out the MR-J3-D01 under it is tightened.

(d) Installation of the side cover



1) Insert the hook of the side cover through the each guide hole a) on the side of servo amplifier.

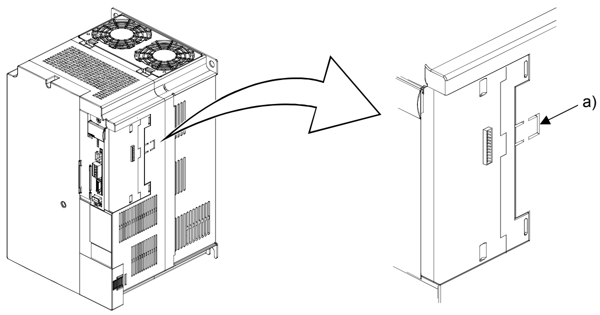


2) Push the side cover at the supporting point a) until the knobs click.

(3) For MR-J3-11KT(4) to MR-J3-22KT(4)

CAUTION	・Avoid touching any remained burr after cutting off the part a) of the case. Any injuries may be caused.

The installing screws for the MR-J3-11KT(4) or more are covered at shipping. When installing the MR-J3-D01 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 MR-J3-D01 are installed. Avoid entering unwanted parts inside of the servo amplifier from the opened area. Refer to section 3.2 (2) in this section for installing and removing the MR-J3-D01. The side cover for the MR-J3-11KT(4) or more is the same construction as the MR-J3-D01. Install and remove the side cover in the same procedure as the MR-J3-D01. However, the installing screw for the side cover is unnecessary.

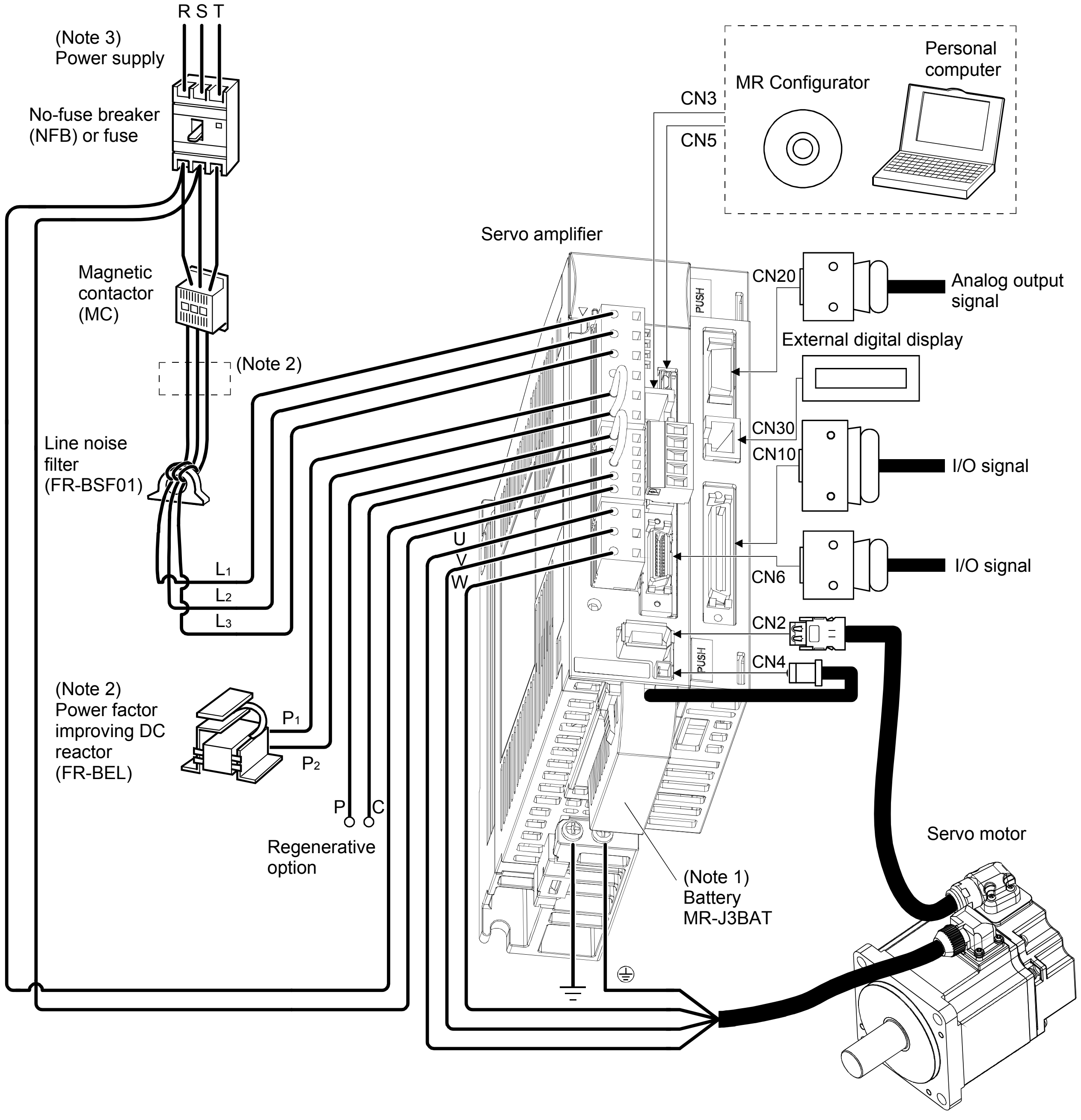


1.7 Configuration including auxiliary equipment

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

(1) MR-J3-100T or less

(a) For 3-phase or 1-phase 200V to 230VAC

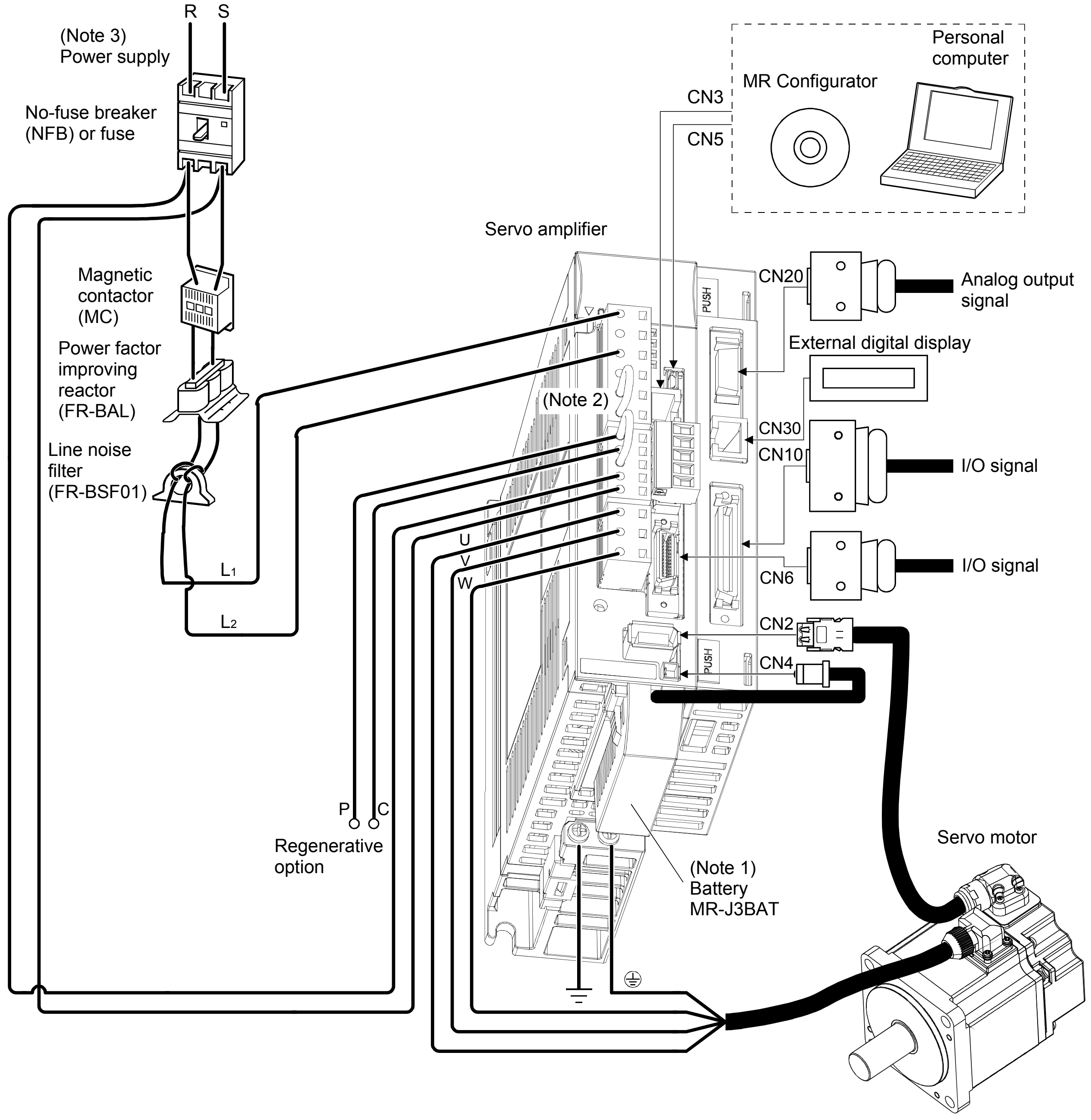


Note 1. The battery (option) is used for the absolute position detection system in the position control mode.

2. The AC reactor can also be used. In this case, the DC reactor cannot be used. When not using DC reactor, short P_1-P_2.

3. A 1-phase 200V to 230VAC power supply may be used with the servo amplifier of MR-J3-70T or less.
For 1-phase 200V to 230VAC, connect the power supply to L_1 ・ L_2 and leave L_3 open. Refer to section 1.2 for the power supply specification.

(b) For 1-phase 100V to 120VAC

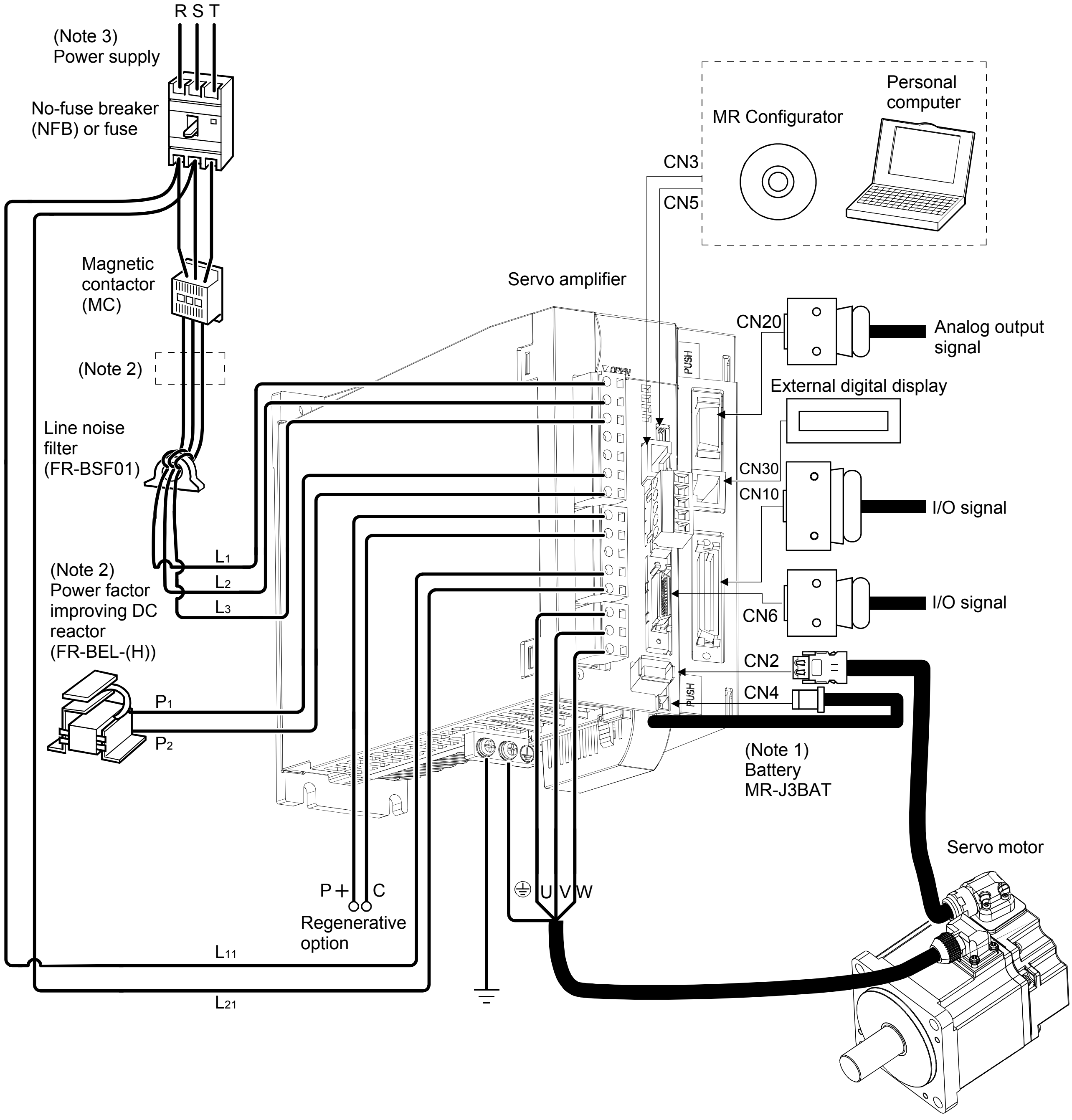


Note 1. The battery (option) is used for the absolute position detection system in the position control mode.

2. The power factor improving DC reactor cannot be used.

3. Refer to section 1.2 for the power supply specification.

(2) MR-J3-60T4 · MR-J3-100T4

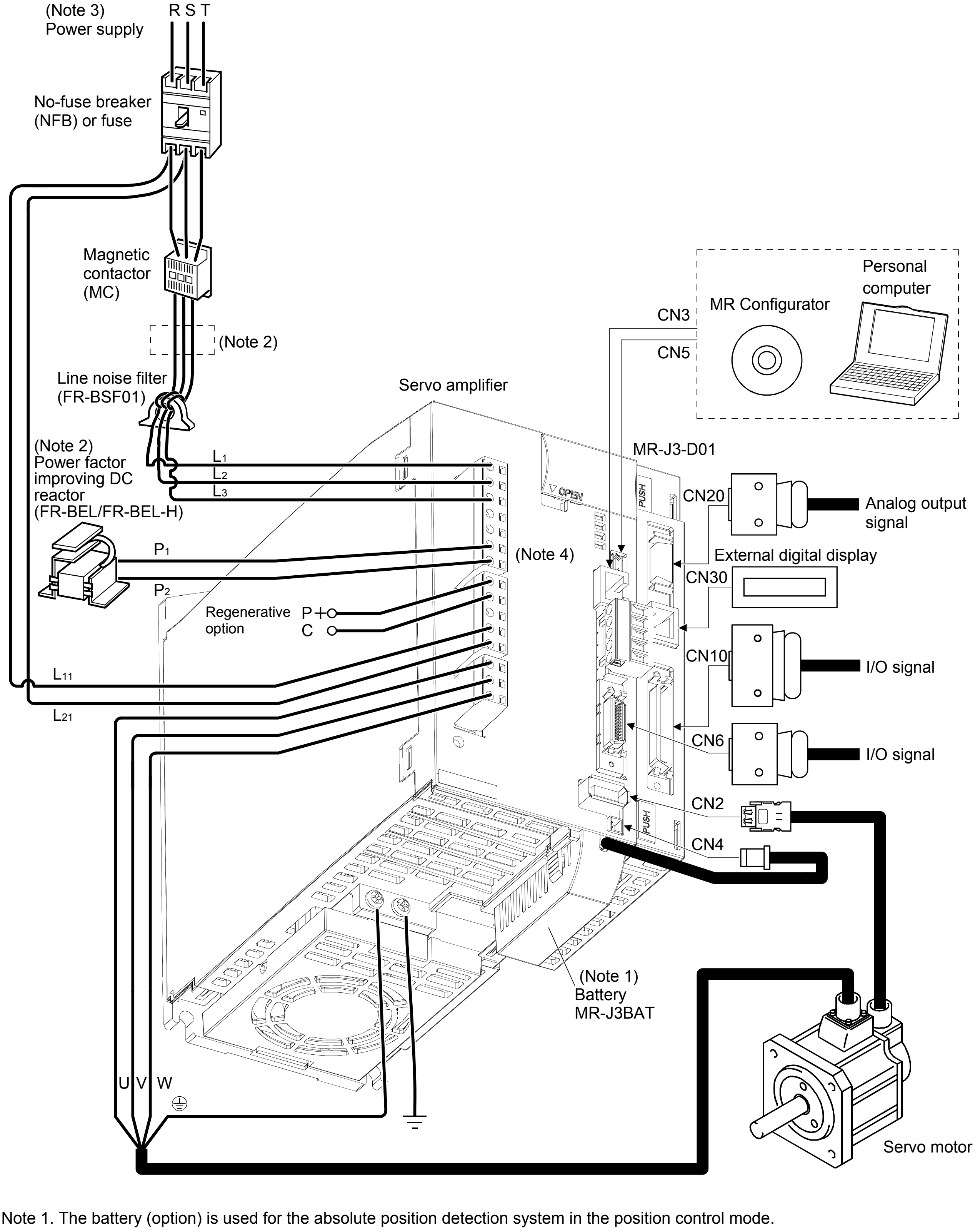


Note 1. The battery (option) is used for the absolute position detection system in the position control mode.

2. The AC reactor can also be used. In this case, the DC reactor cannot be used. When not using DC reactor, short P_1-P_2.

3. Refer to section 1.2 for the power supply specification.

(3) MR-J3-200T(4)



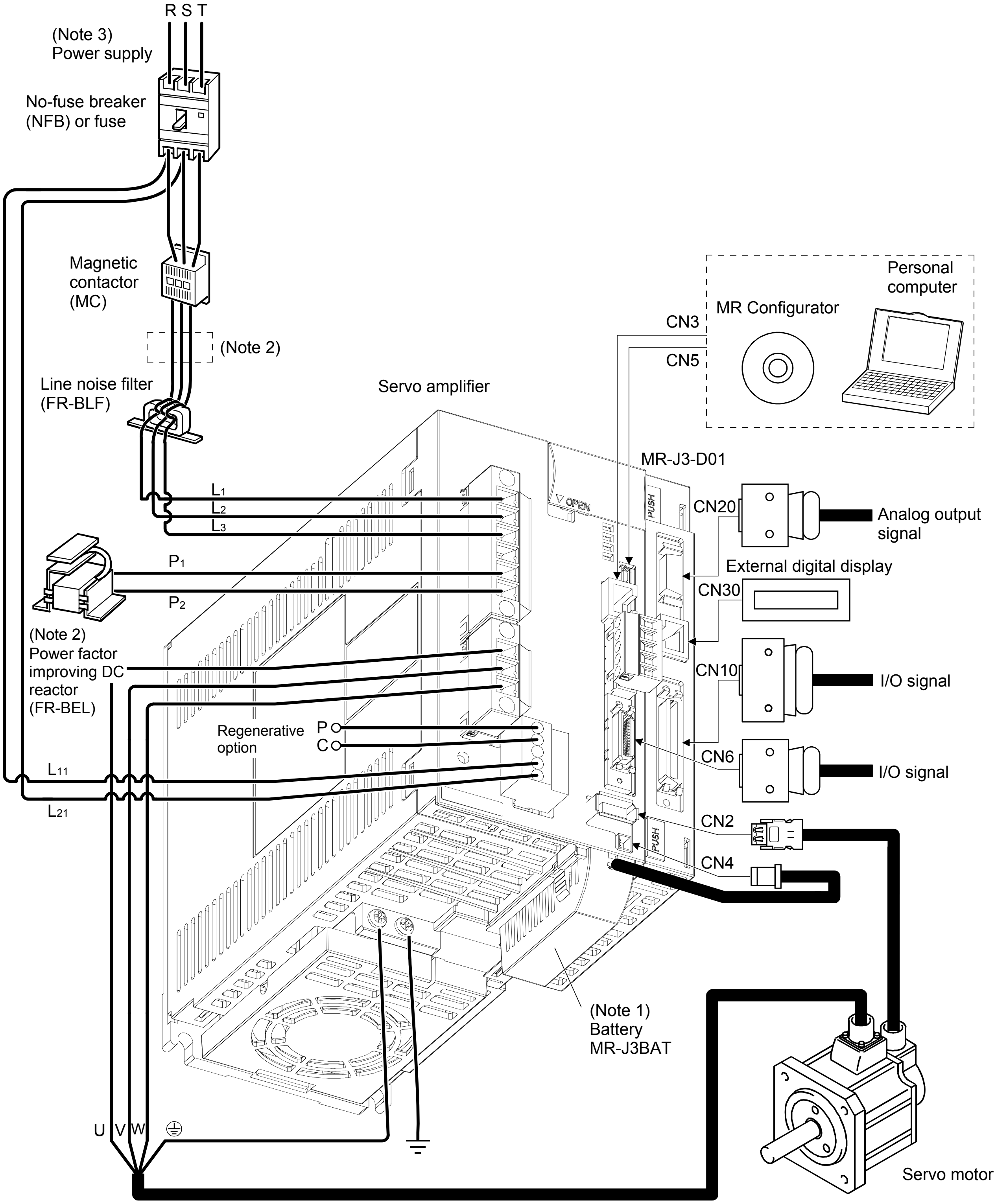
Note 1. The battery (option) is used for the absolute position detection system in the position control mode.

2. The AC reactor can also be used. In this case, the DC reactor cannot be used. When not using DC reactor, short P_1-P_2.

3. Refer to section 1.2 for the power supply specification.

4. Connectors (CNP1, CNP2, and CNP3) and appearance of MR-J3-200T servo amplifier have been changed from January 2008 production. Model name of the existing servo amplifier is changed to MR-J3-200T-RT. For MR-J3-200T-RT, refer to appendix 4.

(4) MR-J3-350T

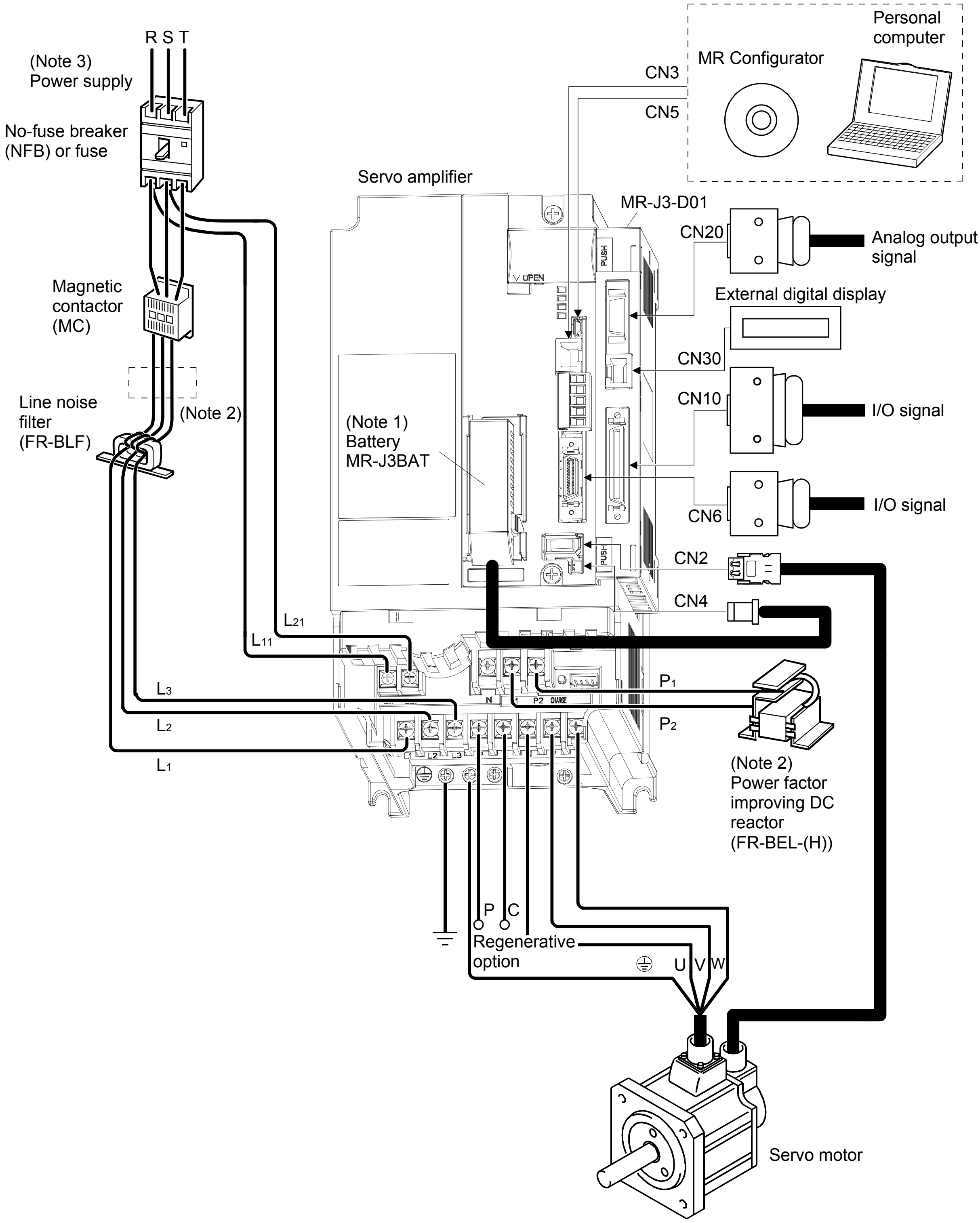


Note 1. The battery (option) is used for the absolute position detection system in the position control mode.

2. The AC reactor can also be used. In this case, the DC reactor cannot be used. When not using DC reactor, short P_1-P_2.

3. Refer to section 1.2 for the power supply specification.

(5) MR-J3-350T4 · MR-J3-500T(4)

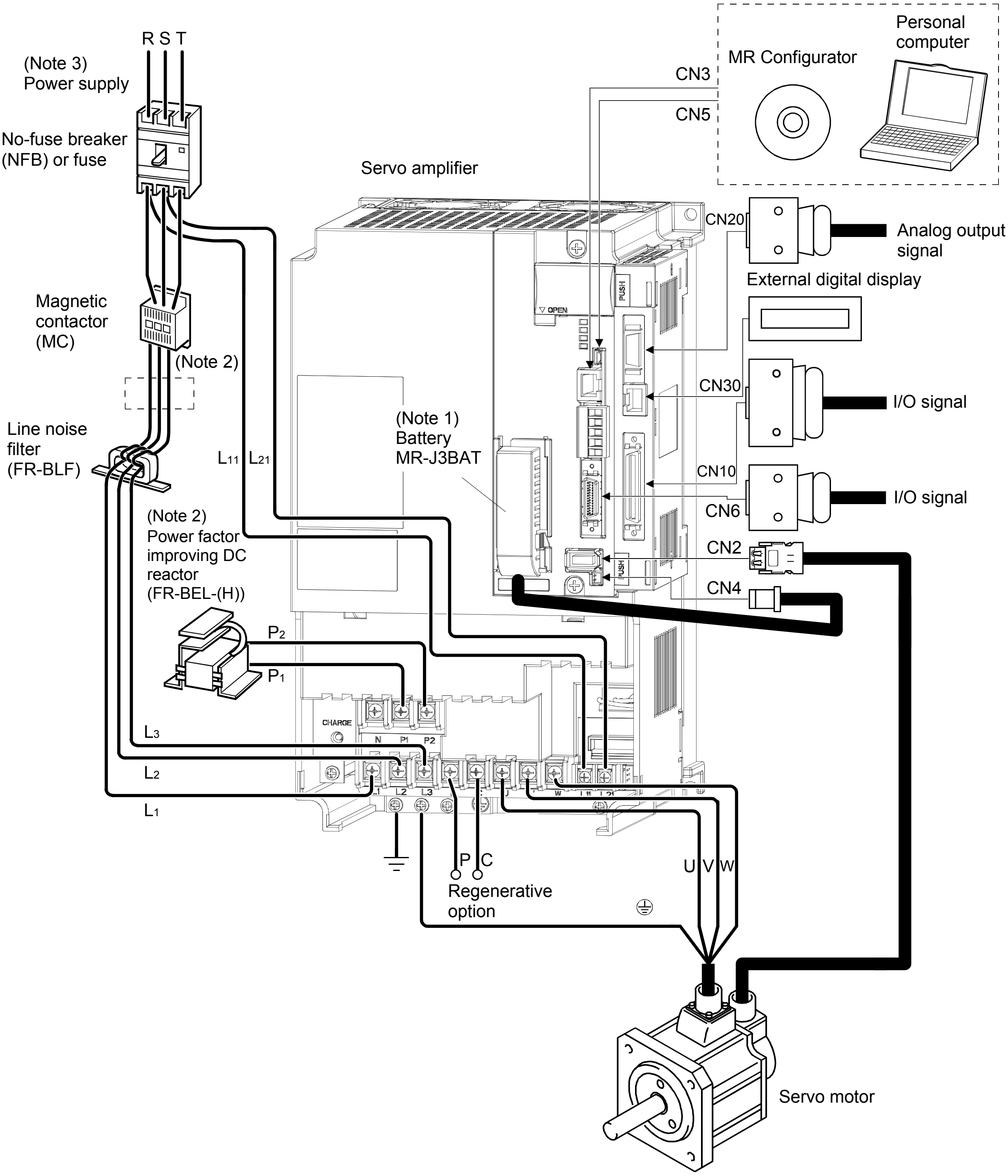


Note 1. The battery (option) is used for the absolute position detection system in the position control mode.

2. The AC reactor can also be used. In this case, the DC reactor cannot be used. When not using DC reactor, short P_1-P_2.

3. Refer to section 1.2 for the power supply specification.

(6) MR-J3-700T(4)

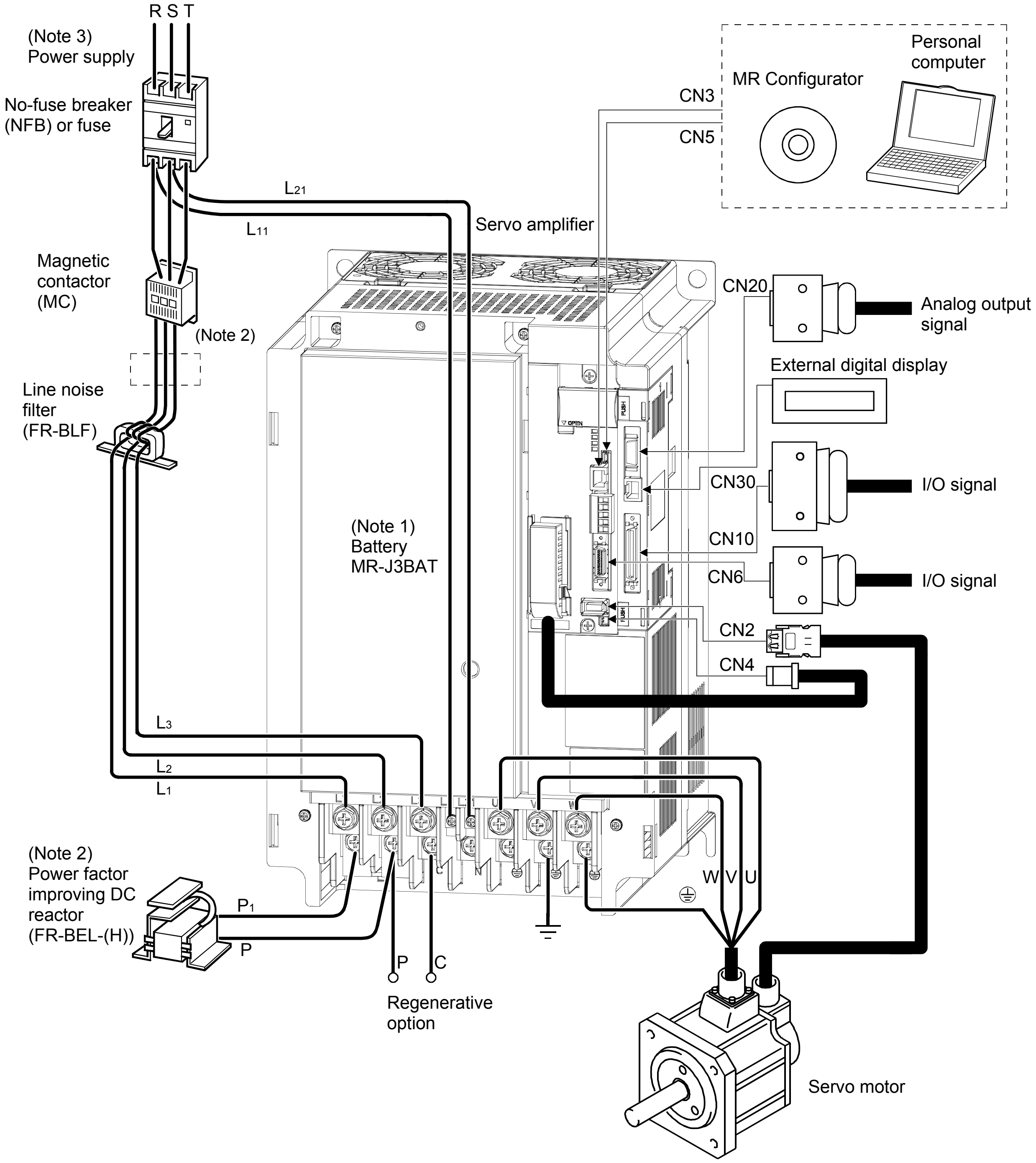


Note 1. The battery (option) is used for the absolute position detection system in the position control mode.

2. The AC reactor can also be used. In this case, the DC reactor cannot be used. When not using DC reactor, short P_1-P_2.

3. Refer to section 1.2 for the power supply specification.

(7) MR-J3-11KT(4) to MR-J3-22KT(4)



Note 1. The battery (option) is used for the absolute position detection system in the position control mode.

2. The AC reactor can also be used. In this case, the DC reactor cannot be used. When not using DC reactor, short P_1-P.

3. Refer to section 1.2 for the power supply specification.

MEMO

2. INSTALLATION

CAUTION

- Stacking in excess of the limited number of products is not allowed.
- Install the equipment to incombustibles. Installing them directly or close to combustibles will led to a fire.
- Install the equipment in a load-bearing place in accordance with this Instruction Manual.
- Do not get on or put heavy load on the equipment to prevent injury.
- Use the equipment within the specified environmental condition range. (For the environmental conditions, refer to section 1.2.)
- Provide an adequate protection to prevent screws, metallic detritus and other conductive matter or oil and other combustible matter from entering the servo amplifier.
- Do not block the intake/exhaust ports of the servo amplifier. Otherwise, a fault may occur.
- Do not subject the servo amplifier to drop impact or shock loads as they are precision equipment.
- Do not install or operate a faulty servo amplifier.
- When the product has been stored for an extended period of time, consult Mitsubishi.

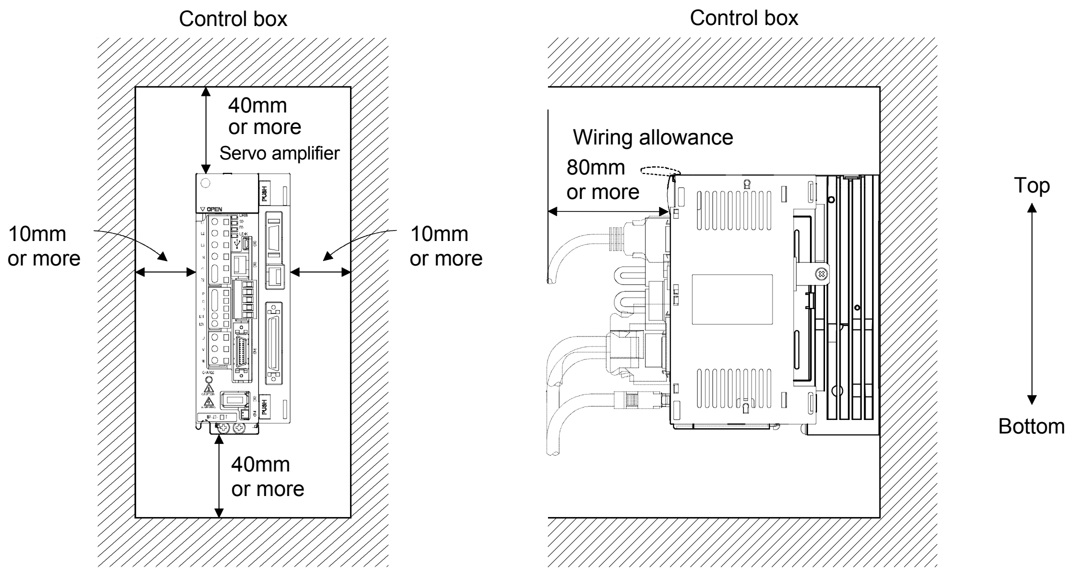
2.1 Installation direction and clearances

CAUTION

- The equipment must be installed in the specified direction. Otherwise, a fault may occur.
- Leave specified clearances between the servo amplifier and control box inside walls or other equipment.

(1) 7kW or less

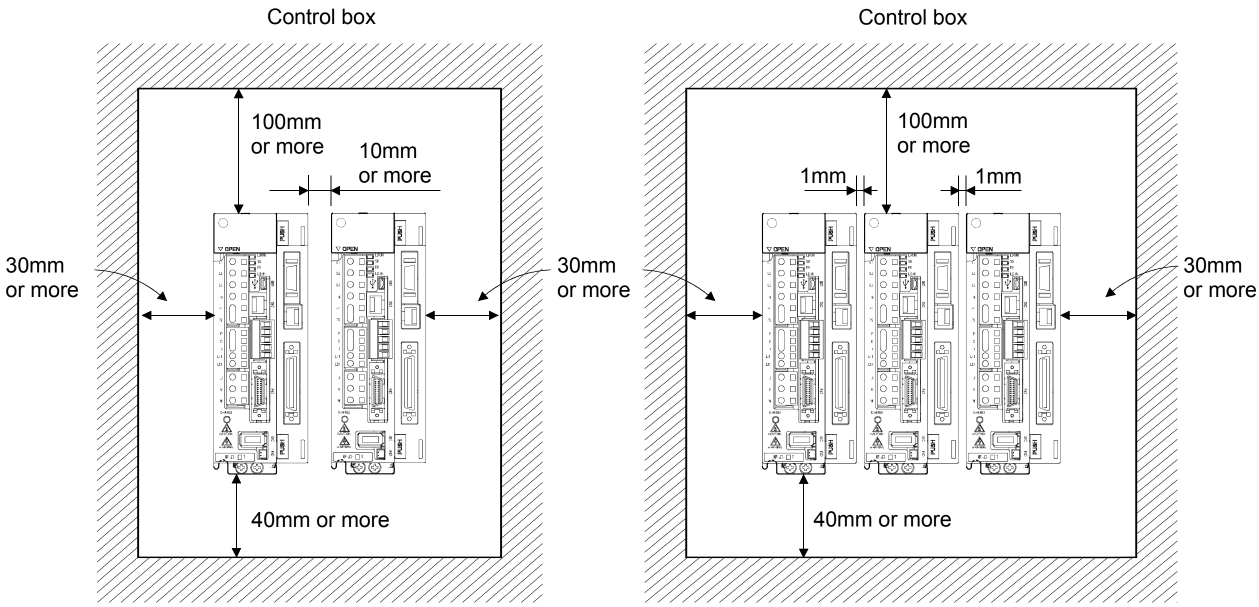
(a) Installation of one servo amplifier



(b) Installation of two or more servo amplifiers

POINT
・Close mounting is available for the servo amplifier of under 3.5kW for 200V class and 400W for 100V class.

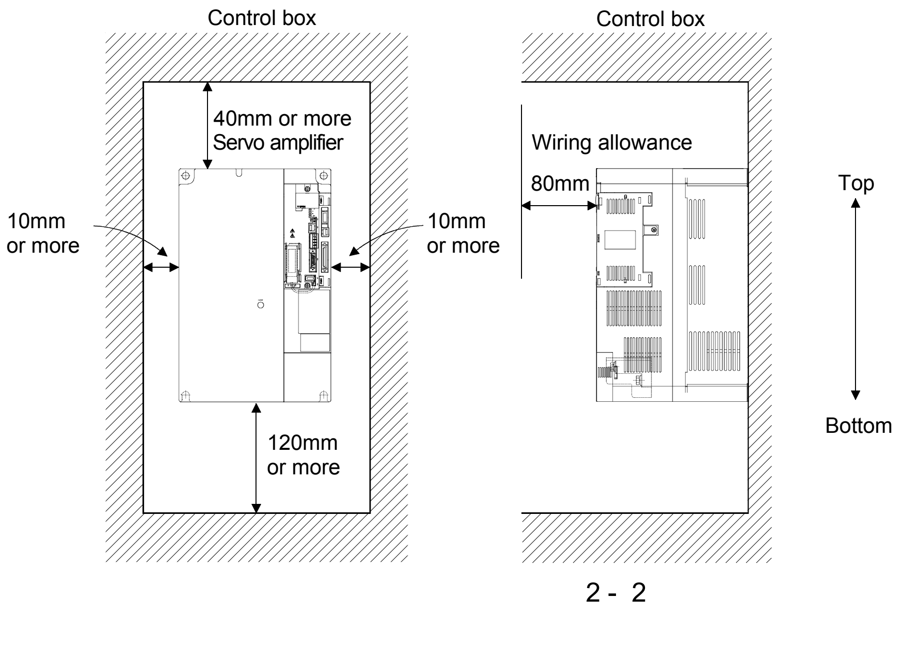
Leave a large clearance between the top of the servo amplifier and the internal surface of the control box, and install a cooling fan to prevent the internal temperature of the control box from exceeding the environmental conditions.
When installing the servo amplifiers closely, leave a clearance of 1mm between the adjacent servo amplifiers in consideration of mounting tolerances.
In this case, bring the ambient temperature within 0 to 45℃ (32 to 113℉), or use it at 75% or a smaller effective load ratio.



Leaving clearance　　　Mounting closely

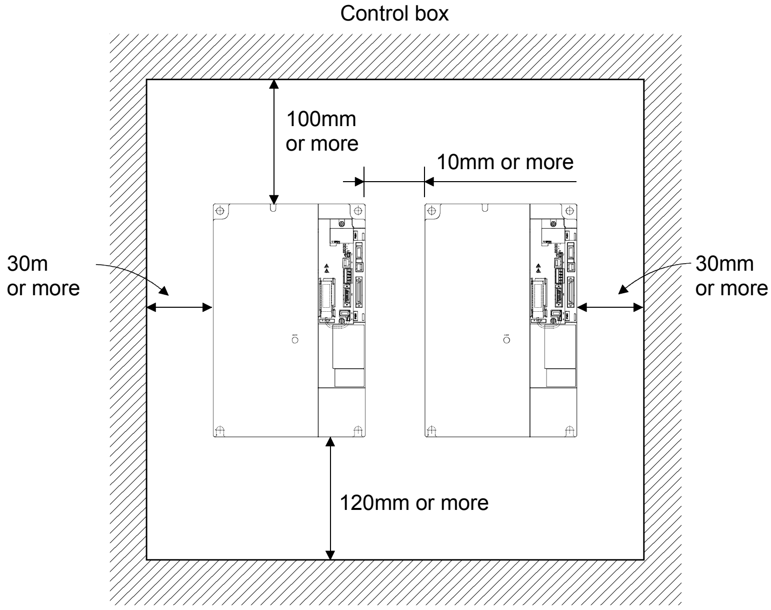
(2) 11k to 22kW

(a) Installation of one servo amplifier



(b) Installation of two or more servo amplifiers

Leave a large clearance between the top of the servo amplifier and the internal surface of the control box, and install a cooling fan to prevent the internal temperature of the control box from exceeding the environmental conditions.



(3) Others

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

2.2 Keep out foreign materials

(1) When installing the unit in a control box, 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 control box or a cooling fan installed on the ceiling.

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

2.3 Cable stress

(1) The way of clamping the cable must be fully examined so that flexing 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, 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 flexing life range. Use the power supply and brake wiring cables within the flexing life of the cables.

(3) Avoid any probability that the cable sheath 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 will move, the flexing radius should be made as large as possible. Refer to section 12.4 for the flexing 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, always confirm from the front of the servo amplifier whether the charge lamp is off or not. ・Any person who is involved in inspection should be fully competent to do the work. Otherwise, you may get an electric shock. For repair and parts replacement, contact your safes representative.

POINT

- Do not test the servo amplifier with a megger (measure insulation resistance), or it may become faulty.
- Do not disassemble and/or repair the equipment on customer side.

It is recommended to make the following checks periodically.

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

(2) Check the cables and the like for scratches and cracks. Perform periodic inspection according to operating conditions.

2.5 Parts having service lives

The following parts must be changed periodically as listed below. If any part is found faulty, it must be changed immediately even when it has not yet reached the end of its life, which depends on the operating method and environmental conditions. For parts replacement, please contact your sales representative.

Part name		Life guideline
Servo amplifier	Smoothing capacitor	10 years
	Relay	Number of power-on and number of forced stop times : 100,000 times
	Cooling fan	10,000 to 30,000hours (2 to 3 years)
	Absolute position battery	Refer to section 4.9

(a) Smoothing capacitor

Affected by ripple currents, etc. and deteriorates in characteristic. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its life in 10 years of continuous operation in normal air-conditioned environment.

(b) Relays

Their contacts will wear due to switching currents and contact faults occur. Relays reach the end of their life when the cumulative number of power-on and forced stop times is 100,000, which depends on the power supply capacity.

(c) Servo amplifier cooling fan

The cooling fan bearings reach the end of their life in 10,000 to 30,000 hours. Normally, therefore, the cooling fan must be changed in a few years of continuous operation as a guideline.

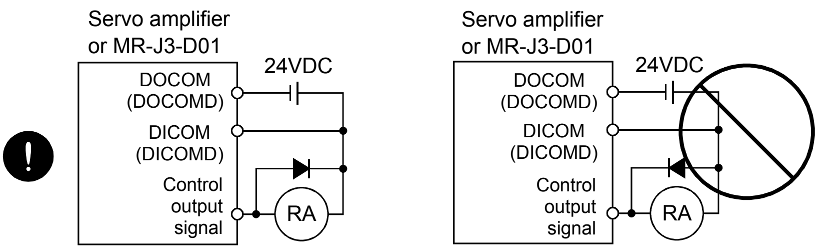
It must also be changed if unusual noise or vibration is found during inspection.

3. SIGNALS AND WIRING

⚠WARNING	・Any person who is involved in wiring should be fully competent to do the work. ・Before wiring, turn off the power and wait for 15 minutes or more until the charge lamp turns off. 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, always confirm from the front of the servo amplifier whether the charge lamp is off or not. ・Ground the servo amplifier and the servo motor securely. ・Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, you may get an electric shock. ・The cables should not be damaged, stressed excessively, loaded heavily, or pinched. Otherwise, you may get an electric shock.

⚠CAUTION

・Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly, resulting in injury.
・Connect cables to correct terminals to prevent a burst, fault, etc.
・Ensure that polarity (+, −) is correct. Otherwise, a burst, damage, etc. may occur.
・The surge absorbing diode installed to the DC relay designed for control output should be fitted in the specified direction. Otherwise, the signal is not output due to a fault, disabling the forced stop (EMG) and other protective circuits.



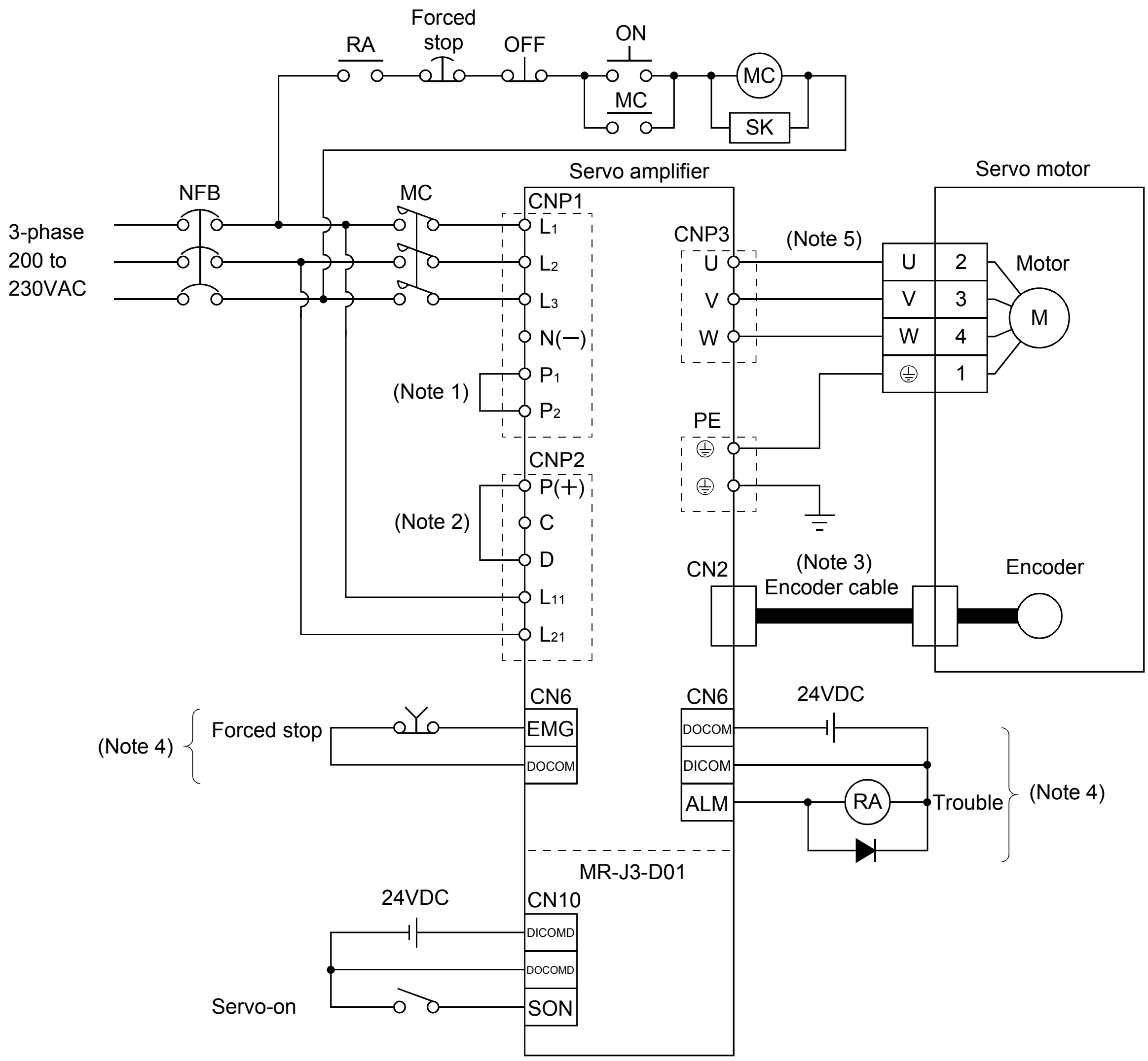
・Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be given to electronic equipment used near the servo amplifier.
・Do not install a power capacitor, surge suppressor or radio noise filter (FR-BIF-(H) option) with the power line of the servo motor.
・When using 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.
・During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.

3.1 Input power supply circuit

CAUTION	
⚠ CAUTION	· Always connect a magnetic contactor (MC) between the main circuit power supply and L_1, L_2, and L_3 of the servo amplifier, and configure the wiring to be able to shut down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor (MC) is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions. · Use the trouble (ALM) to switch power off. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

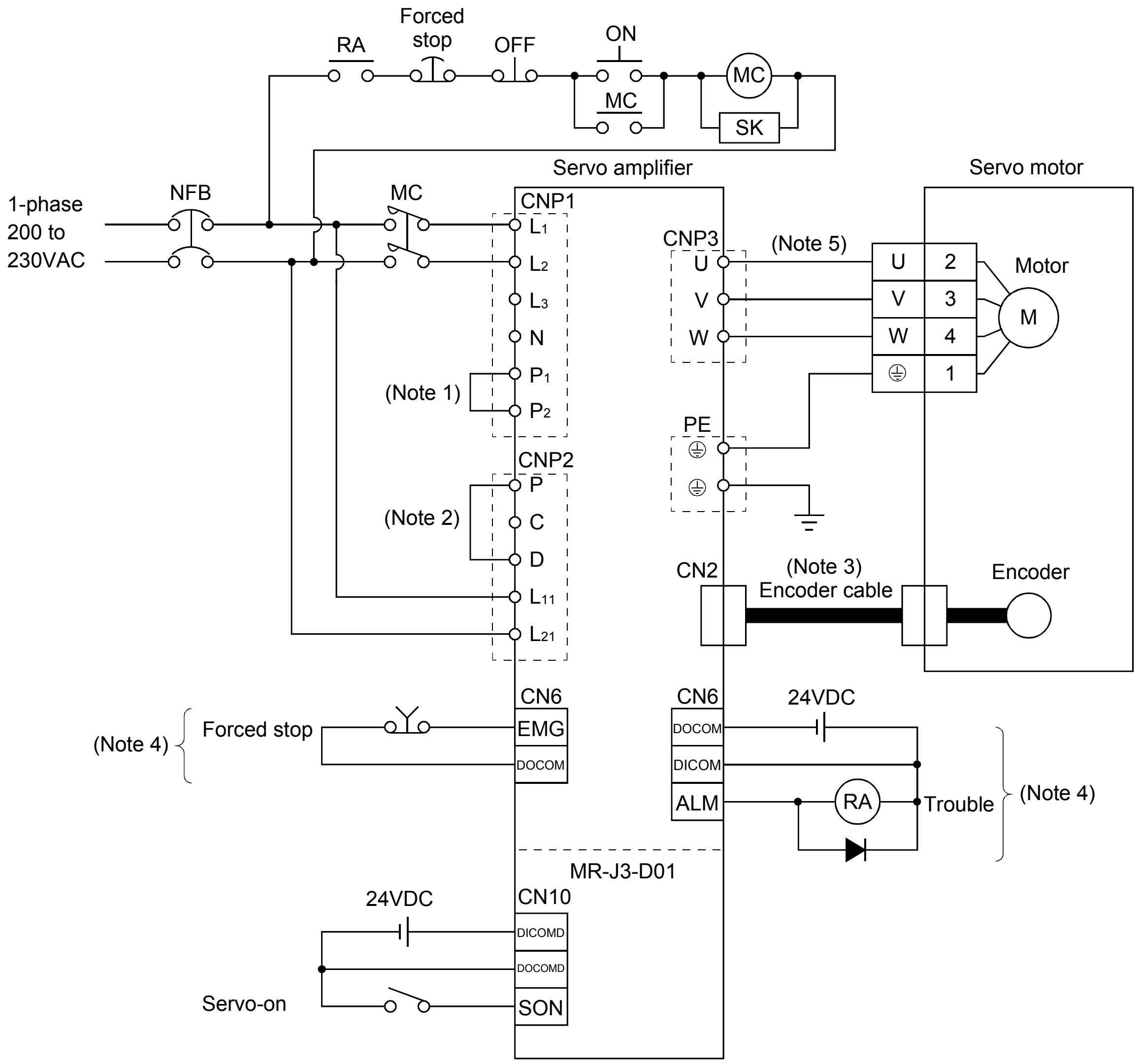
Wire the power supply and main circuit as shown below so that the servo-on (SON) turns off as soon as alarm occurrence is detected and power is shut off.
A no-fuse breaker (NFB) must be used with the input cables of the power supply.

(1) For 3-phase 200 to 230VAC power supply to MR-J3-10T to MR-J3-350T



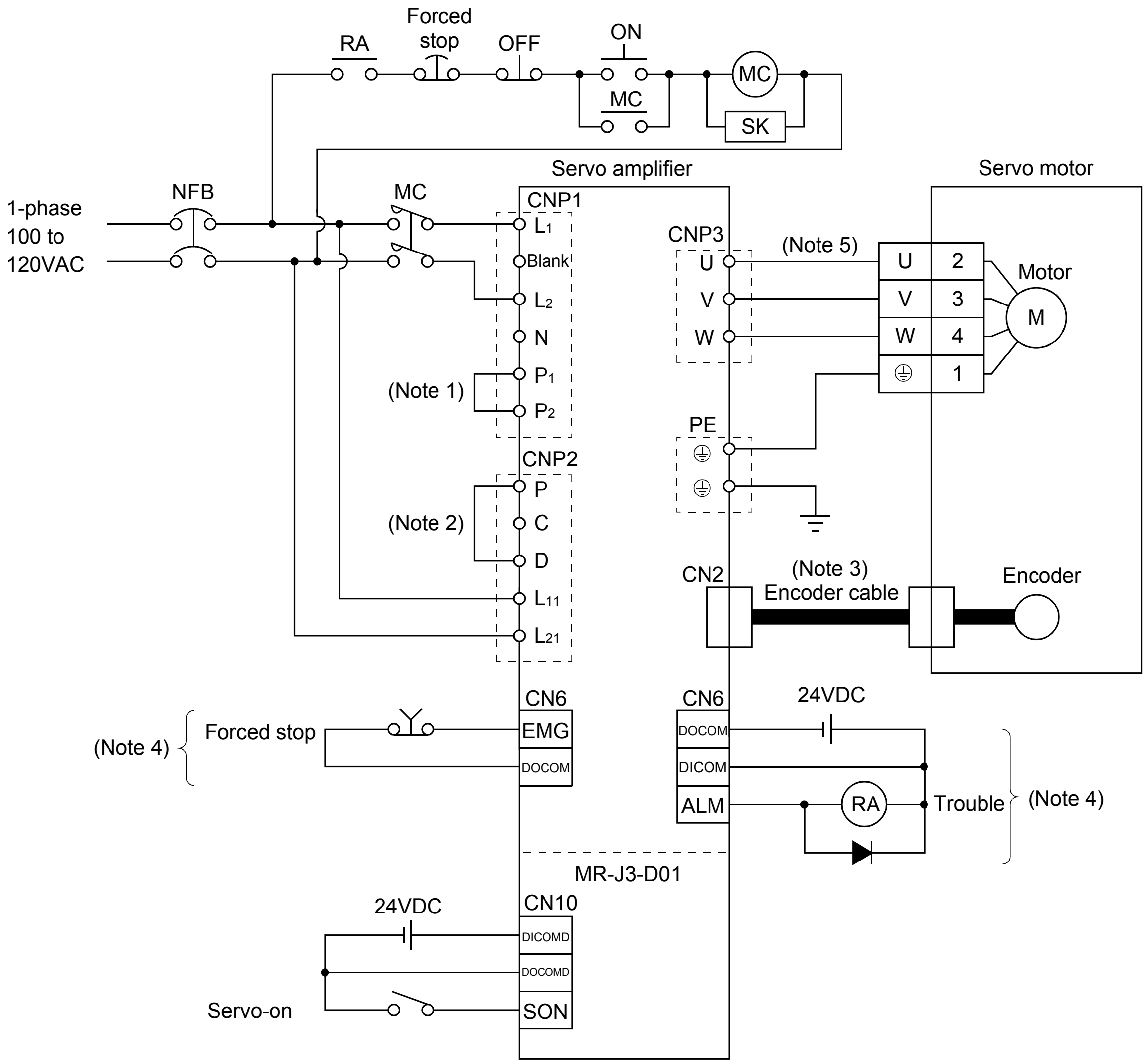
Note 1. Always connect P_1 and P_2. (Factory-wired.) When using the power factor improving DC reactor, refer to section 13.11.
2. Always connect P (+) and D. (Factory-wired.) When using the regenerative option, refer to section 13.2.
3. For encoder cable, use of the option cable is recommended. Refer to section 13.1 for selection of the cable.
4. For the sink I/O interface.
For the source I/O interface, refer to section 3.8.3.
5. Refer to section 3.10.

(2) For 1-phase 200 to 230VAC power supply to MR-J3-10T to MR-J3-70T



Note 1. Always connect P_1 and P_2. (Factory-wired.) When using the power factor improving DC reactor, refer to section 13.11.
2. Always connect P and D. (Factory-wired.) When using the regenerative option, refer to section 13.2.
3. For encoder cable, use of the option cable is recommended. Refer to section 13.1 for selection of the cable.
4. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.
5. Refer to section 3.10.

(3) MR-J3-10T1 to MR-J3-40T1



Note 1. Always connect P_1 and P_2. (Factory-wired.) The power factor improving DC reactor cannot be used.

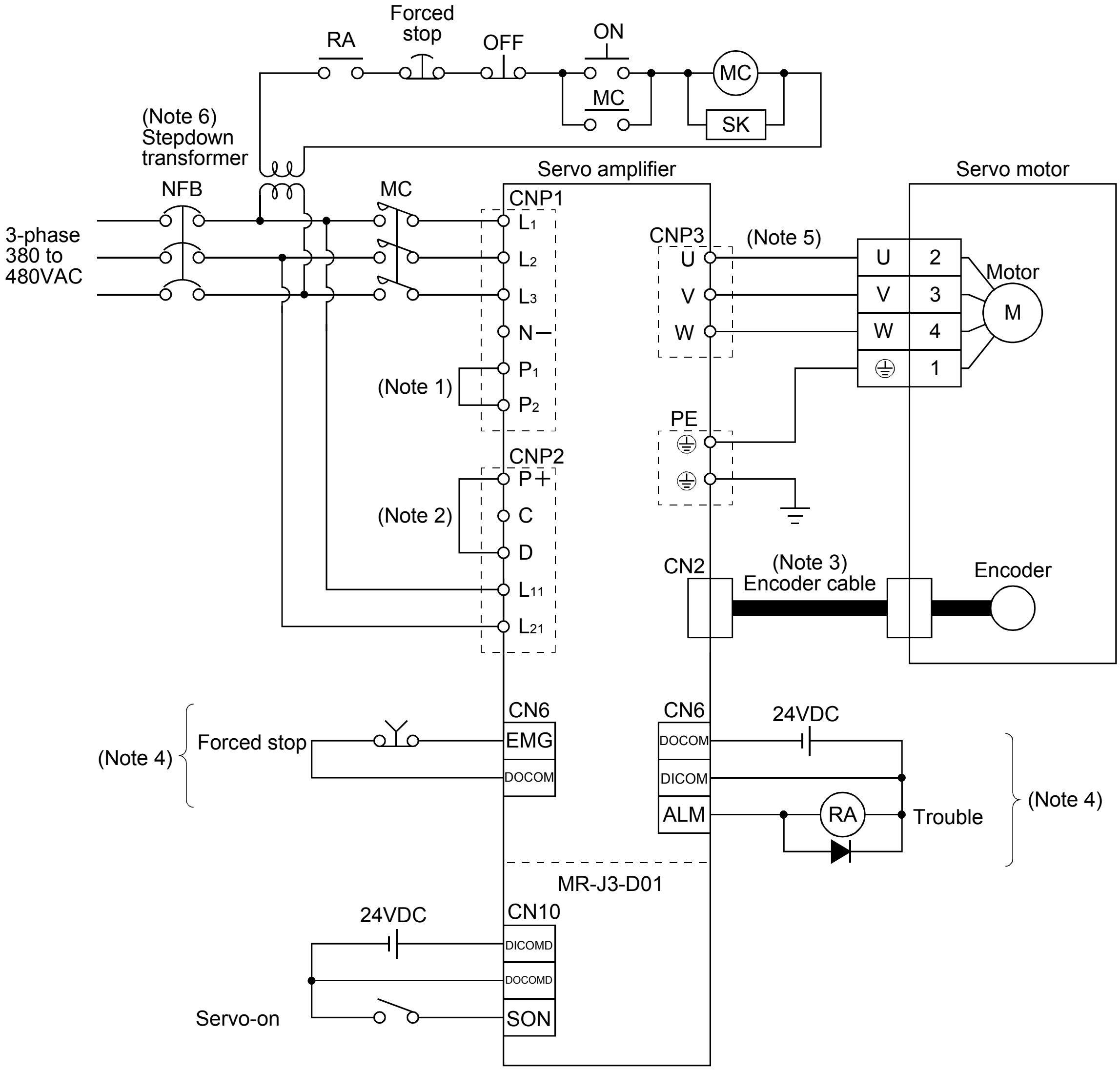
2. Always connect P and D. (Factory-wired.) When using the regenerative option, refer to section 13.2.

3. For encoder cable, use of the option cable is recommended. Refer to section 13.1 for selection of the cable.

4. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.

5. Refer to section 3.10.

(4) MR-J3-60T4 to MR-J3-200T4



Note 1. Always connect P_1 and P_2. (Factory-wired.) When using the power factor improving DC reactor, refer to section 13.11.

2. Always connect P and D. (Factory-wired.) When using the regenerative option, refer to section 13.2.

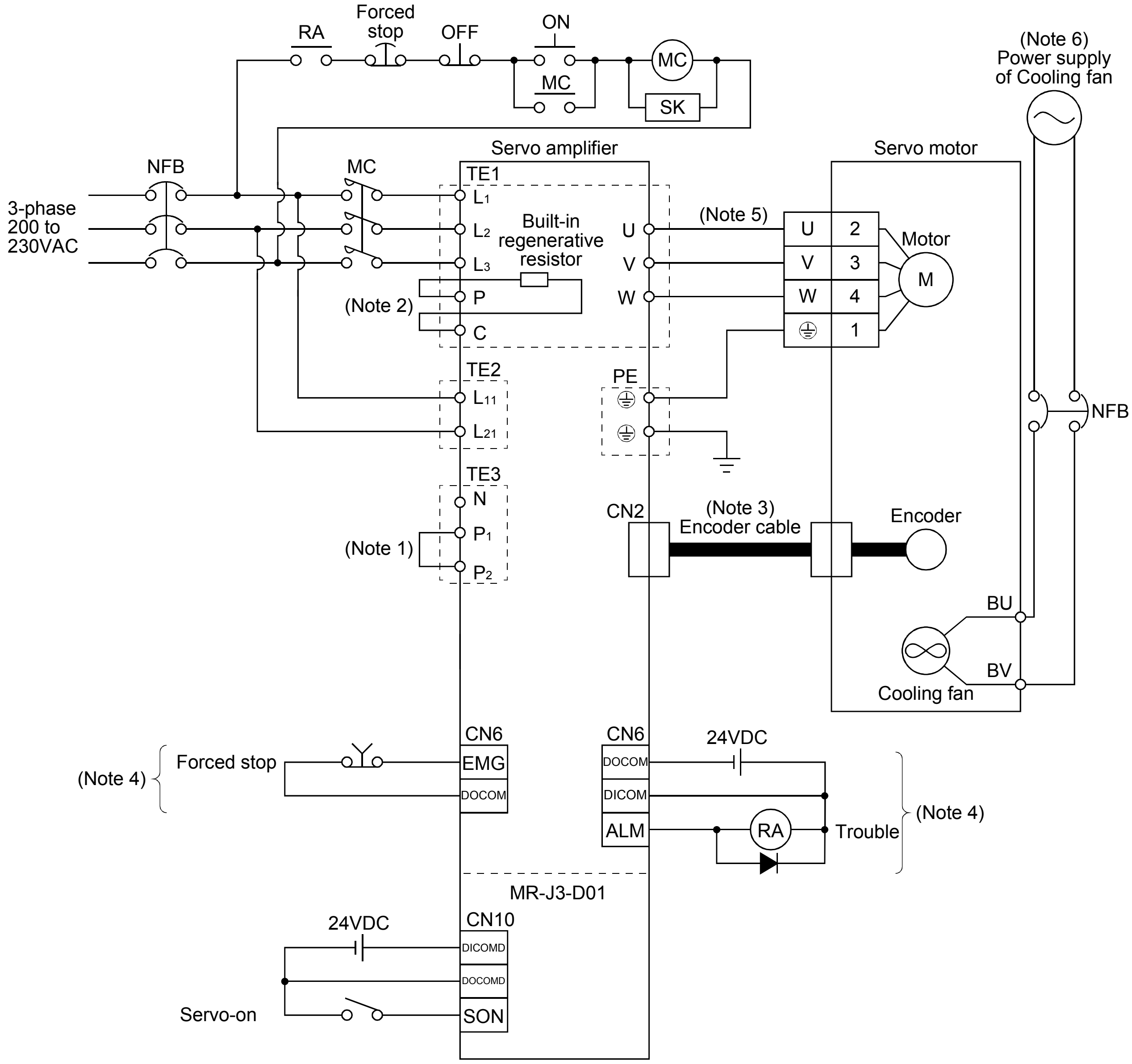
3. For encoder cable, use of the option cable is recommended. Refer to section 131 for selection of the cable.

4. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.

5. Refer to section 3.10.

6. Stepdown transformer is required for coil voltage of magnetic contactor more than 200V class.

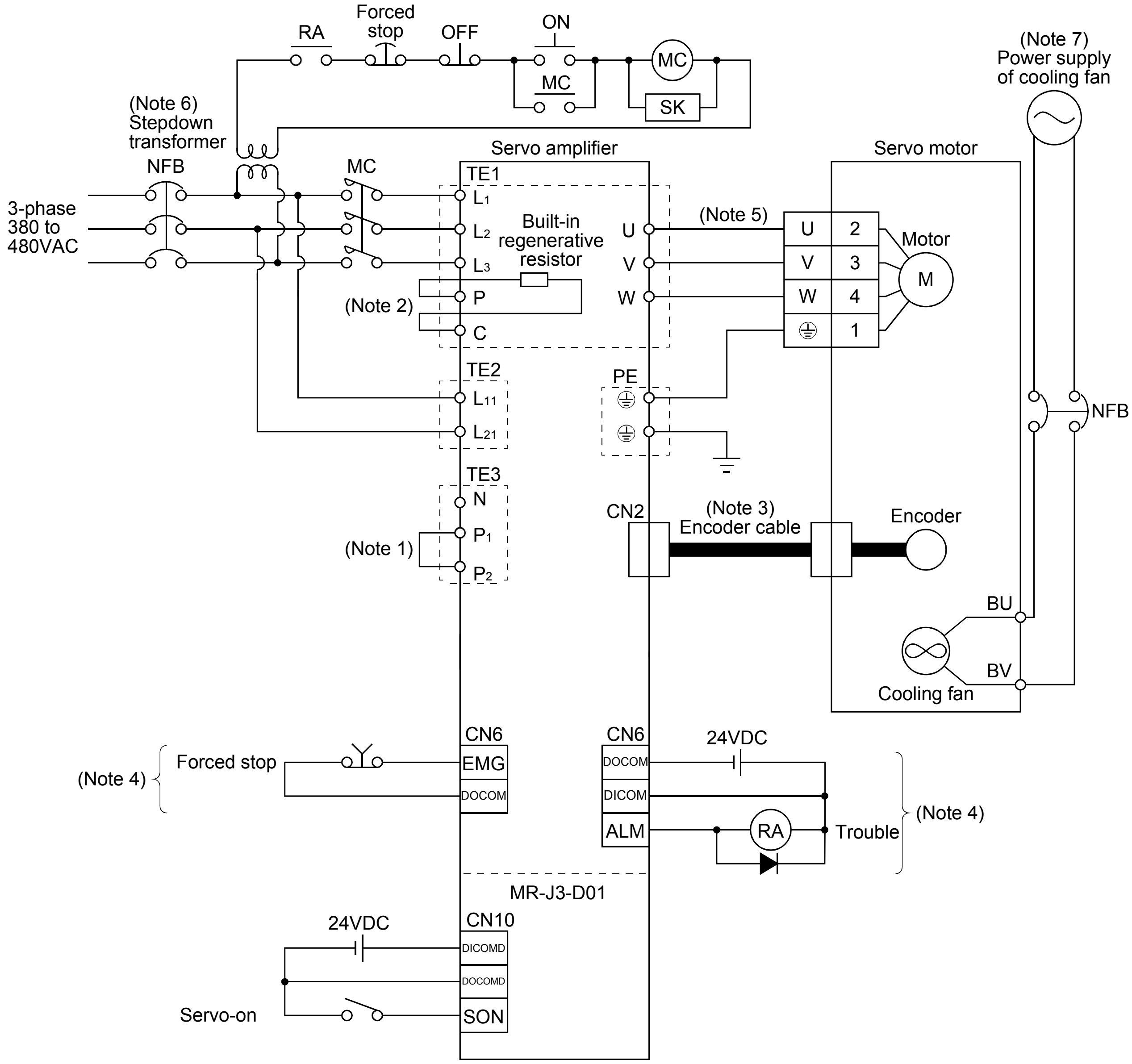
(5) MR-J3-500T・MR-J3-700T



Note 1. Always connect P_1 and P_2. (Factory-wired.) When using the power factor improving DC reactor, refer to section 13.11.

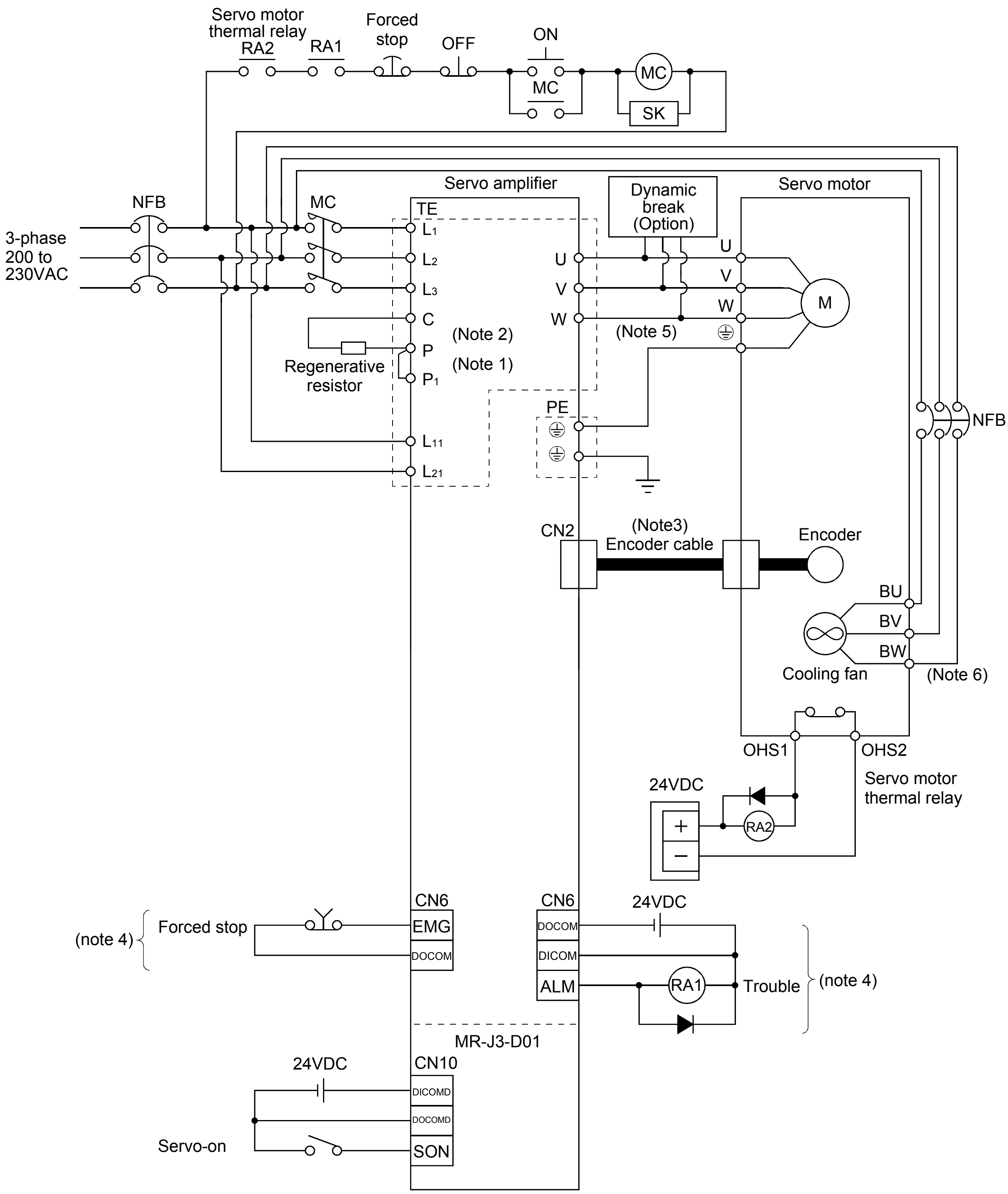
2. When using the regenerative option, refer to section 13.2.
3. For encoder cable, use of the option cable is recommended. Refer to section 13.1 for selection of the cable.
4. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.
5. Refer to section 13.10.
6. A cooling fan is attached to the HA-LP601 and the HA-LP701M servo motors. For power supply specification of the cooling fan, refer to section 3.10.2 (3) (b).

(6) MR-J3-350T4 to MR-J3-700T4



Note 1. Always connect P_1 and P_2. (Factory-wired.) When using the power factor improving DC reactor, refer to section 13.11.
2. When using the regenerative option, refer to section 13.2.
3. For encoder cable, use of the option cable is recommended. Refer to section 13.1 for selection of the cable.
4. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.
5. Refer to section 3.10.
6. Stepdown transformer is required for coil voltage of magnetic contactor more than 200V class.
7. A cooling fan is attached to the HA-LP6014 and the HA-LP701M4 servo motors. For power supply specification of the cooling fan, refer to section 3.10.2 (3) (b).

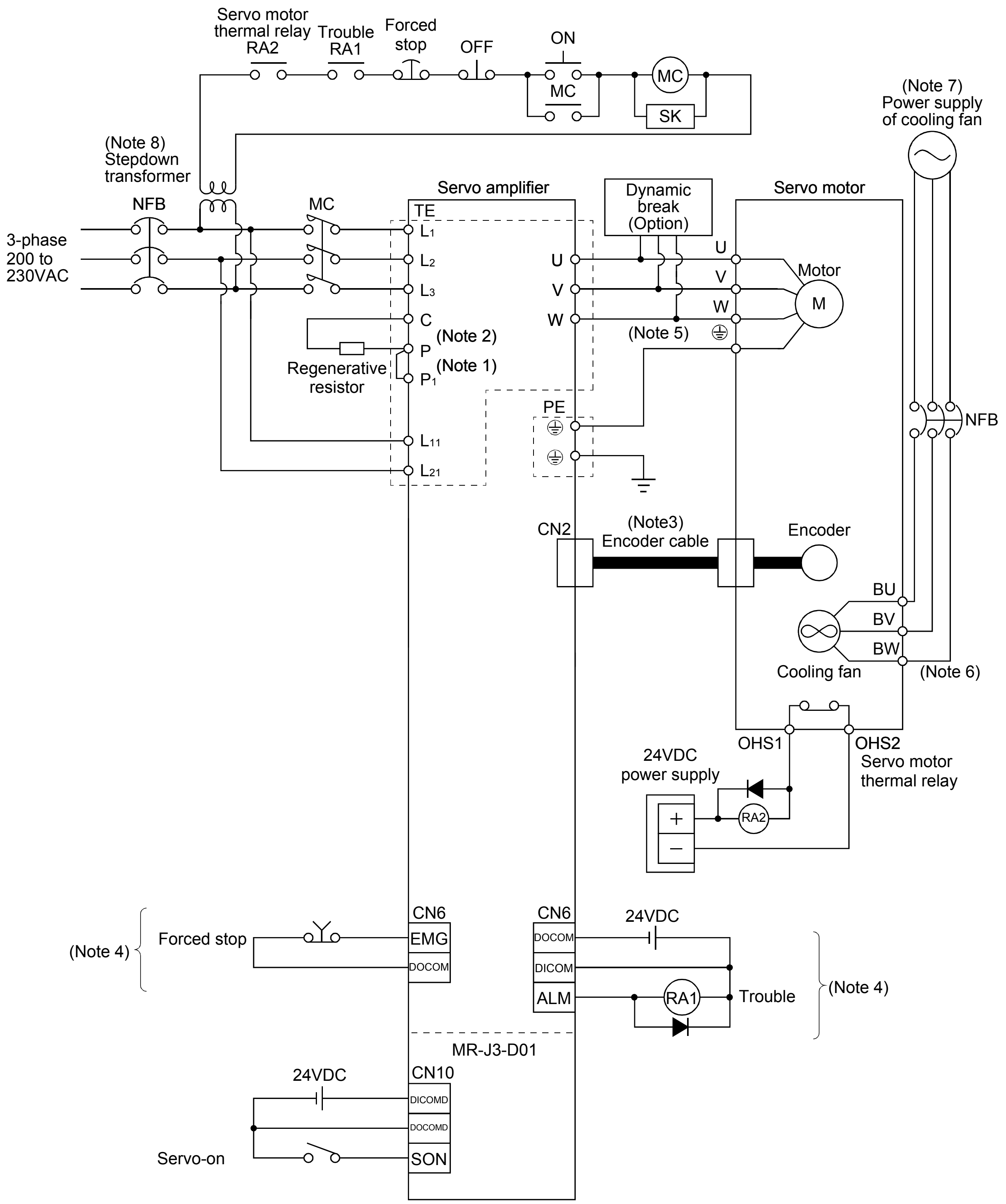
(7) MR-J3-11KT to MR-J3-22KT



Note 1. Always connect P_1 and P. (Factory-wired.) When using the power factor improving DC reactor, refer to section 13.11.

2. Connect the regenerative resistor. When using the regenerative option, refer to section 13.2.
3. For the encoder cable, use of the option cable is recommended. Refer to section 13.1 for selection of the cable.
4. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.
5. Refer to section 3.10.
6. Cooling fan power supply of the HA-LP11K2 servo motor is 1-phase. Power supply specification of the cooling fan is different from that of the servo amplifier. Therefore, separate power supply is required.

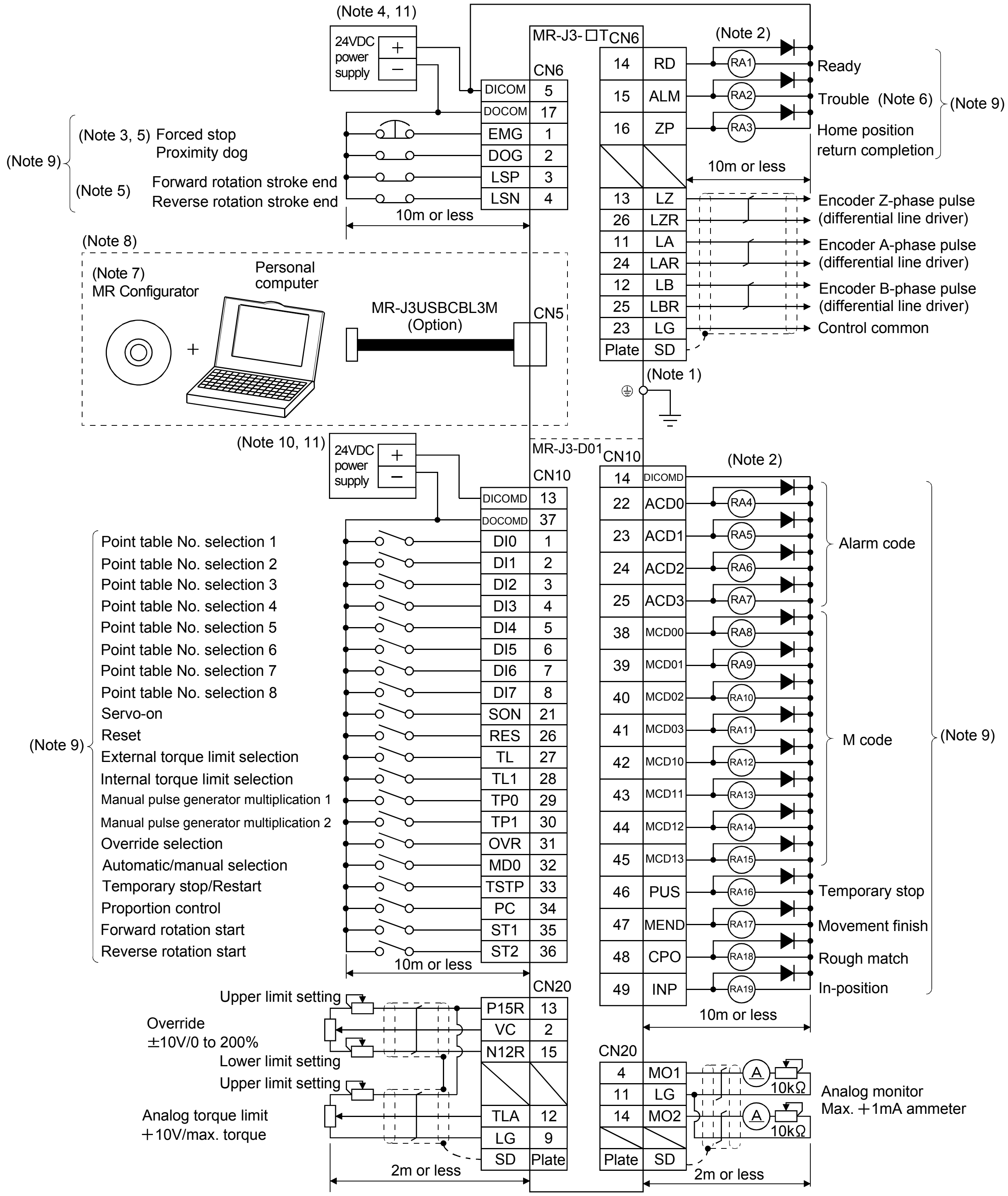
(8) MR-J3-11TK4 to MR-J3-22KT4



Note 1. Always connect P_1 and P_2. (Factory-wired.) When using the power factor improving DC reactor, refer to section 13.11.
2. Connect the regenerative resistor. When using the regenerative option, refer to section 13.2.
3. For encoder cable, use of the option cable is recommended. Refer to section 13.1 for selection of the cable.
4. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.
5. Refer to section 3.10.
6. Servo amplifiers does not have BW when the cooling fan power supply is 1-phase.
7. For the power supply of cooling fan, refer to section 3.10.2 (3) (b).
8. Stepdown transformer is required for coil voltage of magnetic contactor more than 200V class.

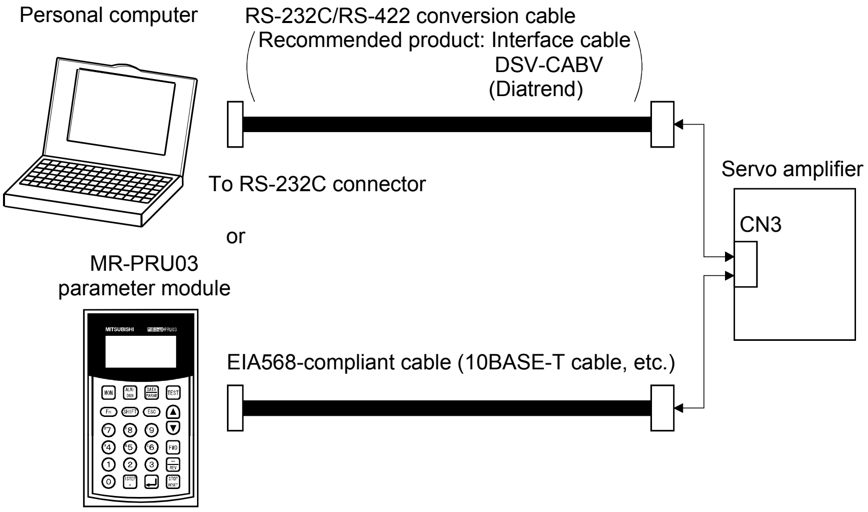
3.2 I/O signal connection diagram

3.2.1 Positioning operation using the point table



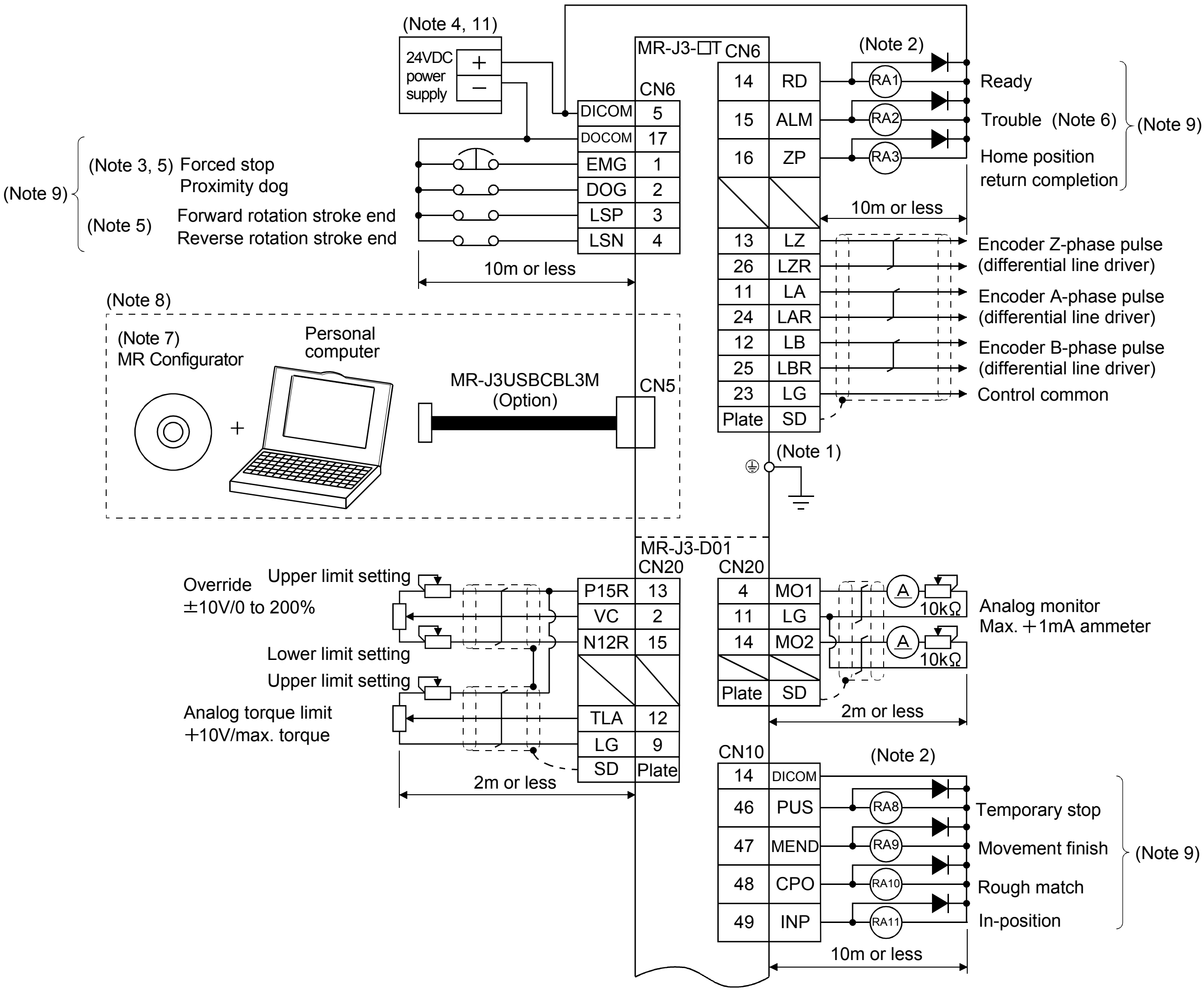
Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (terminal marked ⏚) of the servo amplifier to the protective earth (PE) of the control box.

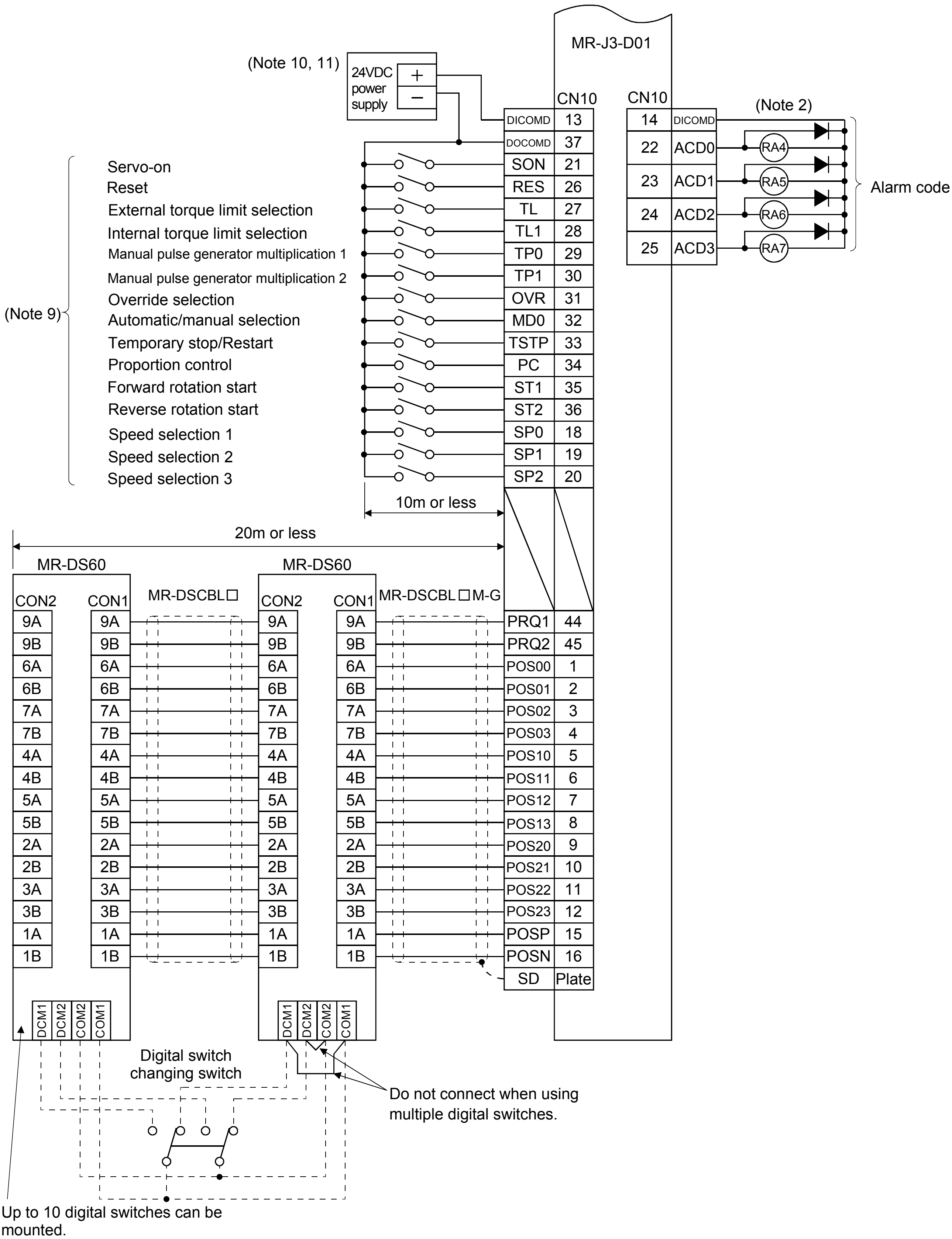
2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier or the MR-J3-D01 will be faulty and will not output signals, disabling the forced stop (EMG) and other protective circuits.
3. The forced stop switch (normally closed contact) must be installed.
4. Supply 24VDC±10% 150mA current for interfaces of the servo amplifier from the outside. 150mA 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.
5. When starting operation, always turn on forced stop (EMG) and Forward/Reverse rotation stroke end (LSP/LSN). (Normally closed contacts)
6. Trouble (ALM) turns on in normal alarm-free condition.
7. Use MRZJW3-SETUP 211E.
8. Personal computers or parameter modules can also be connected via the CN3 connector, enabling RS-422 communication. Note that using the USB communication function (CN5 connector) prevents the RS-422 communication function (CN3 connector) from being used, and vice versa. They cannot be used together.



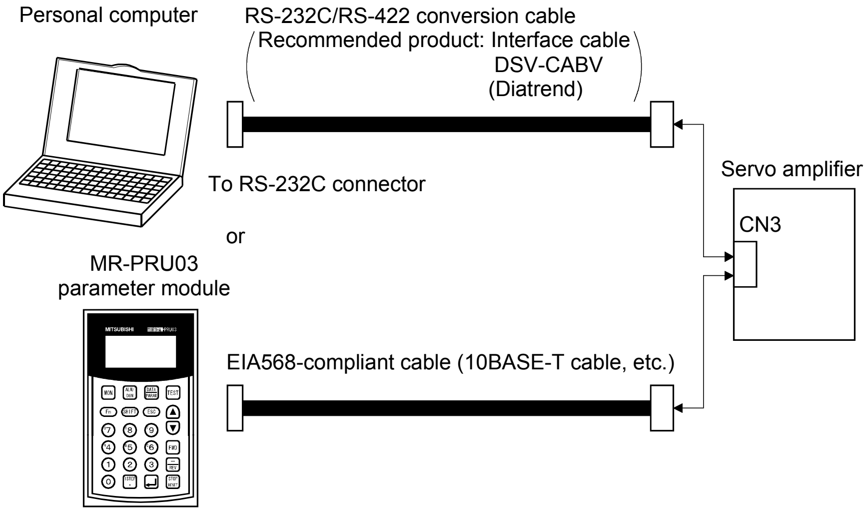
9. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.
10. Supply 24VDC 10% 800mA current for interfaces of the servo amplifier from the outside. 800mA is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points. Refer to section 3.8.2 (1) that gives the current value necessary for the interface.
11. The 24VDC for I/O signal can be supplied to the servo amplifier and MR-J3-D01 with one 24VDC power supply. In this case, use the power supply capacity corresponding to the points of the I/O signal to be used.

3.2.2 BCD input positioning operation with the digital switch



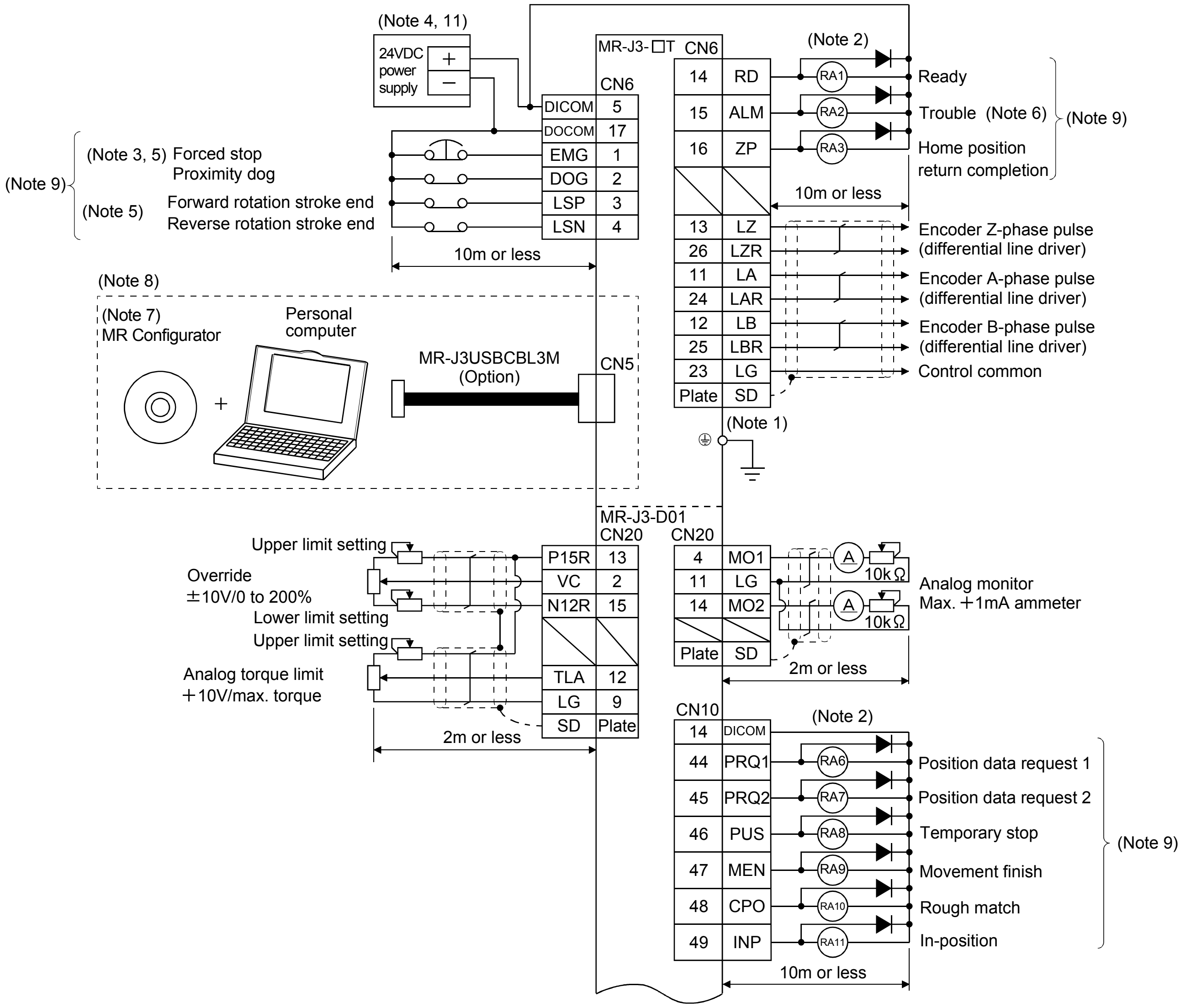

MR-J3-D01
(Note 10, 11)
24VDC power supply
CN10
CN10
(Note 2)
DICOMD 13
DOCOMD 37
SON 21
RES 26
TL 27
TL1 28
TP0 29
TP1 30
OVR 31
MD0 32
TSTP 33
PC 34
ST1 35
ST2 36
SP0 18
SP1 19
SP2 20
14 DICOMD
22 ACD0 RA4
23 ACD1 RA5
24 ACD2 RA6
25 ACD3 RA7
Alarm code
Servo-on
Reset
External torque limit selection
Internal torque limit selection
Manual pulse generator multiplication 1
Manual pulse generator multiplication 2
Override selection
Automatic/manual selection
Temporary stop/Restart
Proportion control
Forward rotation start
Reverse rotation start
Speed selection 1
Speed selection 2
Speed selection 3
(Note 9)
10m or less
20m or less
MR-DS60
MR-DS60
CON2
CON1
MR-DSCBL□
CON2
CON1
MR-DSCBL□M-G
9A 9B 6A 6B 7A 7B 4A 4B 5A 5B 2A 2B 3A 3B 1A 1B
PRQ1 44
PRQ2 45
POS00 1
POS01 2
POS02 3
POS03 4
POS10 5
POS11 6
POS12 7
POS13 8
POS20 9
POS21 10
POS22 11
POS23 12
POSP 15
POSN 16
SD Plate
DCM1 DCM2 COM2 COM1
Digital switch changing switch
Do not connect when using multiple digital switches.
Up to 10 digital switches can be mounted.

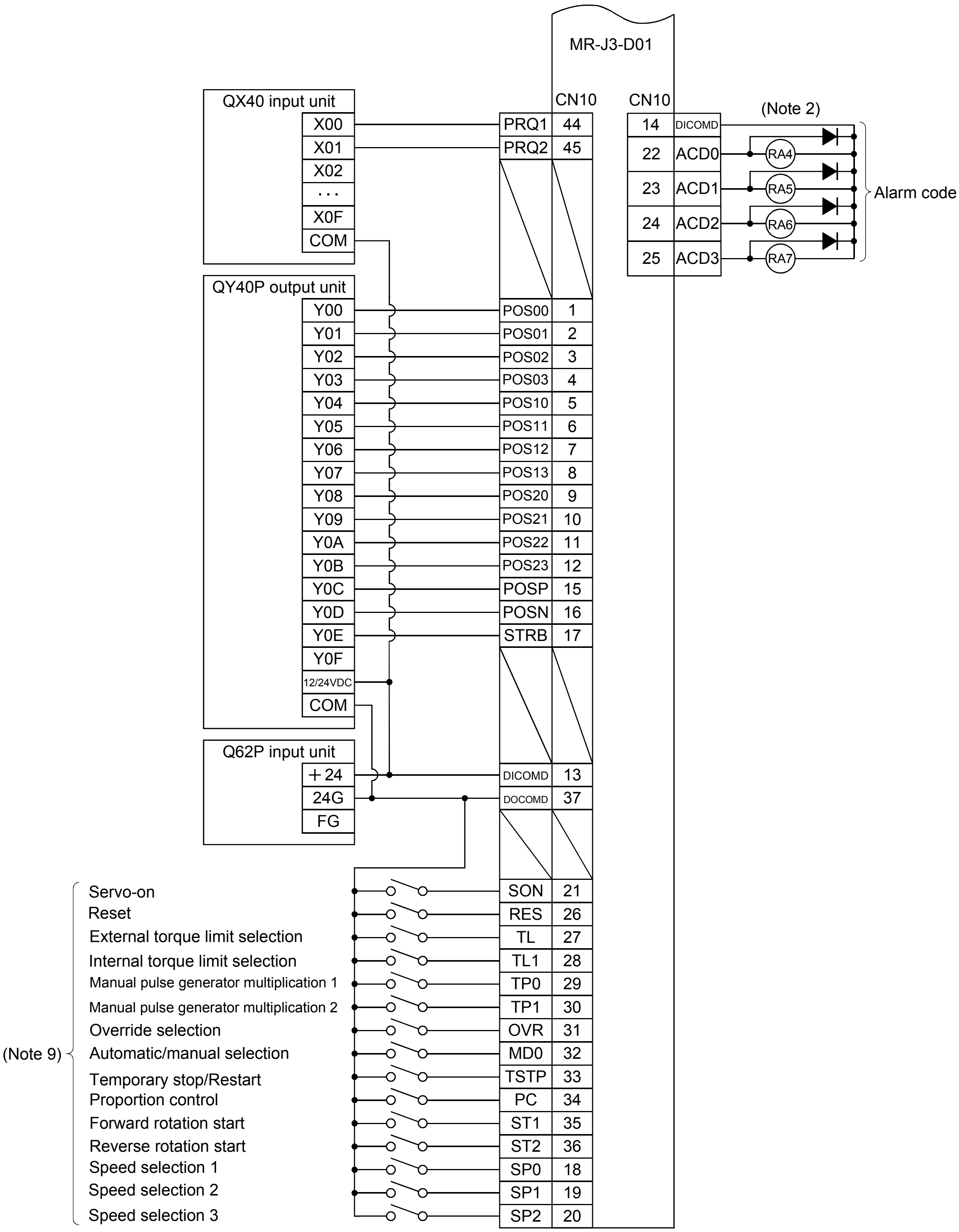
Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (terminal marked ⏚) of the servo amplifier to the protective earth (PE) of the control box.
2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier or the MR-J3-D01 will be faulty and will not output signals, disabling the forced stop (EMG) and other protective circuits.
3. The forced stop switch (normally closed contact) must be installed.
4. Supply 24VDC±10% 150mA current for interfaces of the servo amplifier from the outside. 150mA 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.
5. When starting operation, always turn on forced stop (EMG) and Forward/Reverse rotation stroke end (LSP/LSN). (Normally closed contacts)
6. Trouble (ALM) turns on in normal alarm-free condition.
7. Use MRZJW3-SETUP 211E.
8. Personal computers or parameter modules can also be connected via the CN3 connector, enabling RS-422 communication. Note that using the USB communication function (CN5 connector) prevents the RS-422 communication function (CN3 connector) from being used, and vice versa. They cannot be used together.



9. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.
10. Supply 24VDC 10% 800mA current for interfaces of the servo amplifier from the outside. 800mA 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.
11. The 24VDC for I/O signal can be supplied to the servo amplifier and MR-J3-D01 with one 24VDC power supply. In this case, use the power supply capacity corresponding to the points of the I/O signal to be used.

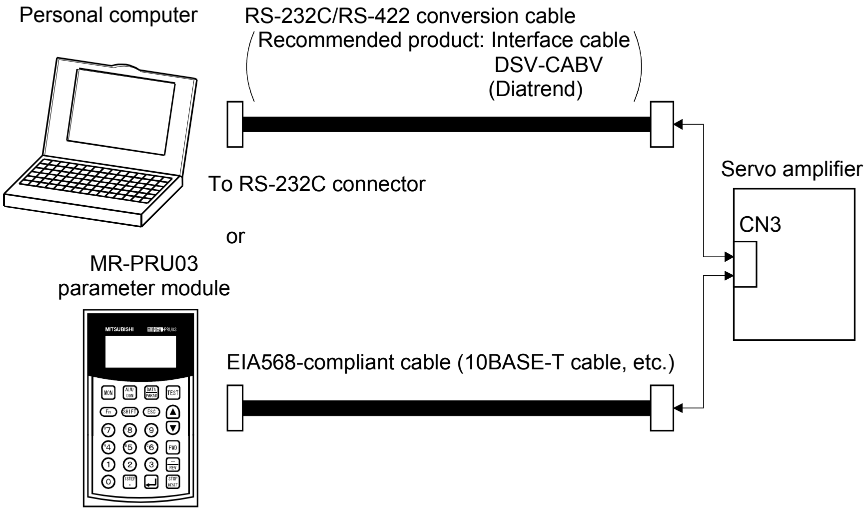
3.2.3 BCD input positioning operation with the programmable controller




MR-J3-D01
QX40 input unit
X00
X01
X02
X0F
COM
CN10
PRQ1 44
PRQ2 45
CN10
14 DICOMD
22 ACD0
23 ACD1
24 ACD2
25 ACD3
(Note 2)
RA4
RA5
RA6
RA7
Alarm code
QY40P output unit
Y00 POS00 1
Y01 POS01 2
Y02 POS02 3
Y03 POS03 4
Y04 POS10 5
Y05 POS11 6
Y06 POS12 7
Y07 POS13 8
Y08 POS20 9
Y09 POS21 10
Y0A POS22 11
Y0B POS23 12
Y0C POSP 15
Y0D POSN 16
Y0E STRB 17
Y0F
12/24VDC
COM
Q62P input unit
+24 DICOMD 13
24G DOCOMD 37
FG
(Note 9)
Servo-on SON 21
Reset RES 26
External torque limit selection TL 27
Internal torque limit selection TL1 28
Manual pulse generator multiplication 1 TP0 29
Manual pulse generator multiplication 2 TP1 30
Override selection OVR 31
Automatic/manual selection MD0 32
Temporary stop/Restart TSTP 33
Proportion control PC 34
Forward rotation start ST1 35
Reverse rotation start ST2 36
Speed selection 1 SP0 18
Speed selection 2 SP1 19
Speed selection 3 SP2 20

Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (terminal marked ⏚) of the servo amplifier to the protective earth (PE) of the control box.

2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier or the MR-J3-D01 will be faulty and will not output signals, disabling the forced stop (EMG) and other protective circuits.
3. The forced stop switch (normally closed contact) must be installed.
4. Supply 24VDC±10% 150mA current for interfaces of the servo amplifier from the outside. 150mA 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.
5. When starting operation, always turn on forced stop (EMG) and Forward/Reverse rotation stroke end (LSP/LSN). (Normally closed contacts)
6. Trouble (ALM) turns on in normal alarm-free condition.
7. Use MRZJW3-SETUP 211E.
8. Personal computers or parameter modules can also be connected via the CN3 connector, enabling RS-422 communication. Note that using the USB communication function (CN5 connector) prevents the RS-422 communication function (CN3 connector) from being used, and vice versa. They cannot be used together.



9. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.

3.3 Explanation of power supply system

3.3.1 Signal explanations

POINT

- For the layout of connector and terminal block, refer to outline drawings in chapter 11.

<table>
<tr><th>Abbreviation</th><th>Connection Target (Application)</th><th>Description</th></tr>
<tr><td>L_1
L_2
L_3</td><td>Main circuit power supply</td><td>Supply the following power to L_1, L_2, L_3. For the 1-phase 200V to 230VAC power supply, connect the power supply to L_1, L_2, and keep L_3 open.
<table>
<tr><th>Power supply \ Servo amplifier</th><th>MR-J3-10T to 70T</th><th>MR-J3-100T to 22KT</th><th>MR-J3-10T1 to 40T1</th></tr>
<tr><td>3-phase 200V to 230VAC, 50/60Hz</td><td colspan="2">L_1 · L_2 · L_3</td><td></td></tr>
<tr><td>1-phase 200V to 230VAC, 50/60Hz</td><td>L_1 · L_2</td><td></td><td></td></tr>
<tr><td>1-phase 100V to 120VAC, 50/60Hz</td><td></td><td></td><td>L_1 · L_2</td></tr>
</table>
<table>
<tr><th>Power supply \ Servo amplifier</th><th>MR-J3-60T4 to 22KT4</th></tr>
<tr><td>3-phase 380V to 480VAC, 50/60Hz</td><td>L_1 · L_2 · L_3</td></tr>
</table></td></tr>
<tr><td>P_1
P_2</td><td>Power factor improving DC reactor</td><td>1) MR-J3-700T(4) or less
When not using the power factor improving DC reactor, connect P_1 and P_2. (Factory-wired.)
When using the power factor improving DC reactor, disconnect P_1 and P_2, and connect the power factor improving DC reactor to P_1 and P_2.
2) MR-J3-11KT(4) to 22KT(4)
MR-J3-11KT(4) to 22KT(4) do not have P_2.
When not using the power factor improving reactor, connect P_1 and P. (Factory-wired)
When using the power factor improving reactor, connect it to P_1 and P.
Refer to section 13.11.</td></tr>
<tr><td>P
C
D</td><td>Regenerative option</td><td>1) MR-J3-350T or less · MR-J3-200T4 or less
When using servo amplifier built-in regenerative resistor, connect P(+) and D. (Factory-wired)
When using regenerative option, disconnect P(+) and D, and connect regenerative option to P and C.
2) MR-J3-350T4 · 500T(4) · 700T(4)
MR-J3-350T4 · 500T(4) and 700T(4) do not have D.
When using servo amplifier built-in regenerative resistor, connect P and C. (Factory-wired)
When using regenerative option, disconnect P and C, and connect regenerative option to P and C.
3) MR-J3-11KT(4) to 22KT(4)
MR-J3-11KT(4) to 22KT(4) do not have D.
When not using the power regenerative converter and the brake unit, make sure to connect the regenerative option to P and C.
Refer to section 13.2 to 13.5.</td></tr>
<tr><td>L_{11}
L_{21}</td><td>Control circuit power supply</td><td>Supply the following power to L_{11} · L_{21}.
<table>
<tr><th>Power supply \ Servo amplifier</th><th>MR-J3-10T to 22KT</th><th>MR-J3-10T1 to 40T1</th><th>MR-J3-60T4 to 22KT4</th></tr>
<tr><td>1-phase 200V to 230VAC, 50/60Hz</td><td>L_{11} · L_{21}</td><td></td><td></td></tr>
<tr><td>1-phase 100V to 120VAC, 50/60Hz</td><td></td><td>L_{11} · L_{21}</td><td></td></tr>
<tr><td>1-phase 380V to 480VAC, 50/60Hz</td><td></td><td></td><td>L_{11} · L_{21}</td></tr>
</table></td></tr>
<tr><td>U
V
W</td><td>Servo motor power</td><td>Connect to the servo motor power supply terminals (U, V, W). During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.</td></tr>
<tr><td>N</td><td>Regenerative converter
Brake unit</td><td>When using the power regenerative converter/brake unit, connect it to P and N.
Do not connect to servo amplifier MR-J3-350T(4) or less.
For details, refer to section 13.3 to 13.5.</td></tr>
<tr><td>⏚</td><td>Protective earth (PE)</td><td>Connect to the earth terminal of the servo motor and to the protective earth (PE) of the control box to perform grounding.</td></tr>
</table>

3.3.2 Power-on sequence

(1) Power-on procedure

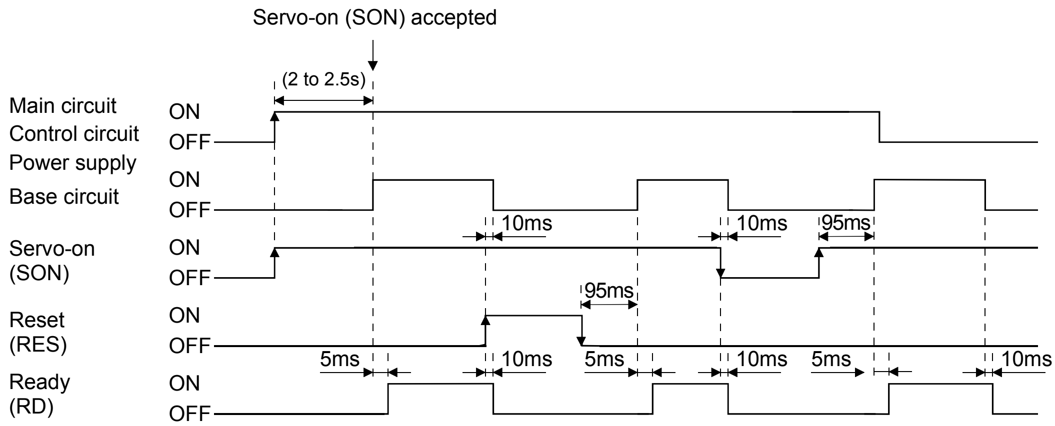
1) Always wire the power supply as shown in above section 3.1 using the magnetic contactor with the main circuit power supply (three-phase: L_1, L_2, L_3, single-phase: L_1, L_2). Configure up an external sequence to switch off the magnetic contactor as soon as an alarm occurs.

2) Switch on the control circuit power supply L_{11}, L_{21} 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 can accept the servo-on (SON) about 1 to 2s after the main circuit power supply is switched on. Therefore, when servo-on (SON) is switched on simultaneously with the main circuit power supply, the base circuit will switch on in about 1 to 2s, and the ready (RD) will switch on in further about 5ms, making the servo amplifier ready to operate. (Refer to paragraph (2) in this section.)

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

(2) Timing chart

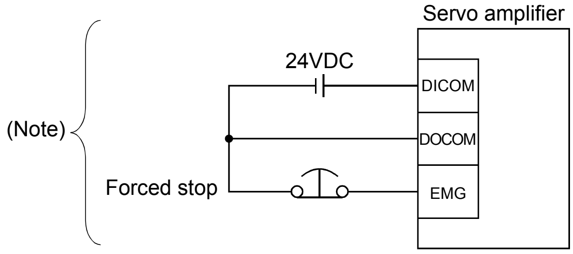


Power-on timing chart

(3) Forced stop

CAUTION	・Provide an external forced stop circuit to ensure that operation can be stopped and power switched off immediately.

Make up a circuit that shuts off main circuit power as soon as EMG is turned off at a forced stop. When EMG is turned off, the dynamic brake is operated to bring the servo motor to a sudden stop. At this time, the display shows the servo forced stop warning (AE6).
During ordinary operation, do not use the external forced stop (EMG) to alternate stop and run.
The servo amplifier life may be shortened.
Also, if the forward rotation start (ST1) and reverse rotation start (ST2) are on or a pulse train is input during a forced stop, the servo motor will rotate as soon as the warning is reset. During a forced stop, always shut off the run command.



Note. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.

3.3.3 CNP1, CNP2, CNP3 wiring method

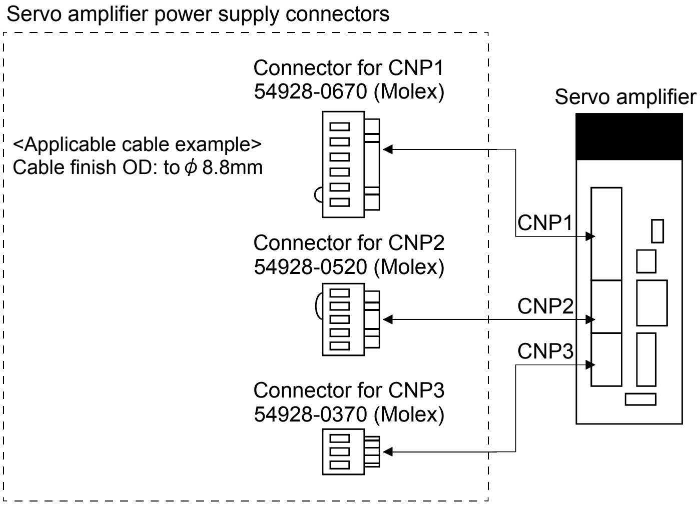
POINT

- Refer to table 13.1 in section 13.9 for the wire sizes used for wiring.
- MR-J3-500T or more and MR-J3-350T4 or more does not have these connectors.

Use the supplied servo amplifier power supply connectors for wiring of CNP1, CNP2 and CNP3.

(1) MR-J3-10T to MR-J3-100T

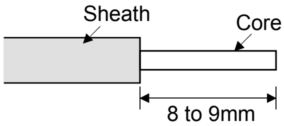
(a) Servo amplifier power supply connectors



Note. These connectors are of insert type. As the crimping type, the following connectors (Molex) are recommended.
For CNP1: 51241-0600 (connector), 56125-0128 (terminal)
For CNP2: 51240-0500 (connector), 56125-0128 (terminal)
For CNP3: 51241-0300 (connector), 56125-0128 (terminal)
Crimping tool: CNP57349-5300
<Connector applicable cable example>
Cable finish OD: to ϕ3.8mm

(b) Termination of the cables

Solid wire: After the sheath has been stripped, the cable can be used as it is.



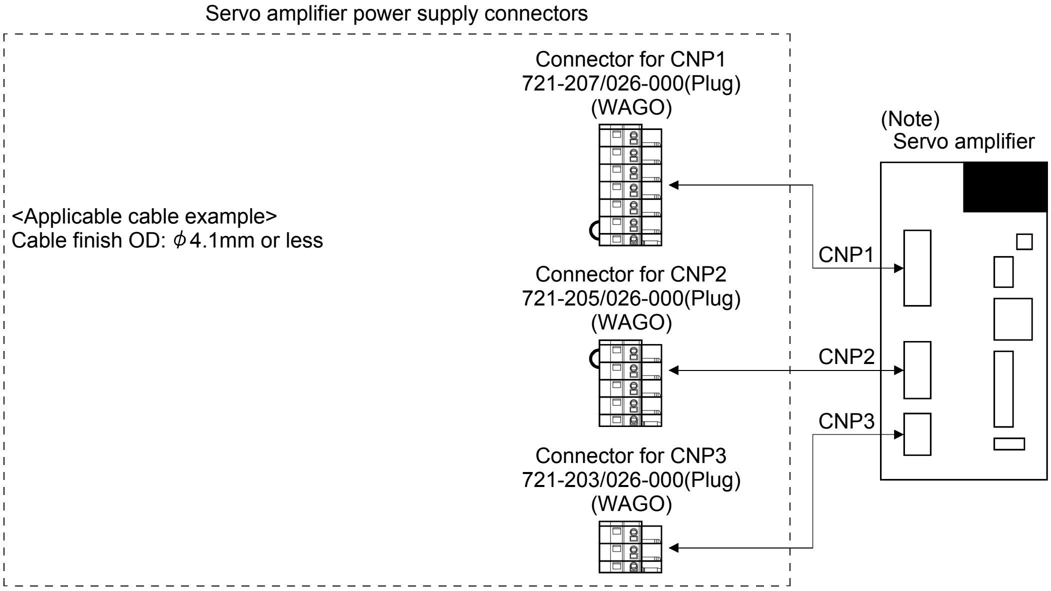
Twisted wire: Use the cable after stripping the sheath and twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

Cable size		Bar terminal type		Crimping tool (Note2)
[mm^2]	AWG	For 1 cable (Note1)	For 2 cable	
1.25/1.5	16	AI1.5-10BK	AI-TWIN2 × 1.5-10BK	Variocrimp 4 206-204
2/2.5	14	AI2.5-10BU		

Note1. Manufacturer: Phoenix Contact
2. Manufacturer: WAGO

(2) MR-J3-200T・MR-J3-60T4 to MR-J3-200T4

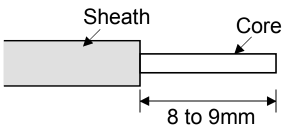
(a) Servo amplifier power supply connectors



Note. Connectors (CNP1, CNP2, and CNP3) and appearance of MR-J3-200T servo amplifier have been changed from January 2008 production. Model name of the existing servo amplifier is changed to MR-J3-200T-RT. For MR-J3-200T-RT, refer to appendix 4.

(b) Termination of the cables

Solid wire: After the sheath has been stripped, the cable can be used as it is.



Twisted wire: Use the cable after stripping the sheath and twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

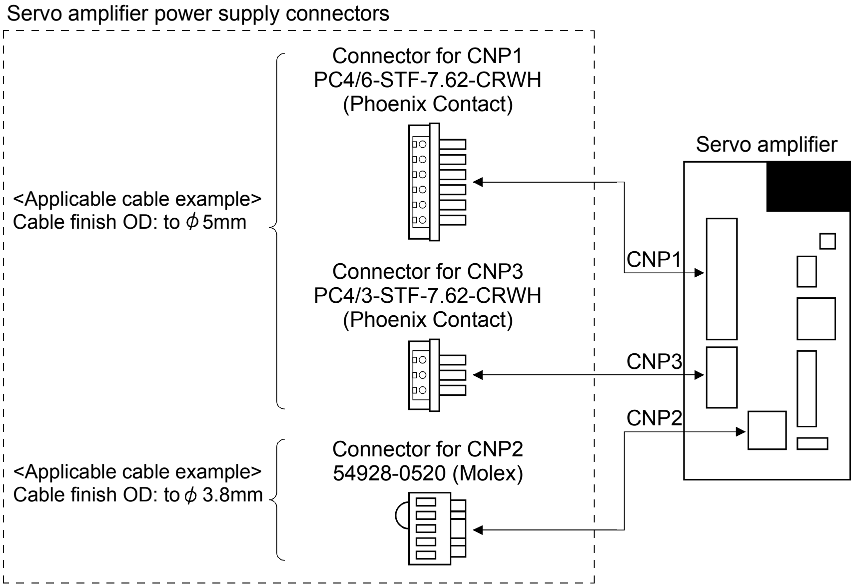
Cable size		Bar terminal type		Crimping tool (Note 2)
[mm^2]	AWG	For 1 cable (Note 1)	For 2 cable	
1.25/1.5	16	AI1.5-10BK	AI-TWIN2 × 1.5-10BK	Variocrimp 4 206-204
2/2.5	14	AI2.5-10BU		

Note 1. Manufacturer: Phoenix Contact

2. Manufacturer: WAGO

(3) MR-J3-350T

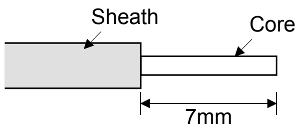
(a) Servo amplifier power supply connectors



(b) Termination of the cables

1) CNP1・CNP3

Solid wire: After the sheath has been stripped, the cable can be used as it is.



Twisted wire: Use the cable after stripping the sheath and twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

Cable size		Bar terminal type		Crimping tool	Manufacturer
[mm^2]	AWG	For 1 cable	For 2 cables		
1.25/1.5	16	AI1.5-8BK	AI-TWIN2×1.5-8BK	CRIMPFOX-ZA3	Phoenix Contact
2.0/2.5	14	AI2.5-8BU	AI-TWIN2×2.5-10BU		
3.5	12	AI4-10Y			

2) CNP2

CNP2 is the same as MR-J3-100T or smaller capacities. Refer to (1) (b) in this section.

(4) Insertion of cable into Molex and WAGO connectors

Insertion of cable into 54928-0670, 54928-0520, 54928-0370 (Molex) connectors and 721-207/026-000, 721-205/026-000 and 721-203/026-000 (WAGO) connectors are as follows.

The following explains for Molex, however use the same procedures for inserting WAGO connectors as well.

POINT
· It may be difficult for a cable to be inserted to the connector depending on wire size or bar terminal configuration. In this case, change the wire type or correct it in order to prevent the end of bar terminal from widening, and then insert it.

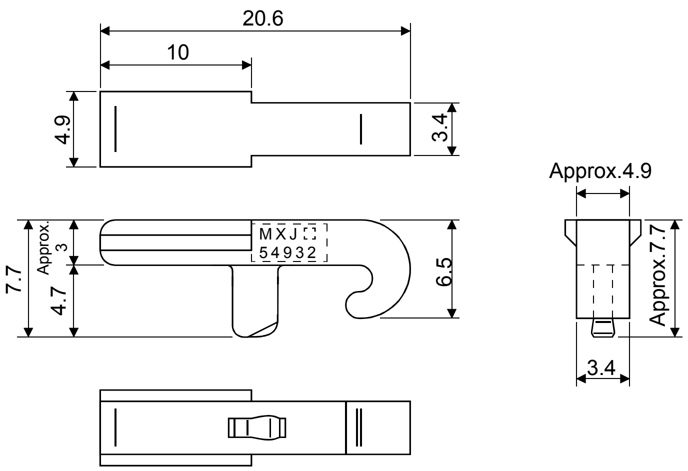
How to connect a cable to the servo amplifier power supply connector is shown below.

(a) When using the supplied cable connection lever

1) The servo amplifier is packed with the cable connection lever.

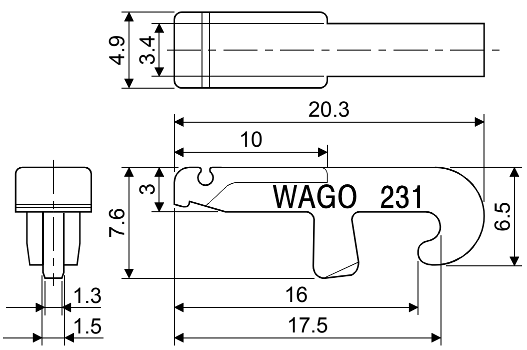
a) 54932-0000 (Molex)

[Unit: mm]

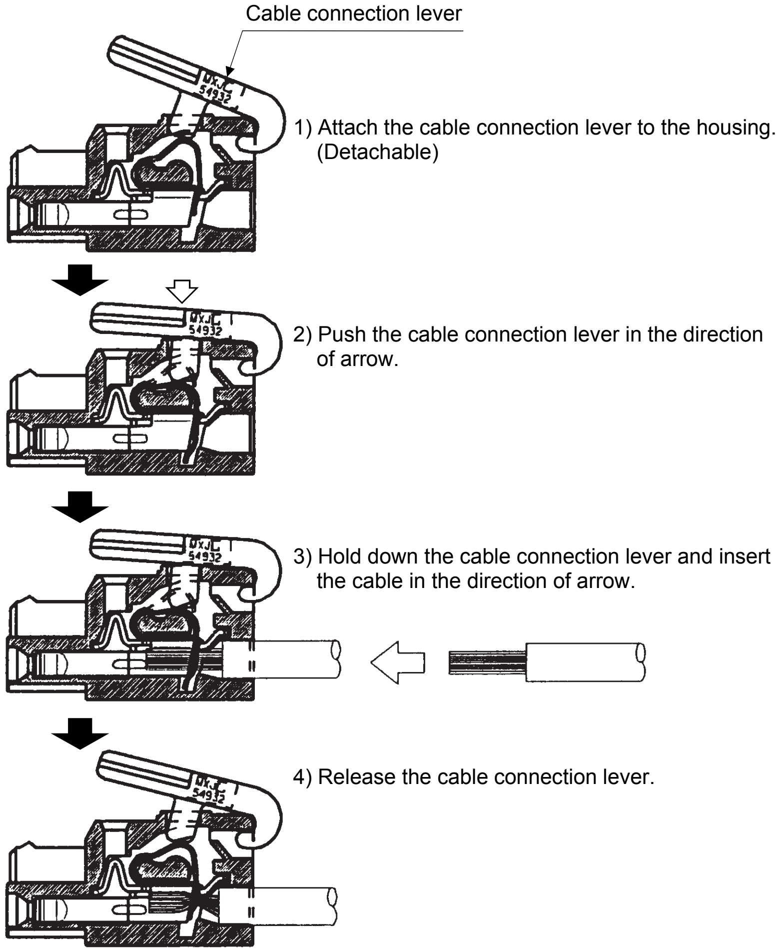


b) 231-131 (WAGO)

[Unit: mm]



2) Cable connection procedure

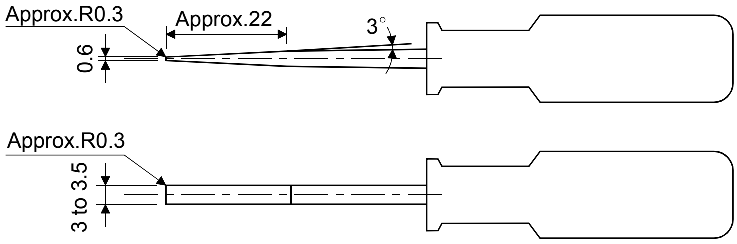


(b) Inserting the cable into the connector

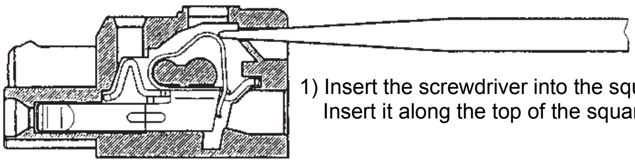
1) Applicable flat-blade screwdriver dimensions

Always use the screwdriver shown here to do the work.

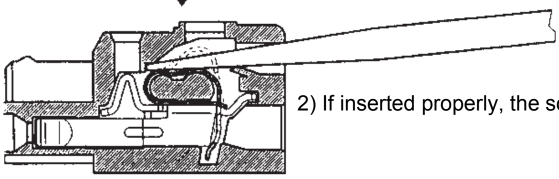
[Unit: mm]



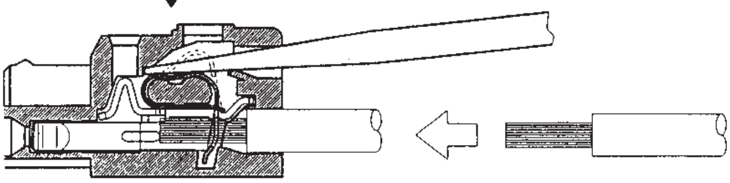
2) When using the flat-blade screwdriver - part 1



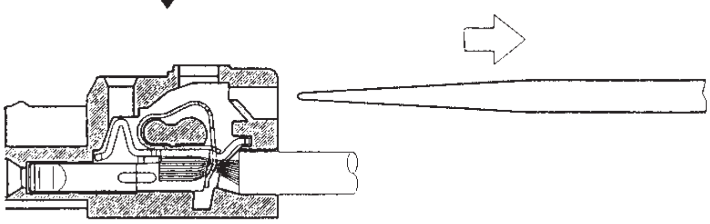
1) Insert the screwdriver into the square hole.
Insert it along the top of the square hole to insert it smoothly.



2) If inserted properly, the screwdriver is held.

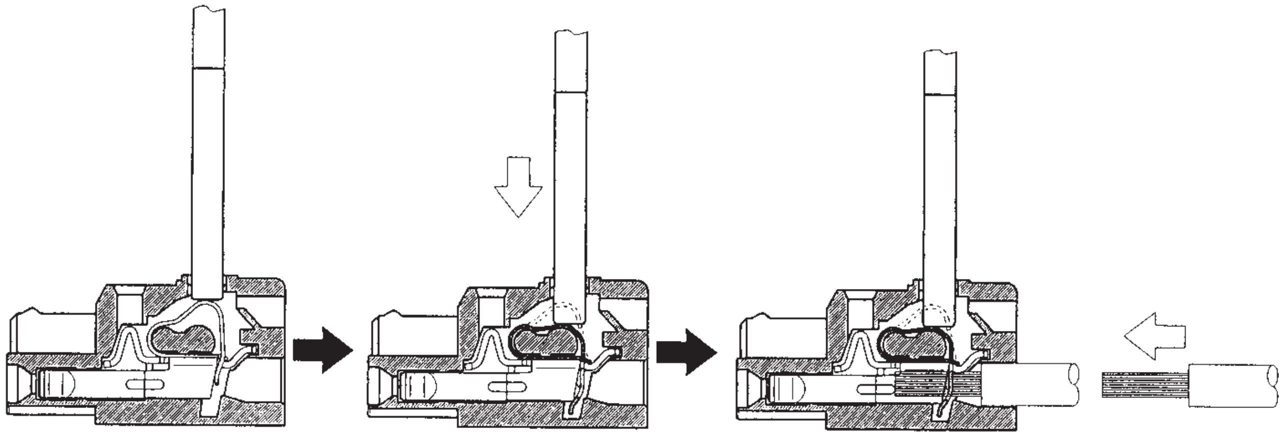


3) With the screwdriver held, insert the cable in the direction of arrow. (Insert the cable as far as it will go.)



4) Releasing the screwdriver connects the cable.

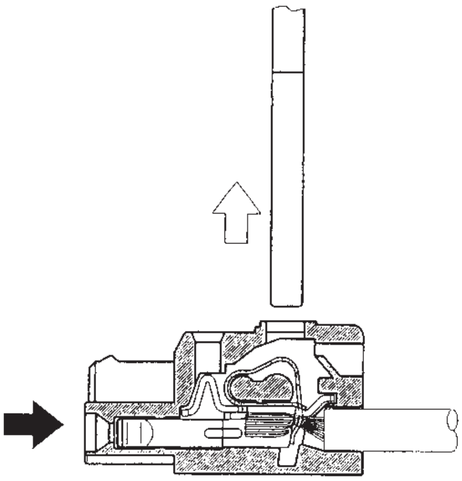
3) When using the flat-blade screwdriver - part 2



1) Insert the screwdriver into the square window at top of the connector.

2) Push the screwdriver in the direction of arrow.

3) With the screwdriver pushed, insert the cable in the direction of arrow. (Insert the cable as far as it will go.)



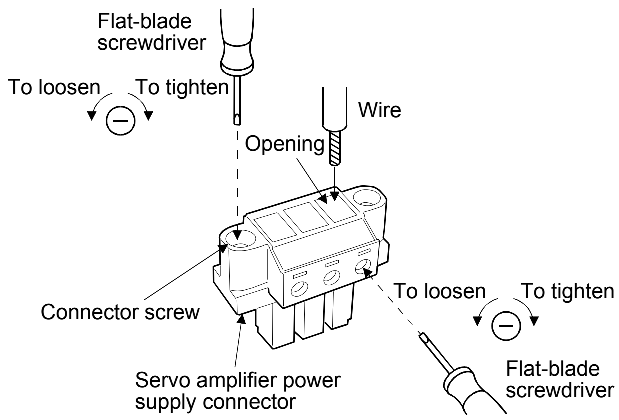
4) Releasing the screwdriver connects the cable.

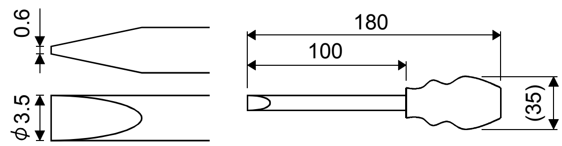
(5) How to insert the cable into Phoenix Contact connector

POINT
・Do not use a precision driver because the cable cannot be tightened with enough torque.

Insertion of cables into Phoenix Contact connector PC4/6-STF-7.62-CRWH or PC4/3-STF-7.62-CRWH is shown as follows.
Before inserting the cable into the opening, make sure that the screw of the terminal is fully loose. Insert the core of the cable into the opening and tighten the screw with a flat-blade screwdriver. When the cable is not tightened enough to the connector, the cable or connector may generate heat because of the poor contact. (When using a cable of 1.5mm^2 or less, two cables may be inserted into one opening.)
Secure the connector to the servo amplifier by tightening the connector screw.
For securing the cable and the connector, use a flat-blade driver with 0.6mm blade edge thickness and 3.5mm diameter (Recommended flat-blade screwdriver. Phoenix Contact SZS 0.6×3.5). Apply 0.5 to 0.6 N・m torque to screw.

[Unit: mm]





Recommended flat-blade screwdriver dimensions

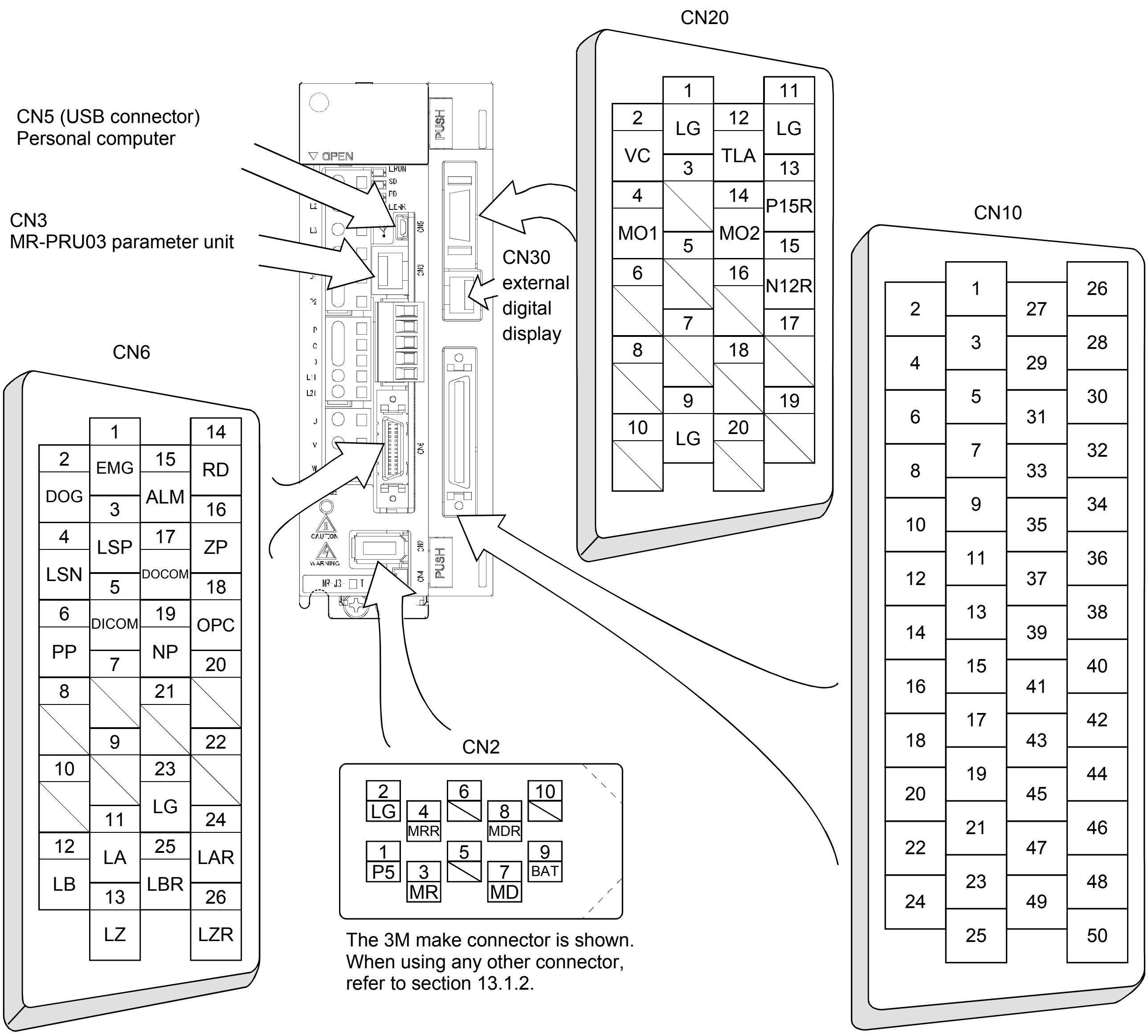
3.4 Connectors and signal arrangements

POINT
・The pin configurations of the connectors are as viewed from the cable connector wiring section. ・Refer to (3) in this section for CN10 signal assignment.

Refer to section 3.5 for details of each signal (device).

(1) Signal arrangement

The servo amplifier front view shown is that of the MR-J3-10T and the MR-J3-D01. Refer to chapter 11 Outline Drawings for the appearances and connector layouts of the other servo amplifiers.



The 3M make connector is shown. When using any other connector, refer to section 13.1.2.

For the signal arrangements, refer to this section (3).

(2) Signal arrangement of CN6 connector

The symbols in the Device change column in the table represent the followings.

○: The device can be changed by the parameters in parentheses.

—: The device cannot be changed.

◺: For manufacturer setting. Do not connect anything to it.

Pin No.	Device assigned in the initial status (Symbol)		I/O division	Device change
	When using the point table	When using the BCD input		
1	Forced stop (EMG)		DI-1	—
2	Proximity dog (DOG)		DI-1	○ (PD06)
3	Forward rotation stroke end (LSP)		DI-1	○ (PD07)
4	Reverse rotation stroke end (LSN)		DI-1	○ (PD08)
5	Digital I/F power supply input (DICOM)			—
6	Manual pulse generator (PP)			—
7				—
8				
9				
10				
11	Encoder A-phase pulse (LA)		DO-2	—
12	Encoder B-phase pulse (LB)		DO-2	—
13	Encoder Z-phase pulse (LZ)		DO-2	—
14	Ready (RD)		DO-1	○ (PD09)
15	Trouble (ALM)		DO-1	○ (PD10)
16	Home position return completion (ZP)		DO-1	○ (PD11)
17	Digital I/F common (DOCOM)			—
18	Manual pulse generator open collector power input (OPC)			—
19	Manual pulse generator input (NP)			—
20				
21				
22				
23	Control common (LG)			—
24	Encoder A-phase pulse (LAR)		DO-2	—
25	Encoder B-phase pulse (LBR)		DO-2	—
26	Encoder Z-phase pulse (LZR)		DO-2	—
Plate	Shield (SD)			—

(3) Signal arrangement of CN10 connector

The symbols in the Device change column in the table represent the followings.

○: The device can be changed by the parameters in parentheses.

—: The device cannot be changed.

Pin No.	Device assigned in the initial status (Symbol)		I/O division	Device change
	When using the point table	When using the BCD input		
1	Point table No.1 (DI0)	Position data input 1 (POS00) (Note 3)	DI-1	—
2	Point table No.2 (DI1)	Position data input 2 (POS01) (Note 3)	DI-1	—
3	Point table No.3 (DI2)	Position data input 3 (POS02) (Note 3)	DI-1	—
4	Point table No.4 (DI3)	Position data input 4 (POS03) (Note 3)	DI-1	—
5	Point table No.5 (DI4)	Position data input 5 (POS10) (Note 3)	DI-1	—
6	Point table No.6 (DI5)	Position data input 6 (POS11) (Note 3)	DI-1	—
7	Point table No.7 (DI6)	Position data input 7 (POS12) (Note 3)	DI-1	—
8	Point table No.8 (DI7)	Position data input 8 (POS13) (Note 3)	DI-1	—
9		Position data input 9 (POS20) (Note 3)	DI-1	—
10		Position data input 10 (POS21) (Note 3)	DI-1	—
11		Position data input 11 (POS22) (Note 3)	DI-1	—
12		Position data input 12 (POS23) (Note 3)	DI-1	—
13	Digital I/F power supply input (DICOMD)			—
14	Digital I/F power supply input (DICOMD)			—
15		Position data input symbol + (POSP)	DI-1	—
16		Position data input symbol − (POSN)	DI-1	—
17		Strobe (STRB)	DI-1	—
18		Speed selection 1 (SP0) (Note 3)	DI-1	—
19		Speed selection 2 (SP1) (Note 3)	DI-1	—
20		Speed selection 3 (SP2) (Note 3)	DI-1	—
21	Servo-on (SON)		DI-1	○ (Po02)
22	Alarm code output 1 (ACD0)		DO-1	—
23	Alarm code output 2 (ACD1)		DO-1	—
24	Alarm code output 3 (ACD2)		DO-1	—
25	Alarm code output 4 (ACD3)		DO-1	—
26	Reset (RES)		DI-1	○ (Po02)
27	External torque limit selection (TL)		DI-1	○ (Po03)
28	Internal torque limit selection (TL1)		DI-1	○ (Po03)
29	Manual pulse generator multiplication 1 (TP0)		DI-1	○ (Po04)
30	Manual pulse generator multiplication 2 (TP1)		DI-1	○ (Po04)
31	Override selection (OVR)		DI-1	○ (Po05)
32	Automatic/manual selection (MD0)		DI-1	○ (Po05)
33	Temporary stop/Restart (TSTP)		DI-1	○ (Po06)
34	Proportion control (PC)		DI-1	○ (Po06)
35	Forward rotation start (ST1)		DI-1	○ (Po07)
36	Reverse rotation start (ST2)		DI-1	○ (Po07)
37	Digital I/F common (DOCOMD)			—
38	M code 1 (MCD00)		DO-1	—
39	M code 2 (MCD01)		DO-1	—
40	M code 3 (MCD02)		DO-1	—
41	M code 4 (MCD03)		DO-1	—
42	M code 5 (MCD10)		DO-1	—
43	M code 6 (MCD11)		DO-1	—
44	M code 7 (MCD12)	Position data request 1 (PRQ1)	DO-1	—
45	M code 8 (MCD13)	Position data request 2 (PRQ2)	DO-1	—
46	Temporary stop (PUS)		DO-1	○ (Po08)
47	Movement finish (MEND)		DO-1	○ (Po08)
48	Rough match (CPO)		DO-1	○ (Po09)

<table>
<tr><th rowspan="2">Pin No.</th><th colspan="2">Device assigned in the initial status (Symbol)</th><th rowspan="2">I/O division</th><th rowspan="2">Device change</th></tr>
<tr><th>When using the point table</th><th>When using the BCD input</th></tr>
<tr><td>49</td><td colspan="2">In position (INP)</td><td>DO-1</td><td>○ (Po09)</td></tr>
<tr><td>50</td><td colspan="2">Shield (SD)</td><td></td><td>—</td></tr>
<tr><td>Plate</td><td colspan="2">Shield (SD)</td><td></td><td>—</td></tr>
</table>

3.5 Signal (device) explanation

3.5.1 Devices

(1) Input device

The Connector pin No. column indicates the connector pin Nos. assigned at default. The device with ○ can change the connector pin Nos. assigned by changing the parameter No. PD06 to PD08 and Po02 to Po07. The devices indicated with ⧅ cannot be used.

PT in the table indicates when using a point table, and BCD indicates when using a 6-digit BCD input with symbol.

<table>
<tr><th rowspan="2">Device</th><th rowspan="2">Symbol</th><th colspan="2">Connector pin No.</th><th rowspan="2">Functions/Applications</th></tr>
<tr><th>PT</th><th>BCD</th></tr>
<tr><td>Forced stop</td><td>EMG</td><td colspan="2">CN6-1
○</td><td>Turn EMG off (open between commons) to bring the motor to a forced stop state, in which the base circuit is shut off and the dynamic brake is operated. Turn EMG on (short between commons) in the forced stop state to reset that state.</td></tr>
<tr><td>Proximity dog</td><td>DOG</td><td colspan="2">CN6-2
○</td><td>When DOG is turned OFF, the proximity dog is detected. The polarity of dog detection can be changed using parameter No. PD16.
<table>
<tr><th>Parameter No, PD16</th><th>Proximity dog (DOG) detection polarity</th></tr>
<tr><td>□0□□ (initial value)</td><td>OFF</td></tr>
<tr><td>□1□□</td><td>ON</td></tr>
</table></td></tr>
<tr><td>Forward rotation stroke end</td><td>LSP</td><td colspan="2">CN6-3
○</td><td rowspan="2">To start operation, turn LSP/LSN on. Turn it off to bring the motor to a sudden stop and make it servo-locked.
<table>
<tr><th colspan="2">(Note) Input signals</th><th colspan="2">Operation</th></tr>
<tr><th>LSP</th><th>LSN</th><th>CCW direction</th><th>CW direction</th></tr>
<tr><td>1</td><td>1</td><td>○</td><td>○</td></tr>
<tr><td>0</td><td>1</td><td></td><td>○</td></tr>
<tr><td>1</td><td>0</td><td>○</td><td></td></tr>
<tr><td>0</td><td>0</td><td></td><td></td></tr>
</table>
Note. 0: OFF
1: ON
The stop method can be changed by parameter No. PD20.
Set parameter No. PD01 as indicated below to switch on the signals (keep terminals connected) automatically in the servo amplifier.
<table>
<tr><th rowspan="2">Parameter No, PD01</th><th colspan="2">Status</th></tr>
<tr><th>LSP</th><th>LSN</th></tr>
<tr><td>□4□□</td><td>Automatic ON</td><td></td></tr>
<tr><td>□8□□</td><td></td><td>Automatic ON</td></tr>
<tr><td>□C□□</td><td>Automatic ON</td><td>Automatic ON</td></tr>
</table>
When LPS or LSN turns OFF, an external stroke limit warning (A99) occurs, and Warning (WNG) turns OFF. However, when using WNG, set the parameter No. PD06 to PD08/Po02 to Po07 to make it usable.</td></tr>
<tr><td>Reverse rotation stroke end</td><td>LSN</td><td colspan="2">CN6-4
○</td></tr>
</table>

<table>
<tr><th rowspan="2">Device</th><th rowspan="2">Symbol</th><th colspan="2">Connector pin No.</th><th rowspan="2">Functions/Applications</th></tr>
<tr><th>PT</th><th>BCD</th></tr>
<tr><td>Servo-on</td><td>SON</td><td colspan="2">CN10-21
○</td><td>Turn SON on to power on the base circuit and make the servo amplifier ready to operate (servo-on).
Turn it off to shut off the base circuit and coast the servo motor.
Set " □□□4 " in parameter No. PD01 to switch this signal on (keep terminals connected) automatically in the servo amplifier.</td></tr>
<tr><td>Reset</td><td>RES</td><td colspan="2">CN10-26
○</td><td>Keeping RES ON for 50ms or longer allows an alarm to be deactivated.
Some alarms cannot be deactivated by Reset RES. (Refer to section 10.2.1.)
If RES is turned ON with no alarm occurring, the base circuit will not be shut off.
When " □□0□ " is set in parameter No. PD20 (function selection D-1), the base circuit is not shut off.
This device is not designed to make a stop. Do not turn it ON during operation.</td></tr>
<tr><td>External torque limit selection</td><td>TL</td><td colspan="2">CN10-27
○</td><td>Turn TL off to make Forward torque limit (parameter No. PA11) and Reverse torque limit (parameter No. PA12) valid, or turn it on to make Analog torque limit (TLA) valid. (Refer to section 3.6.3)</td></tr>
<tr><td>Internal torque limit selection</td><td>TL1</td><td colspan="2">CN10-28
○</td><td>Turn TL off to make Forward torque limit (parameter No. PA11) and Reverse torque limit (parameter No. PA12) valid, or turn it on to make Internal torque limit (parameter No. PC35) valid. (Refer to section 3.6.3)</td></tr>
<tr><td>Manual pulse generator multiplication 1</td><td>TP0</td><td colspan="2">CN10-29
○</td><td rowspan="2">Used to select the multiplication factor of the manual pulse generator.
When it is not selected, the parameter No. PA05 setting is made valid.
<table><tr><th colspan="2">(Note) Input device</th><th rowspan="2">Manual pulse generator multiplication factor</th></tr><tr><th>TP1</th><th>TP0</th></tr><tr><td>0</td><td>0</td><td>Parameter No. PA05 setting</td></tr><tr><td>0</td><td>1</td><td>1 time</td></tr><tr><td>1</td><td>0</td><td>10 times</td></tr><tr><td>1</td><td>1</td><td>100 times</td></tr></table>Note. 0: OFF
1: ON</td></tr>
<tr><td>Manual pulse generator multiplication 2</td><td>TP1</td><td colspan="2">CN10-30
○</td></tr>
<tr><td>Override selection</td><td>OVR</td><td colspan="2">CN10-31
○</td><td>Turn OVR ON to make Override (VC) valid.</td></tr>
<tr><td>Automatic/manual selection</td><td>MD0</td><td colspan="2">CN10-32
○</td><td>Turning MD0 ON selects the automatic operation mode, and turning it OFF selects the manual operation mode.</td></tr>
<tr><td>Temporary stop/Restart</td><td>TSTP</td><td colspan="2">CN10-33
○</td><td>Turning TSTP ON during automatic operation makes a temporary stop.
Turning TSTP ON again makes a restart.
Forward rotation start (ST1) or Reverse rotation start (ST2) is ignored if it is turned ON during a temporary stop.
When the automatic operation mode is changed to the manual operation mode during a temporary stop, the movement remaining distance is erased.
During a home position return or during JOG operation, Temporary stop/Restart input is ignored.</td></tr>
<tr><td>Proportion control</td><td>PC</td><td colspan="2">CN10-34
○</td><td>When PC is turned ON, the speed amplifier is switched from the proportional integral type to the proportional type.
If the servo motor at a stop is rotated even one pulse by an external factor, it develops torque in an attempt to compensate for a position shift. When the shaft is locked mechanically after Movement finish (MEND) is turned OFF, for example, turning Proportion control (PC) ON as soon as Movement finish (MEND) turns OFF allows control of unnecessary torque developed in an attempt to compensate for a position shift.
When the shaft is to be locked for an extended period of time, turn External torque limit selection (TL) ON simultaneously with Proportion control (PC) to make the torque not more than the rated torque using Analog torque limit (TLA).</td></tr>
</table>

Device	Symbol	Connector pin No. PT	Connector pin No. BCD	Functions/Applications
Forward rotation start	ST1	CN10-35	CN10-35	1. In absolute value command system Turning ST1 ON for automatic operation executes positioning once on the basis of the position data set to the point table. Turning ST1 ON for a home position return immediately starts a home position return. Keeping ST1 ON for JOG operation performs rotation in the forward rotation direction. Forward rotation indicates the address increasing direction. 2. In incremental value command system Turning ST1 ON for automatic operation executes positioning once in the forward rotation direction on the basis of the position data set to the point table. Turning ST1 ON for a home position return immediately starts a home position return. Keeping ST1 ON for JOG operation performs rotation in the forward rotation direction. Forward rotation indicates the address increasing direction.
Reverse rotation start	ST2	CN10-36	CN10-36	Use this device in the incremental value command system. Turning ST2 ON for automatic operation executes positioning once in the reverse rotation direction on the basis of the position data set to the point table. Keeping ST2 ON for JOG operation performs rotation in the reverse rotation direction. Reverse rotation indicates the address decreasing direction. Reverse rotation start (ST2) is also used as the start signal of the high-speed automatic positioning function to the home position.
Clear	CR	○	○	When the parameter No. PD22 setting is " □□□ 1 ", the position control counter droop pulses is cleared at the leading edge of CR. The pulse width should be 10ms or more. When the parameter No. PD22 setting is " □□□ 2 ", the pulses are always cleared while CR is on.
Gain changing	CDP	○	○	When CDP is turned ON, the load inertia moment ratio and the corresponding gain values change to the values of parameter No. PB29 to PB32. To change the gain using CDP, make the auto tuning invalid.
Point table No. selection 1	DI0	CN10-1		The point table No. and the home position return are selected by DI0 to DI7.
Point table No. selection 2	DI1	CN10-2		
Point table No. selection 3	DI2	CN10-3		
Point table No. selection 4	DI3	CN10-4		
Point table No. selection 5	DI4	CN10-5		
Point table No. selection 6	DI5	CN10-6		
Point table No. selection 7	DI6	CN10-7		
Point table No. selection 8	DI7	CN10-8		Note. 0: OFF 1: ON

(Note) Device								Selection
DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0	
0	0	0	0	0	0	0	0	Home position return mode
0	0	0	0	0	0	0	1	Point table No.1
0	0	0	0	0	0	1	0	Point table No.2
0	0	0	0	0	0	1	1	Point table No.3
0	0	0	0	0	1	0	0	Point table No.4
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
1	1	1	1	1	1	1	0	Point table No.254
1	1	1	1	1	1	1	1	Point table No.255

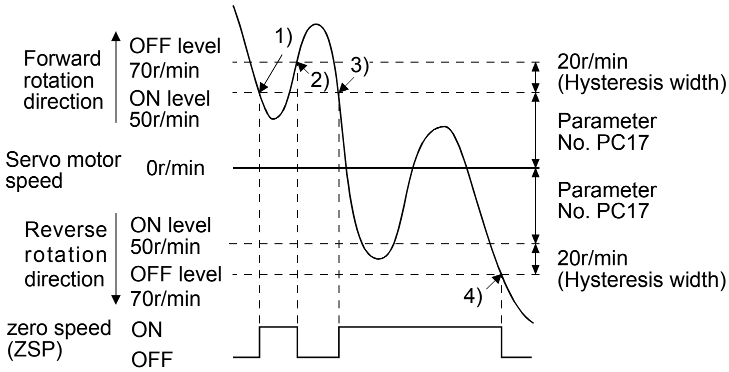
<table>
<tr><th rowspan="2">Device</th><th rowspan="2">Symbol</th><th colspan="2">Connector pin No.</th><th rowspan="2">Functions/Applications</th></tr>
<tr><th>PT</th><th>BCD</th></tr>
<tr><td>Position data input 1
(1/4digit bit0)</td><td>POS00</td><td></td><td>CN10-1</td><td rowspan="12">The 6-digit (BCD 3 digits ×2) position data is input by POS00 to POS03, POS10 to POS13 and POS20 to POS23.
<table><tr><td>bit3 POS23</td><td>bit2 POS22</td><td>bit1 POS21</td><td>bit0 POS20</td><td>bit3 POS13</td><td>bit2 POS12</td><td>bit1 POS11</td><td>bit0 POS10</td><td>bit3 POS03</td><td>bit2 POS02</td><td>bit1 POS01</td><td>bit0 POS00</td></tr><tr><td colspan="4">3rd digit
6th digit</td><td colspan="4">2nd digit
5th digit</td><td colspan="4">1st digit
4th digit</td></tr></table></td></tr>
<tr><td>Position data input 2
(1/4digit bit1)</td><td>POS01</td><td></td><td>CN10-2</td></tr>
<tr><td>Position data input 3
(1/4digit bit2)</td><td>POS02</td><td></td><td>CN10-3</td></tr>
<tr><td>Position data input 4
(1/4digit bit3)</td><td>POS03</td><td></td><td>CN10-4</td></tr>
<tr><td>Position data input 5
(2/5digit bit0)</td><td>POS10</td><td></td><td>CN10-5</td></tr>
<tr><td>Position data input 6
(2/5digit bit1)</td><td>POS11</td><td></td><td>CN10-6</td></tr>
<tr><td>Position data input 7
(2/5digit bit2)</td><td>POS12</td><td></td><td>CN10-7</td></tr>
<tr><td>Position data input 8
(2/5digit bit3)</td><td>POS13</td><td></td><td>CN10-8</td></tr>
<tr><td>Position data input 9
(3/6digit bit0)</td><td>POS20</td><td></td><td>CN10-9</td></tr>
<tr><td>Position data input 10
(3/6digit bit1)</td><td>POS21</td><td></td><td>CN10-10</td></tr>
<tr><td>Position data input 11
(3/6digit bit2)</td><td>POS22</td><td></td><td>CN10-11</td></tr>
<tr><td>Position data input 12
(3/6digit bit3)</td><td>POS23</td><td></td><td>CN10-12</td></tr>
<tr><td>Position data input symbol +</td><td>POSP</td><td></td><td>CN10-15</td><td>The plus symbol of the BCD 3 digits × 2 is input.</td></tr>
<tr><td>Position data input symbol −</td><td>POSN</td><td></td><td>CN10-16</td><td>The minus symbol of the BCD 3 digits × 2 is input.</td></tr>
<tr><td>Strobe input</td><td>STRB</td><td></td><td>CN10-17</td><td>A strobe signal used for inputting the BCD 3 digits × 2 from the programmable controller.</td></tr>
<tr><td>Speed selection 1</td><td>SP0</td><td></td><td>CN10-18</td><td rowspan="4">Used to select a point table and the home position return mode with SP0 to SP3. The motor speed and acceleration/deceleration time constant values of the selected point table are the speed commands for the positioning operation with the BCD 3 digits × 2 input.
<table><tr><th colspan="4">(Note) Device</th><th rowspan="2">Selection</th></tr><tr><th>SP3</th><th>SP2</th><th>SP1</th><th>SP0</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>Home position return mode</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>Point table No.1</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>Point table No.2</td></tr><tr><td>·</td><td>·</td><td>·</td><td>·</td><td>·</td></tr><tr><td>·</td><td>·</td><td>·</td><td>·</td><td>·</td></tr><tr><td>·</td><td>·</td><td>·</td><td>·</td><td>·</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td><td>Point table No.14</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>Point table No.15</td></tr></table></td></tr>
<tr><td>Speed selection 2</td><td>SP1</td><td></td><td>CN10-19</td></tr>
<tr><td>Speed selection 3</td><td>SP2</td><td></td><td>CN10-20</td></tr>
<tr><td>Speed selection 4</td><td>SP3</td><td colspan="2"></td></tr>
</table>

(2) Output device

The Connector pin No. column indicates the connector pin Nos. assigned at default. The device with ○ can change the connector pin Nos. assigned by changing the parameter No. PD09 to PD11, Po08 and Po09. The devices indicated with ⧅ cannot be used.

PT in the table indicates when using a point table, and BCD indicates when using a 6-digit BCD input with symbol.

Device	Symbol	Connector pin No.		Functions/Applications
		PT	BCD	
Ready	RD	CN6-14 ○		RD turns ON when the servo amplifier is ready to operate after servo-on.
Trouble	ALM	CN6-15 ○		ALM turns off when power is switched off or the protective circuit is activated to shut off the base circuit. Without alarm occurring, ALM turns on within 1.5s after power-on.
Home position return completion	ZP	CN6-16 ○		In an absolute position system, ZP turns ON when operation is ready to start, but turns OFF in any of the following cases. 1) Servo-on (SON) is turned OFF. 2) Forced stop (EMG) is turned OFF. 3) Reset (RES) is turned ON. 4) Alarm occurs. 5) Forward rotation stroke end (LSP) or Reverse rotation stroke end (LSN) is turned OFF. 6) Home position return has not been made after product purchase. 7) Home position return has not been made after occurrence of Absolute position erase (A25) or Absolute position counter warning (AE3). 8) Home position return has not been made after electronic gear change. 9) Home position return has not been made after the absolute position system was changed from invalid to valid. 10) Parameter No. PA13 (Rotation direction selection) has been changed. 11) Software limit is valid. 12) While a home position return is being made. When any of 1) to 12) has not occurred and a home position return is already completed at least once, Home position return completion (ZP) turns to the same output status as Ready (RD).
Temporary stop	PUS	CN10-46 ○		TSTP turns ON when deceleration is started to make a stop by Temporary stop/Restart (TSTP). When Temporary stop/Restart (TSTP) is made valid again to resume operation, TSTP turns OFF.
Movement finish	MEND	CN10-47 ○		MEND turns ON when In position (INP) turns ON and the command remaining distance is "0". MEND turns ON at servo-on.
Rough match	CPO	CN10-48 ○		CPO turns ON when the command remaining distance becomes less than the rough match output range set in the parameter. CPO turns ON at servo-on.
In position	INP	CN10-49 ○		INP turns ON when the droop pulse value is within the preset in-position range. The in-position range can be changed using parameter No. PA10. Increasing the in-position range may result in a continuous conduction status during low-speed rotation. INP turns ON at servo-on.

<table>
<tr><th rowspan="2">Device</th><th rowspan="2">Symbol</th><th colspan="2">Connector pin No.</th><th rowspan="2">Functions/Applications</th></tr>
<tr><th>PT</th><th>BCD</th></tr>
<tr><td>Zero speed</td><td>ZSP</td><td colspan="2">○</td><td>ZSP turns on when the servo motor speed is zero speed (50r/min) or less. Zero speed can be changed using parameter No. PC17.
Example
Zero speed is 50r/min


ZSP turns on 1) when the servo motor is decelerated to 50r/min, and ZSP turns off 2) when the servo motor is accelerated to 70r/min again. ZSP turns on 3) when the servo motor is decelerated again to 50r/min, and turns off 4) when the servo motor speed has reached -70r/min. 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 20r/min for this servo amplifier.</td></tr>
<tr><td>Limiting torque</td><td>TLC</td><td colspan="2">○</td><td>TLC turns on when the torque generated reaches the value set to the Forward torque limit (parameter No. PA11), Reverse torque limit (parameter No. PA12) or analog torque limit (TLA).</td></tr>
<tr><td>Warning</td><td>WNG</td><td colspan="2">○</td><td>WNG turns ON when a warning occurs.
When no warning has occurred, WNG turns OFF within about 1s after power-on.</td></tr>
<tr><td>Electromagnetic brake interlock</td><td>MBR</td><td colspan="2">○</td><td>MBR turns OFF at servo-off or alarm occurrence. At alarm occurrence, it turns OFF independently of the base circuit status.</td></tr>
<tr><td>Dynamic brake interlock</td><td>DB</td><td colspan="2">○</td><td>DB turns off simultaneously when the dynamic brake is operated. When using the external dynamic brake on the servo amplifier of 11 kW or more, this device is required. (Refer to section 13.6.) For the servo amplifier of 7kW or less, it is not necessary to use this device.</td></tr>
<tr><td>Battery warning</td><td>BWNG</td><td colspan="2">○</td><td>BWNG turns ON when Open battery cable warning (A92) or Battery warning (A9F) occurs. When no battery warning has occurred, BWNG turns OFF within about 1s after power-on.</td></tr>
<tr><td>Position range</td><td>POT</td><td colspan="2">○</td><td>POT turns ON when the actual current position falls within the range set in the parameter. It is OFF when a home position return is not yet completed or while the base circuit is off.</td></tr>
<tr><td>Variable gain selection</td><td>CDPS</td><td colspan="2">○</td><td>CDPS is on during gain changing.</td></tr>
<tr><td>Command speed reached</td><td>SA</td><td colspan="2">○</td><td>SA turns on when servo-on (SON) is on and the commanded speed is at the target speed.
SA always turns on when servo-on (SON) is on and the commanded speed is 0r/min.
SA turns off when servo-on (SON) is off or the commanded speed is in acceleration/deceleration.</td></tr>
</table>

<table>
<tr><th rowspan="2">Device</th><th rowspan="2">Symbol</th><th colspan="2">Connector pin No.</th><th rowspan="2">Functions/Applications</th></tr>
<tr><th>PT</th><th>BCD</th></tr>
<tr><td>Point table No. output 1</td><td>PT0</td><td>○</td><td></td><td rowspan="8">As soon as Movement finish (MEND) turns ON, the point table No. is output in 8-bit code.
<table>
<tr><th colspan="8">(Note) Device</th><th rowspan="2">Point table No.</th></tr>
<tr><th>PT7</th><th>PT6</th><th>PT5</th><th>PT4</th><th>PT3</th><th>PT2</th><th>PT1</th><th>PT0</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>2</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>3</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>4</td></tr>
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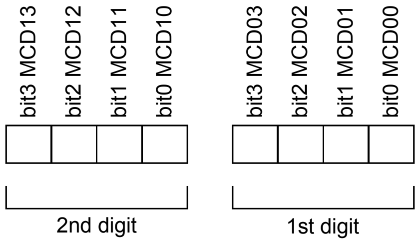
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>254</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>255</td></tr>
</table>
Note. 0 :OFF
1 :ON

PT0 to PT7 turn OFF in any of the following statuses.
・Power on
・Servo off
・During home position return
・Home position return completion
In any of the following statuses, PT0 to PT7 maintain their pre-change status (ON/OFF).
・When operation mode is changed
・When Automatic/manual selection (MD0) is turned from OFF to ON or from ON to OFF to change the operation mode.
・During manual operation
・During execution of automatic positioning to home position</td></tr>
<tr><td>Point table No. output 2</td><td>PT1</td><td>○</td><td></td></tr>
<tr><td>Point table No. output 3</td><td>PT2</td><td>○</td><td></td></tr>
<tr><td>Point table No. output 4</td><td>PT3</td><td>○</td><td></td></tr>
<tr><td>Point table No. output 5</td><td>PT4</td><td>○</td><td></td></tr>
<tr><td>Point table No. output 6</td><td>PT5</td><td>○</td><td></td></tr>
<tr><td>Point table No. output 7</td><td>PT6</td><td>○</td><td></td></tr>
<tr><td>Point table No. output 8</td><td>PT7</td><td>○</td><td></td></tr>
<tr><td>Alarm code 0</td><td>ACD0</td><td colspan="2">CN10-22
○</td><td rowspan="4">This device is output when an alarm occurs.
Refer to section 10.2.1 for the alarm codes to be output.</td></tr>
<tr><td>Alarm code 1</td><td>ACD1</td><td colspan="2">CN10-23
○</td></tr>
<tr><td>Alarm code 2</td><td>ACD2</td><td colspan="2">CN10-24
○</td></tr>
<tr><td>Alarm code 3</td><td>ACD3</td><td colspan="2">CN10-25
○</td></tr>
</table>

Device	Symbol	Connector pin No. PT	Connector pin No. BCD	Functions/Applications
M code 1 (bit0)	MCD00	CN10-38		As soon as Rough match (CPO) turns ON, the M code is output.  MCD00 to MCD03 and MCD10 to MCD13 turn OFF in any of the following statuses. ・Power on ・Servo off ・During home position return ・Home position return completion In any of the following statuses, MCD00 to MCD03 and MCD10 to MCD13 maintain their pre-change status (ON/OFF). ・When operation mode is changed ・When Automatic/manual selection (MD0) is turned from OFF to ON or from ON to OFF to change the operation mode. ・During manual operation ・During execution of automatic positioning to home position
M code 2 (bit1)	MCD01	CN10-39		
M code 3 (bit2)	MCD02	CN10-40		
M code 4 (bit3)	MCD03	CN10-41		
M code 5 (bit4)	MCD10	CN10-42		
M code 6 (bit5)	MCD11	CN10-43		
M code 7 (bit6)	MCD12	CN10-44		
M code 8 (bit7)	MCD13	CN10-45		
Position data request 1	PRQ1		CN10-44	PRQ0 is turned ON when the position data of symbol and sixth/fifth/fourth digits are requested to a programmable controller during the positioning operation with the BCD 3 digits × 2 input.
Position data request 2	PRQ2		CN10-45	PRQ1 is turned ON when the position data of third/second/first digits are requested to a programmable controller during the positioning operation with the BCD 3 digits × 2 input.

3.5.2 Input signals

Signal	Symbol	Connector pin No.	Functions/Applications	I/O division
Manual pulse generator	PP	CN6-6	Used to connect the manual pulse generator (MR-HDP01). (Refer to section 13.18.)	
	NP	CN6-19		
Analog torque limit	TLA	CN20-12	When the analog torque limit (TLA) is valid, torque is limited in the full servo motor output torque range. Apply 0 to +10VDC across TLA-LG. Connect the positive terminal of the power supply to TLA. Maximum torque is generated at +10V. (Refer to section 3.6.3.) Resolution: 12bit	Analog input
Override	VC	CN20-2	By applying -10 to +10V across VC-LG, the servo motor speed is limited. The limit value is 0% with -10V, 100% with 0V and 200% with +10V to the rated speed of the servo motor.	Analog input

3.5.3 Output signals

Refer to section 3.8.2 for the output interfaces (symbols in the I/O Division field in the table) of the corresponding connector pins.

Signal	Symbol	Connector pin No.	Functions/Applications	I/O division
Encoder A-phase pulse (differential line driver)	LA LAR	CN6-11 CN6-24	Outputs pulses per servo motor revolution set in parameter No. PA15 in the differential line driver system. In CCW rotation of the servo motor, the encoder B-phase pulse lags the encoder A-phase pulse by a phase angle of $\pi/2$. The relationships between rotation direction and phase difference of the A- and B-phase pulses can be changed using parameter No. PC19.	DO-2
Encoder B-phase pulse (differential line driver)	LB LBR	CN6-12 CN6-25		
Encoder Z-phase pulse (differential line driver)	LZ LZR	CN6-13 CN6-26	Outputs the zero-point signal of the encoder in the differential line driver system. One pulse is output per servo motor revolution. This signal turns on when the zero-point position is reached. (Negative logic)The minimum pulse width is about 400μs. For home position return using this pulse, set the creep speed to 100r/min. or less.	DO-2
Analog monitor 1	MO1	CN20-4	Used to output the data set in parameter No. Po13 to across MO1-LG in terms of voltage. Resolution 12 bits	Analog output
Analog monitor 2	MO2	CN20-14	Used to output the data set in parameter No. Po14 to across MO2-LG in terms of voltage. Resolution 12 bits	Analog output

3.5.4 Power supply

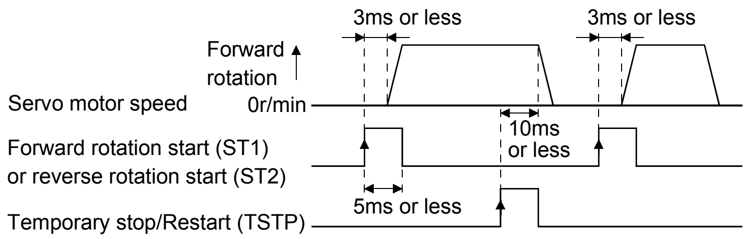
Signal	Symbol	Connector pin No.	Functions/Applications	I/O division
Servo amplifier digital I/F power supply input	DICOM	CN6-5	Used to input 24VDC (24VDC 10% 150mA) for I/O interface of the servo amplifier. The power supply capacity changes depending on the number of I/O interface points to be used. Connect the positive terminal of the 24VDC external power supply for the sink interface.	
Servo amplifier digital I/F common	DOCOM	CN6-17	Common terminal for input signals such as DOG and EMG of the servo amplifier. Pins are connected internally. Separated from LG. Connect the positive terminal of the 24VDC external power supply for the source interface.	
MR-HDP01 open collector power input	OPC	CN6-18	When using the MR-HDP01 manual pulse generator, connect OPC and DICOMD, and supply OPC with the positive (+) voltage of 24VDC.	
MR-HDP01 digital I/F power supply input	DICOMD	CN10-13 CN10-14	Used to input 24VDC (24VDC ±10% 800mA) for I/O interface of the MR-J3-D01. The power supply capacity changes depending on the number of I/O interface points to be used. Connect the positive terminal of the 24VDC external power supply for the sink interface. Pins are connected internally.	
MR-HDP01 digital I/F common	DOCOMD	CN10-37	Common terminal for input signals such as SON and RES of the MR-J3-D01. Pins are connected internally. Separated from LG. Connect the positive terminal of the 24VDC external power supply for the source interface.	
+15VDC power supply	P15R	CN20-13	Outputs +15VDC to across P15R-LG. Available as power for TLA, VC. Permissible current: 30mA	
−12VDC power supply	N12R	CN20-15	Outputs −12VDC to across N12R-LG. Available as power for VC. However, there is an individual difference of about -12 to -15V in the voltage. Permissible current: 30mA	
Control common	LG	CN6-23 CN20-1 CN20-9 CN20-11 CN30-1	Common terminal for TLA, VC, VLA, OP, MO1, MO2 and P15R. Pins are connected internally.	
Shield	SD	CN10-50 Plate	Connect the external conductor of the shield cable.	

3.6 Detailed description of signals (devices)

3.6.1 Forward rotation start · Reverse rotation start · Temporary stop/Restart

(1) A forward rotation start (ST1) or a reverse rotation start (ST2) should make the sequence which can be used after the main circuit has been established. These signals are invalid if it is switched on before the main circuit is established.
Normally, it is interlocked with the ready signal (RD).

(2) A start in the servo amplifier is made when a forward rotation start (ST1) or a reverse rotation start (ST2) changes from OFF to ON. The delay time of the servo amplifier's internal processing is max. 3ms. The delay time of other devices is max. 10ms.



(3) When a programmable controller is used, the ON time of a forward rotation start (ST1), a reverse rotation start (ST2) or temporary start/stop (TSTP) signal should be 6ms or longer to prevent a malfunction.

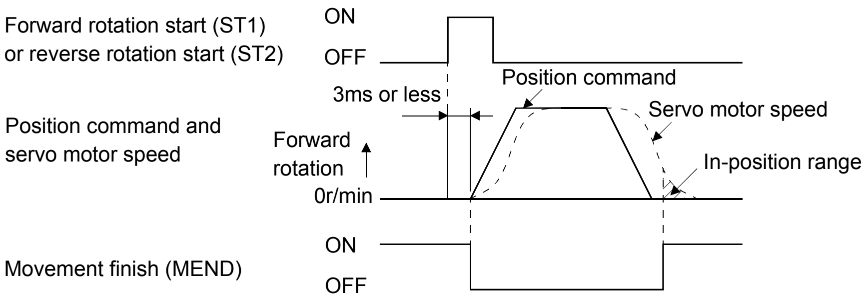
(4) During operation, the forward rotation start (ST1) or reverse rotation start (ST2) is not accepted. The next operation should always be started after the rough match (CPO) is output with the rough match output range set to “0” or after the movement finish (MEND) is output.

3.6.2 Movement finish · Rough match · In position

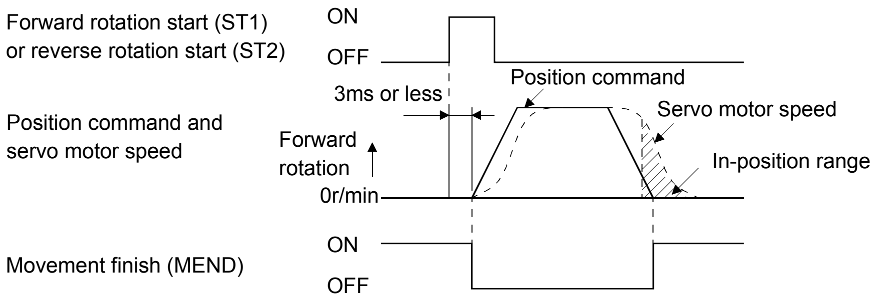
POINT
· If servo-on occurs after a stop made by servo-off, alarm occurrence or Forced stop (EMG) ON during automatic operation, Movement finish (MEND), Rough match (CPO) and In position (INP) turn on. To make a start again, confirm the point table No. being specified, and turn on Forward rotation start (ST1).

(1) Movement finish

The following timing charts show the output timing relationships between the position command generated in the servo amplifier and the movement finished (MEND). This timing can be changed using parameter No. PA10 (in-position range). MEND turns ON in the servo-on status. MEND does not turn ON during automatic operation.



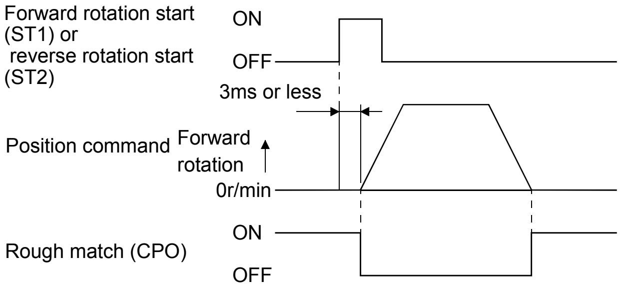
When parameter No. PA10 is small



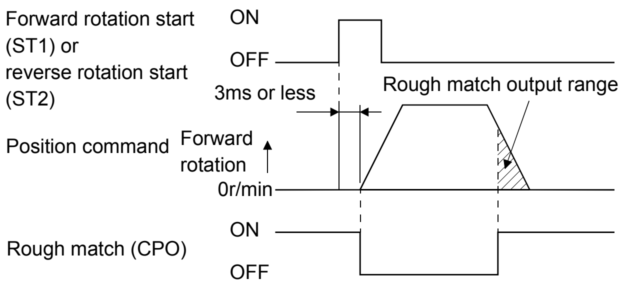
When parameter No. PA10 is large

(2) Rough match

The following timing charts show the relationships between the signal and the position command generated in the servo amplifier. This timing can be changed using parameter No. PC11 (rough match output range). CPO turns ON in the servo-on status. CPO does not turn ON during automatic operation.



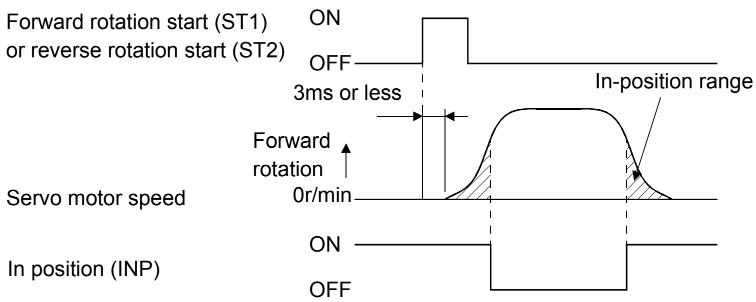
When "0" is set in parameter No. PC11



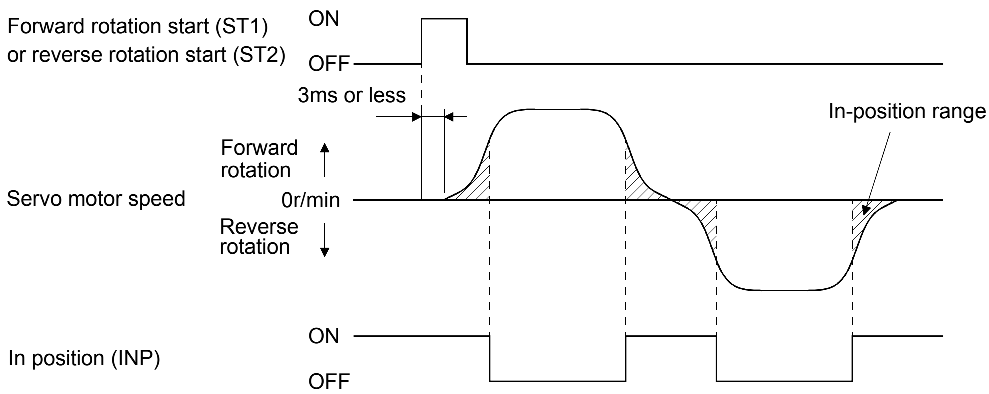
When more than "0" is set in parameter No. PC11

(3) In position

The following timing chart shows the relationship between the signal and the feedback pulse of the servo motor. This timing can be changed using parameter No. PA10 (in-position range). INP turns ON in the servo-on status.



When positioning operation is performed once



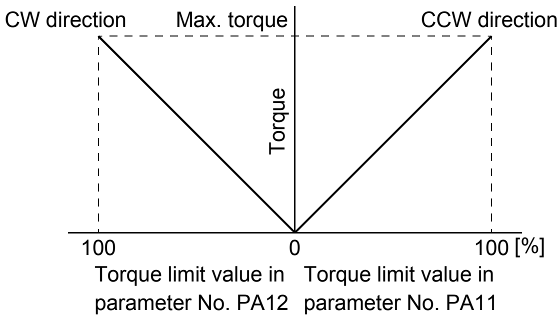
When servo motor reverses rotation direction during automatic continuous operation

3.6.3 Torque limit

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

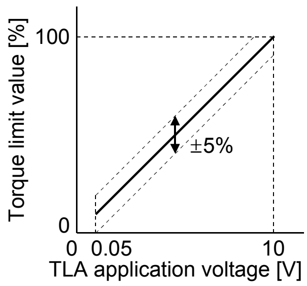
(1) Torque limit and torque

By setting parameter No. PA11 (forward torque limit) or parameter No. PA12 (reverse torque limit), torque is always limited to the maximum value during operation. A relationship between the limit value and servo motor torque is shown below.

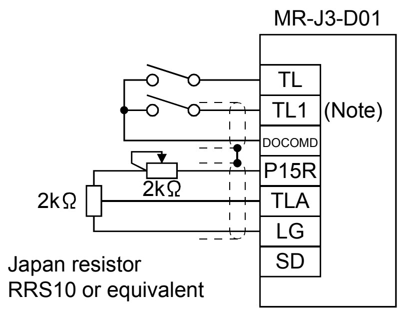


A relationship between the applied voltage of the analog torque limit (TLA) and the torque limit value of the servo motor is shown below. Torque limit values will vary about 5% relative to the voltage depending on products.

At the voltage of less than 0.05V, torque may vary as it may not be limited sufficiently. Therefore, use this function at the voltage of 0.05V or more.



TLA application voltage vs. torque limit value



Connection example

Note. For the sink I/O interface. For the source I/O interface, refer to section 3.8.3.

(2) Torque limit value selection and internal torque limit selection (TL1)

As shown below, the forward torque limit (parameter No. PA11), or reverse torque limit (parameter No. PA12), the analog torque limit (TLA) and internal torque limit 2 (Parameter No. PC35) can be chosen using the internal torque limit selection (TL1).

However, if the parameter No. PA11 and parameter No. PA12 value is less than the limit value selected by TL/TL1, the parameter No. PA11 and parameter No. PA12 value is made valid.

(Note) Input devices		Limit Value Status	Torque limite to be enabled	
TL1	TL		CCW driving/CW regeneration	CW driving/CCW regeneration
0	0		Parameter No. PA11	Parameter No. PA12
0	1	TLA > Parameter No. PA11 Parameter No. PA12	Parameter No. PA11	Parameter No. PA12
		TLA < Parameter No. PA11 Parameter No. PA12	TLA	TLA
1	0	Parameter No. PC35 > Parameter No. PA11 Parameter No. PA12	Parameter No. PA11	Parameter No. PA12
		Parameter No. PC35 < Parameter No. PA11 Parameter No. PA12	Parameter No. PC35	Parameter No. PC35
1	1	TLA > Parameter No. PC35	Parameter No. PC35	Parameter No. PC35
		TLA < Parameter No. PC35	TLA	TLA

Note. 0: off
1: on

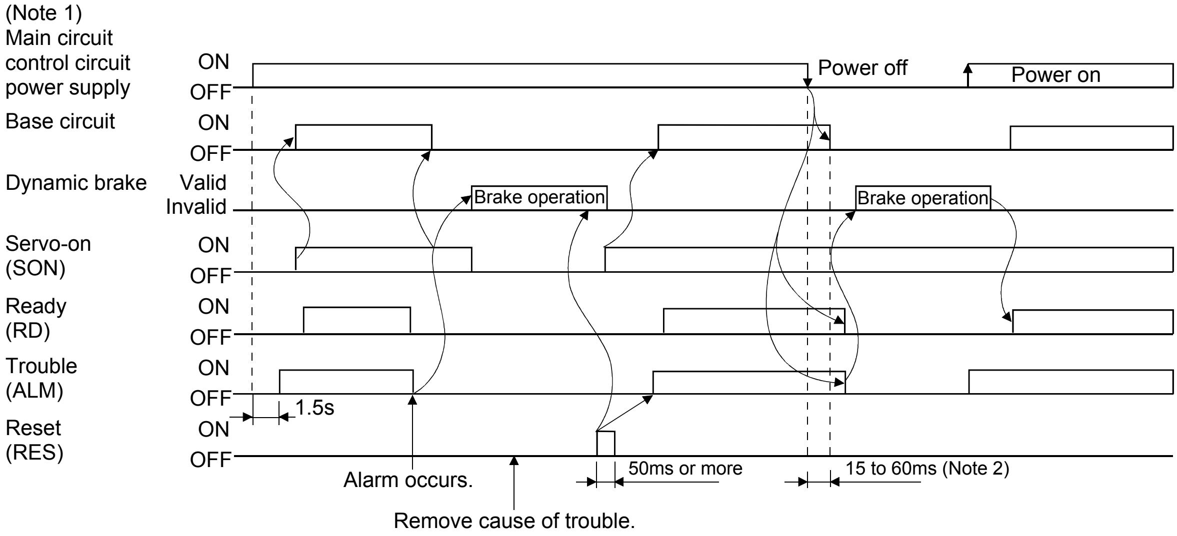
(3) Limiting torque (TLC)

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

3.7 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. ・As soon as an alarm occurs, turn off Servo-on (SON) and power off.

When an alarm occurs in the servo amplifier, the base circuit is shut off and the servo motor is coated to a stop. Switch off the main circuit power supply in the external sequence. To reset the alarm, switch the control circuit power supply from off to on, or turn the reset (RES) from off to on. However, the alarm cannot be reset unless its cause is removed.



Note 1. Shut off the main circuit power as soon as an alarm occurs.
2. Changes depending on the operating status.

(1) Overcurrent, overload 1 or overload 2
If operation is repeated by switching control circuit power off, then on to reset the overcurrent (A32), overload 1 (A50) or overload 2 (A51) alarm after its occurrence, without removing its cause, the servo amplifier and servo motor may become faulty due to temperature rise. Securely remove the cause of the alarm and also allow about 30 minutes for cooling before resuming operation.

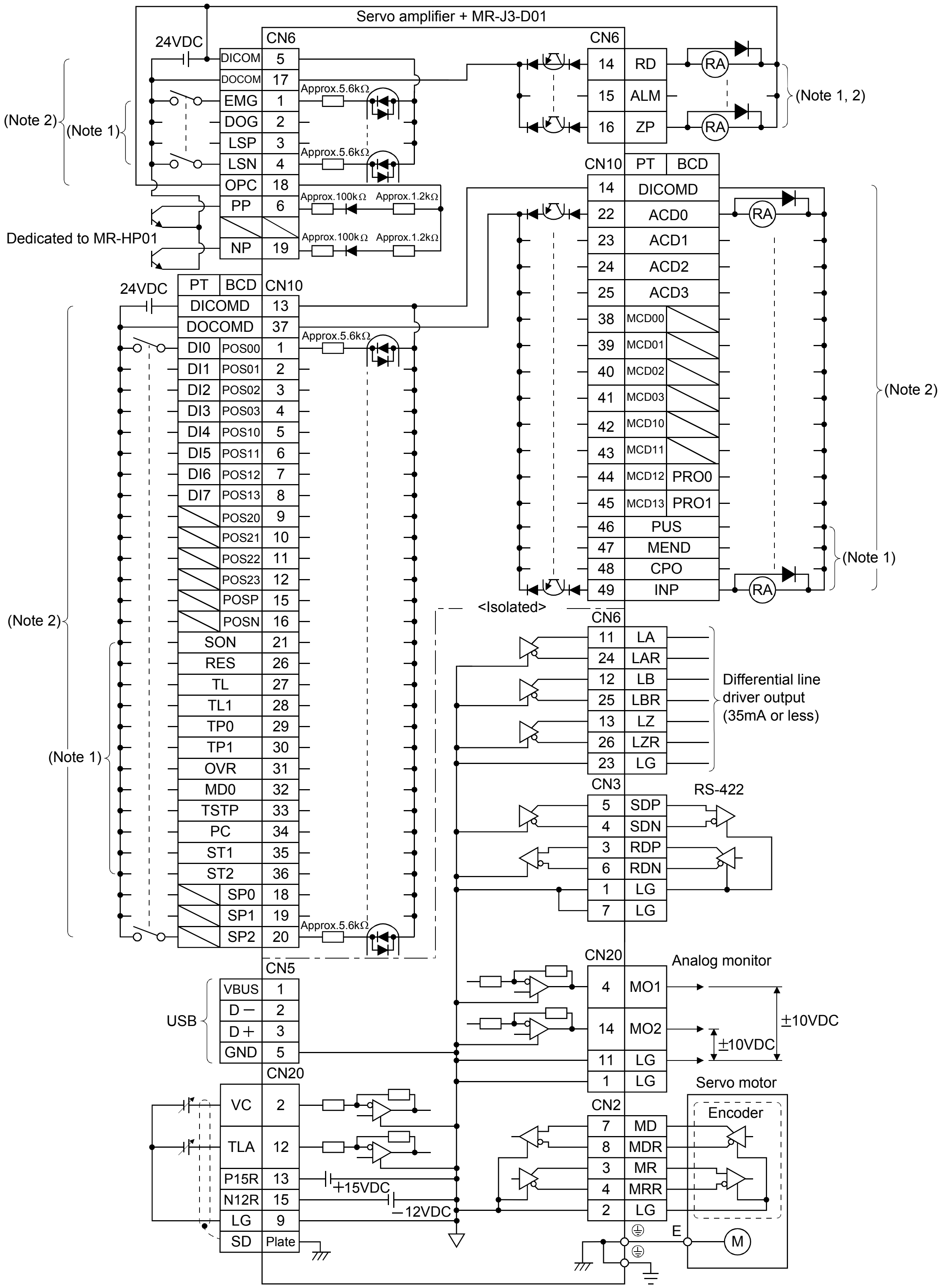
(2) Regenerative alarm
If operation is repeated by switching control circuit power off, then on to reset the regenerative (A30) alarm after its occurrence, the external regenerative resistor will generate heat, resulting in an accident.

(3) Instantaneous power failure
Undervoltage (A10) occurs when the input power is in either of the following statuses.
- A power failure of the control circuit power supply continues for 60ms or longer and the control circuit is not completely off.
- The bus voltage dropped to 200VDC or less for the MR-J3-□T, to 158VDC or less for the MR-J3-□T1, or to 380VDC or less for the MR-J3-□T4.

(4) Incremental system
When an alarm occurs, the home position is lost. When resuming operation after deactivating the alarm, make a home position return.

3.8 Interface

3.8.1 Internal connection diagram



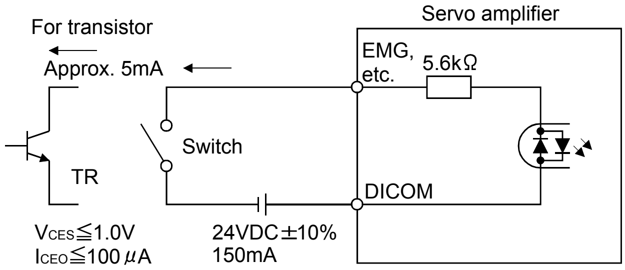
Note 1. Devices assigned to these pins can be changed in the parameter settings.
2. For this sink I/O interface. For the source I/O interface, refer to section 3.8.3.

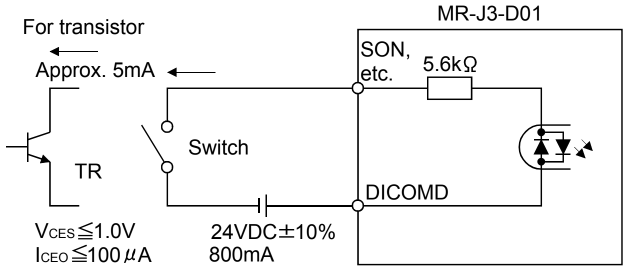
3.8.2 Detailed description of interfaces

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

(1) Digital input interface DI-1

Give a signal with a relay or open collector transistor. Refer to section 3.8.3 for the source input.

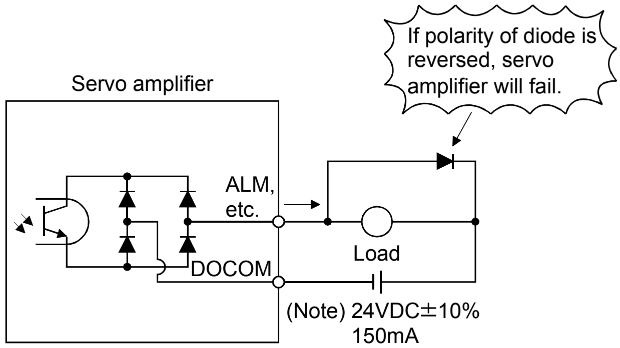


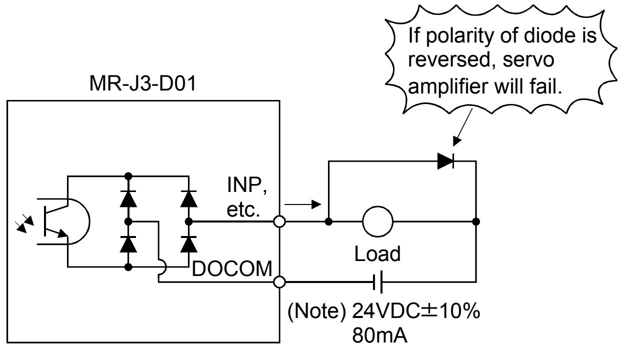


(2) Digital output interface DO-1

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

Refer to section 3.8.3 for the source output.



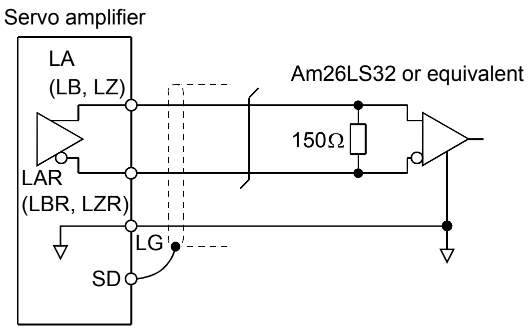


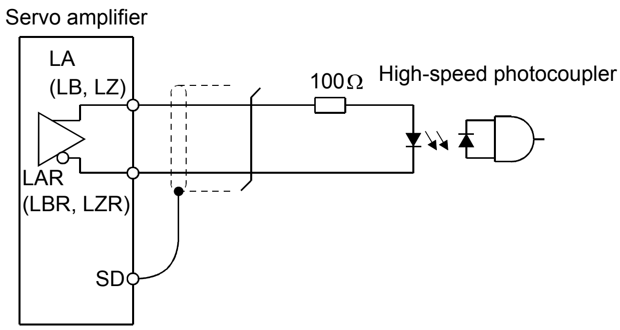
Note. If the voltage drop (maximum of 2.6V) interferes with the relay operation, apply high voltage (up to 26.4V) from external source.

(3) Encoder output pulse DO-2 (Differential line driver system)

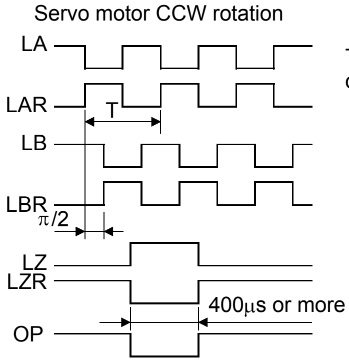
(a) Interface

Max. output current: 35mA





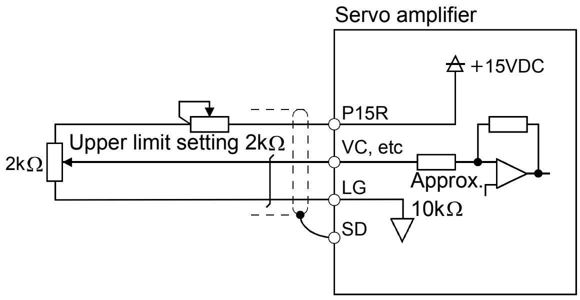
(b) Output pulse

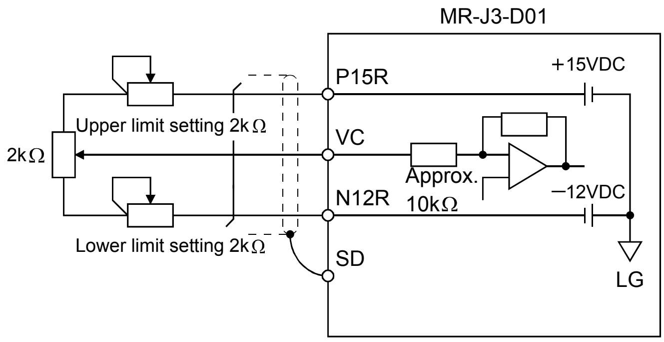


Time cycle (T) is determined by the settings of parameter No.PA15 and PC19.

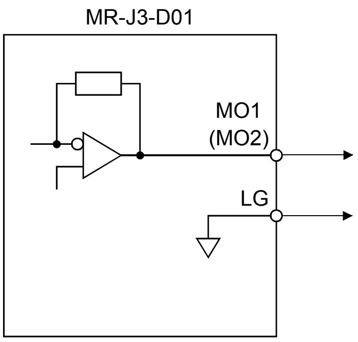
(4) Analog input

Input impedance 10 to 12kΩ





(5) Analog output

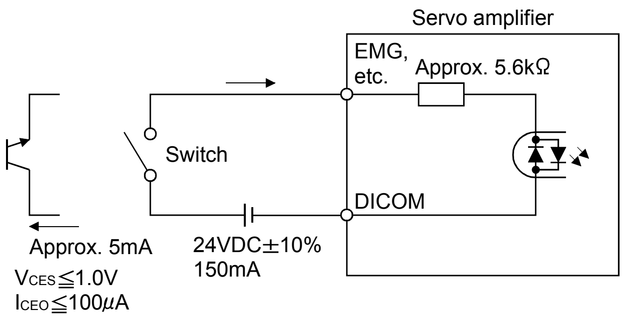


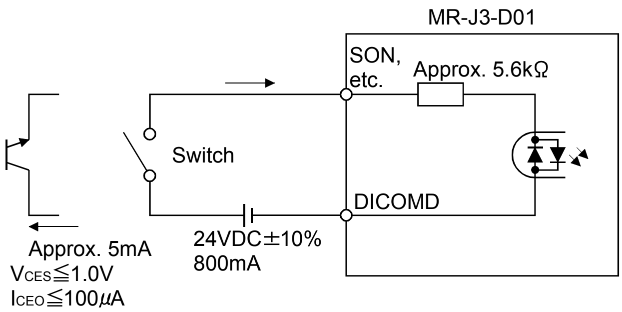
Output voltage±10V
Max. 1mA
Max. Output current Resolution: 12 bit

3.8.3 Source I/O interfaces

In this servo amplifier, source type I/O interfaces can be used. In this case, all DI-1 input signals and DO-1 output signals are of source type. Perform wiring according to the following interfaces.

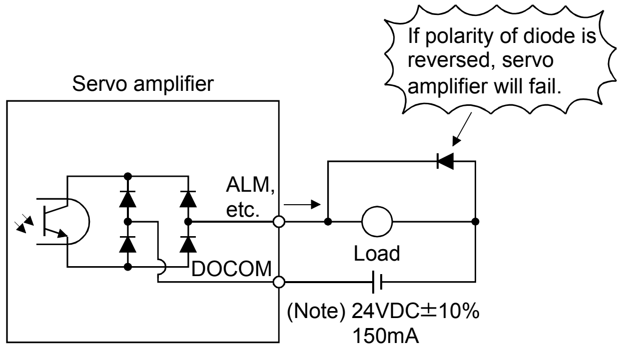
(1) Digital input interface DI-1

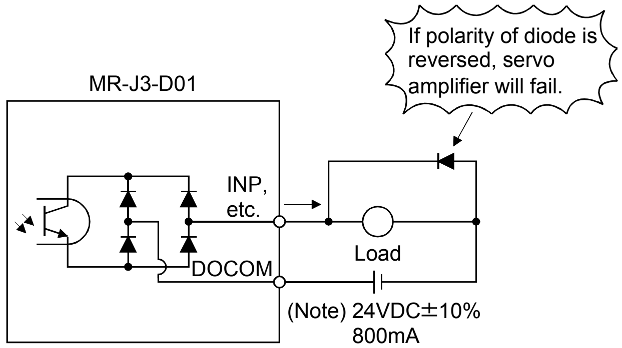




(2) Digital output interface DO-1

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

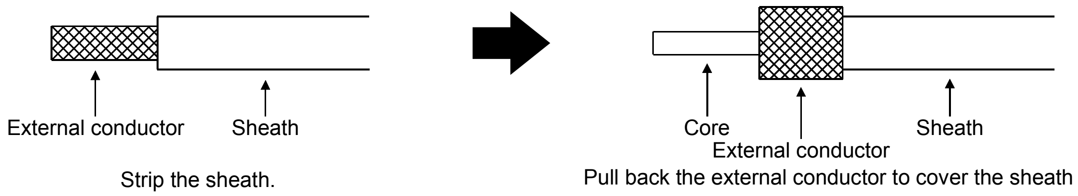




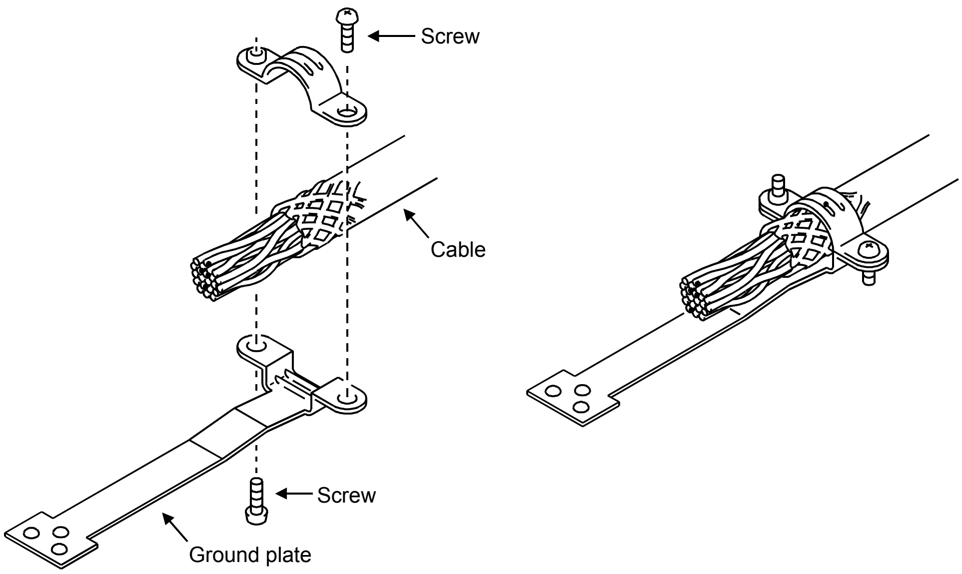
Note. If the voltage drop (maximum of 2.6V) interferes with the relay operation, apply high voltage (up to 26.4V) from external source.

3.9 Treatment of cable shield external conductor

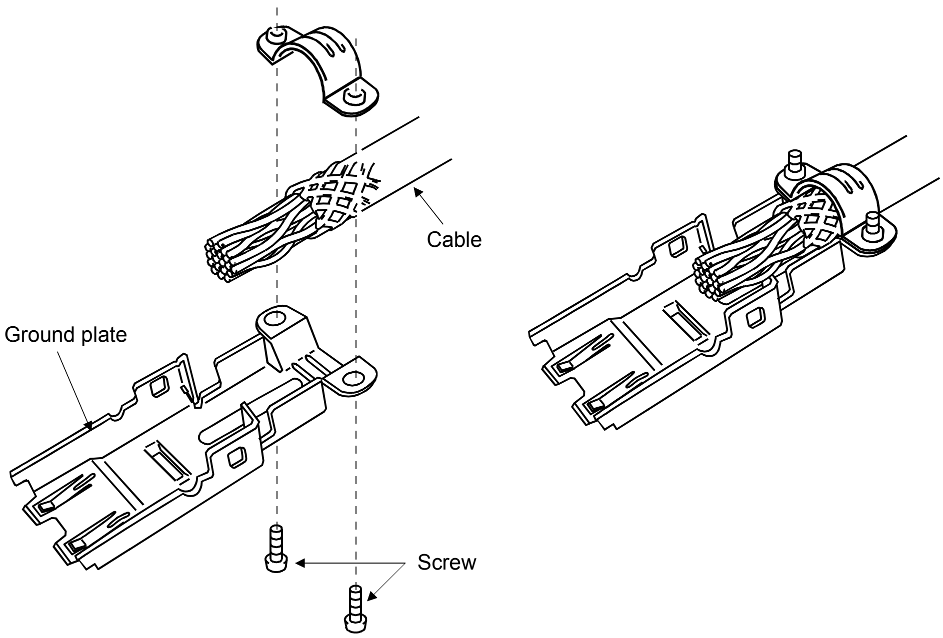
In the case of the CN2, CN6, CN10 and CN20 connectors, securely connect the shielded external conductor of the cable to the ground plate as shown in this section and fix it to the connector shell.



(1) For CN6, CN10 and CN20 connector (3M connector)



(2) For CN2 connector (3M or Molex connector)



3.10 Connection of servo amplifier and servo motor

⚠ WARNING	・During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.

3.10.1 Connection instructions

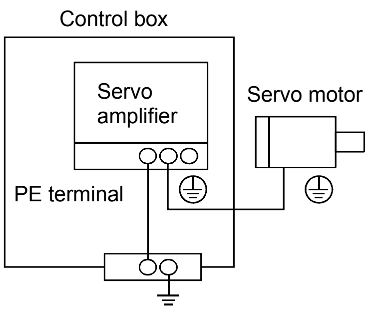
⚠ WARNING	・Insulate the connections of the power supply terminals to prevent an electric shock.

⚠ CAUTION	・Connect the wires to the correct phase terminals (U, V, W) of the servo amplifier and servo motor. Not doing so may cause unexpected operation. ・Do not connect AC power supply directly to the servo motor. Otherwise, a fault may occur.

POINT
・Refer to section 13.1 for the selection of the encoder cable.

This section indicates the connection of the servo motor power (U, V, W). Use of the optional cable and connector set is recommended for connection between the servo amplifier and servo motor. When the options are not available, use the recommended products. Refer to section 13.1 for details of the options.

(1) For grounding, connect the earth cable of the servo motor to the protective earth (PE) terminal (⏚) of the servo amplifier and connect the ground cable of the servo amplifier to the earth via the protective earth of the control box. Do not connect them directly to the protective earth of the control panel.

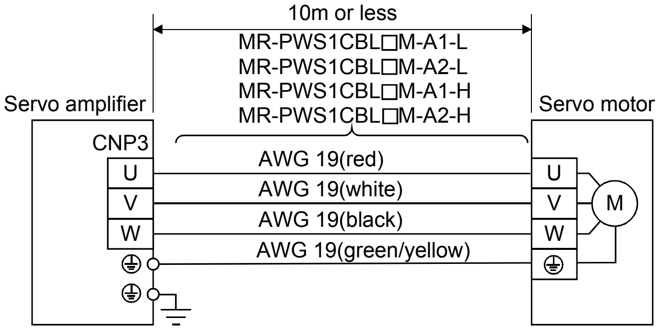


(2) Do not share the 24VDC interface power supply between the interface and electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake.

3.10.2 Power supply cable wiring diagrams

(1) HF-MP service・HF-KP series servo motor

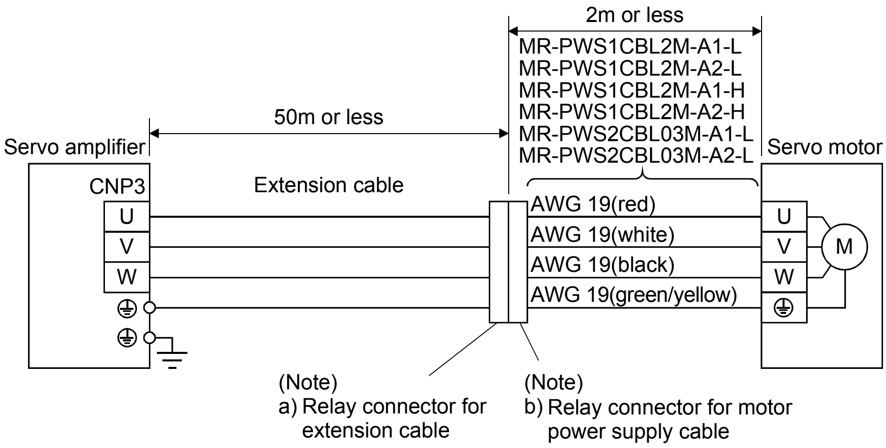
(a) When cable length is 10m or less



(b) When cable length exceeds 10m

When the cable length exceeds 10m, fabricate an extension cable as shown below. In this case, the motor power supply cable should be within 2m long.

Refer to section 13.9 for the wire used for the extension cable.



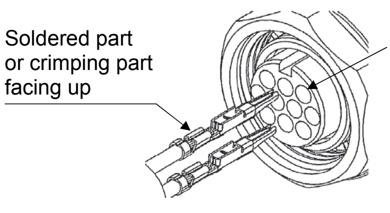
Note. Use of the following connectors is recommended when ingress protection (IP65) is necessary.

Relay Connector	Description	Protective Structure
a) Relay connector for extension cable	Connector: RM15WTPZ-4P(71) Cord clamp: RM15WTP-CP(5)(71) (Hirose Electric) └ Numeral changes depending on the cable OD	IP65
b) Relay connector for motor power supply cable	Connector: RM15WTJA-4S(71) Cord clamp: RM15WTP-CP(8)(71) (Hirose Electric) └ Numeral changes depending on the cable OD	IP65

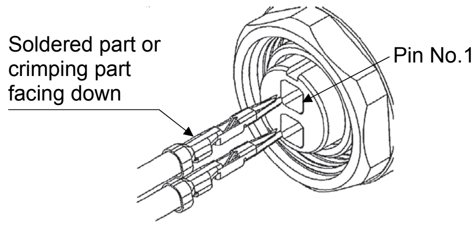
(2) HF-SP series・HC-RP series・HC-UP series・HC-LP series servo motor

POINT

・B Insert a contact in the direction shown in the figure. If inserted in the wrong direction, the contact is damaged and falls off.



For CM10-SP10S-☐

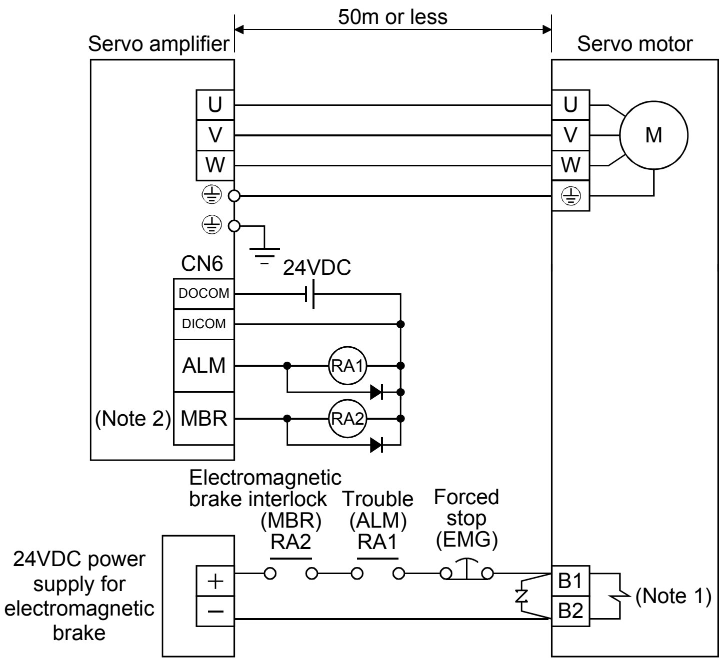


For CM10-SP2S-☐

(a) Wiring diagrams

Refer to section 13.9 for the cables used for wiring.

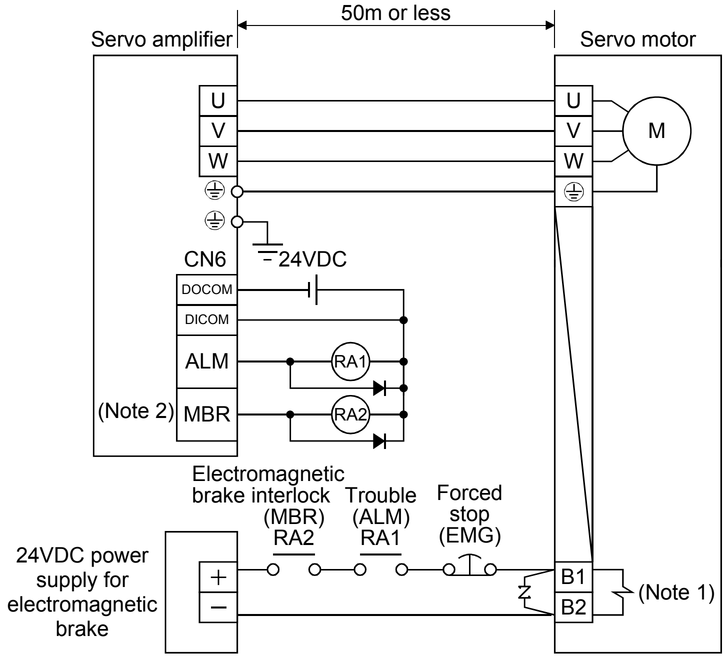
1) When the power supply connector and the electromagnetic brake connector are separately supplied



Note 1. There is no polarity in electromagnetic brake terminals B1 and B2.

2. When using a servo motor with electromagnetic brake, assign the electromagnetic brake interlock (MBR) to external output signal in the parameters No. PD09 to PD11, Po08 and Po09.

2) When the power supply connector and the electromagnetic brake connector are shared

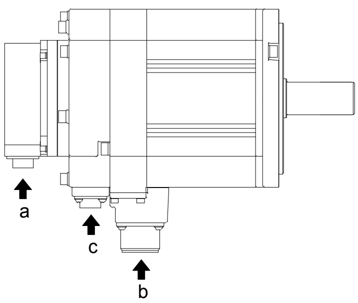


Note 1. There is no polarity in electromagnetic brake terminals B1 and B2.

2. When using a servo motor with electromagnetic brake, assign the electromagnetic brake interlock (MBR) to external output signal in the parameters No. PD09 to PD11, Po08 and Po09.

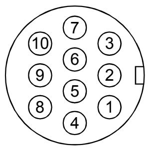
(b) Connector and signal allotment

The connector fitting the servo motor is prepared as optional equipment. Refer to section 13.1. For types other than those prepared as optional equipment, refer to chapter 3 in Servo motor Instruction Manual, Vol. 2 to select.



Servo motor	Servo motor side connectors		
	Encoder	Power supply	Electromagnetic brake
HF-SP52(4) to 152(4)	CM10-R10P (DDK)	MS3102A18-10P	CM10-R2P (DDK)
HF-SP51 ・ 81			
HF-SP202(4) to 502(4)		MS3102A22-22P	
HF-SP121 to 301			
HF-SP421 ・ 702(4)		CE05-2A32-17PD-B	
HC-RP103 to 203		CE05-2A22-23PD-B	The connector for power is shared
HC-RP353 ・ 503		CE05-2A24-10PD-B	
HC-UP72 ・ 152		CE05-2A22-23PD-B	
HC-UP202 to 502		CE05-2A24-10PD-B	MS3102A10SL-4P
HC-LP52 to 152		CE05-2A22-23PD-B	The connector for power is shared
HC-LP202 ・ 302		CE05-2A24-10PD-B	MS3102A10SL-4P

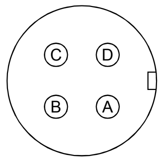
Encoder connector signal allotment
CM10-R10P



View a

Terminal No.	Signal
1	MR
2	MRR
3	
4	BAT
5	LG
6	
7	
8	P5
9	
10	SHD

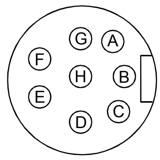
Power supply connector signal allotment
MS3102A18-10P
MS3102A22-22P
CE05-2A32-17PD-B



View b

Terminal No.	Signal
A	U
B	V
C	W
D	⏚ (earth)

Power supply connector signal allotment
CE05-2A22-23PD-B

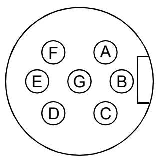


View b

Terminal No.	Signal
A	U
B	V
C	W
D	⏚ (earth)
E	
F	
G	B1 (Note)
H	B2 (Note)

Note. For the motor with electromagnetic brake, supply electromagnetic brake power (24VDC). There is no polarity.

Power supply connector signal allotment
CE05-2A24-10PD-B

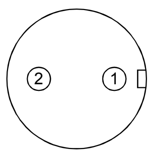


View b

Terminal No.	Signal
A	U
B	V
C	W
D	⏚ (earth)
E	B1 (Note)
F	B2 (Note)
G	

Note. For the motor with electromagnetic brake, supply electromagnetic brake power (24VDC). There is no polarity.

Brake connector signal allotment
CM10-R2P

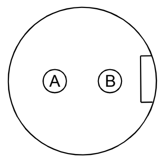


View c

Terminal No.	Signal
1	B1 (Note)
2	B2 (Note)

Note. For the motor with electromagnetic brake, supply electromagnetic brake power (24VDC). There is no polarity.

Brake connector signal allotment
MS3102A10SL-4P



View c

Terminal No.	Signal
A	B1 (Note)
B	B2 (Note)

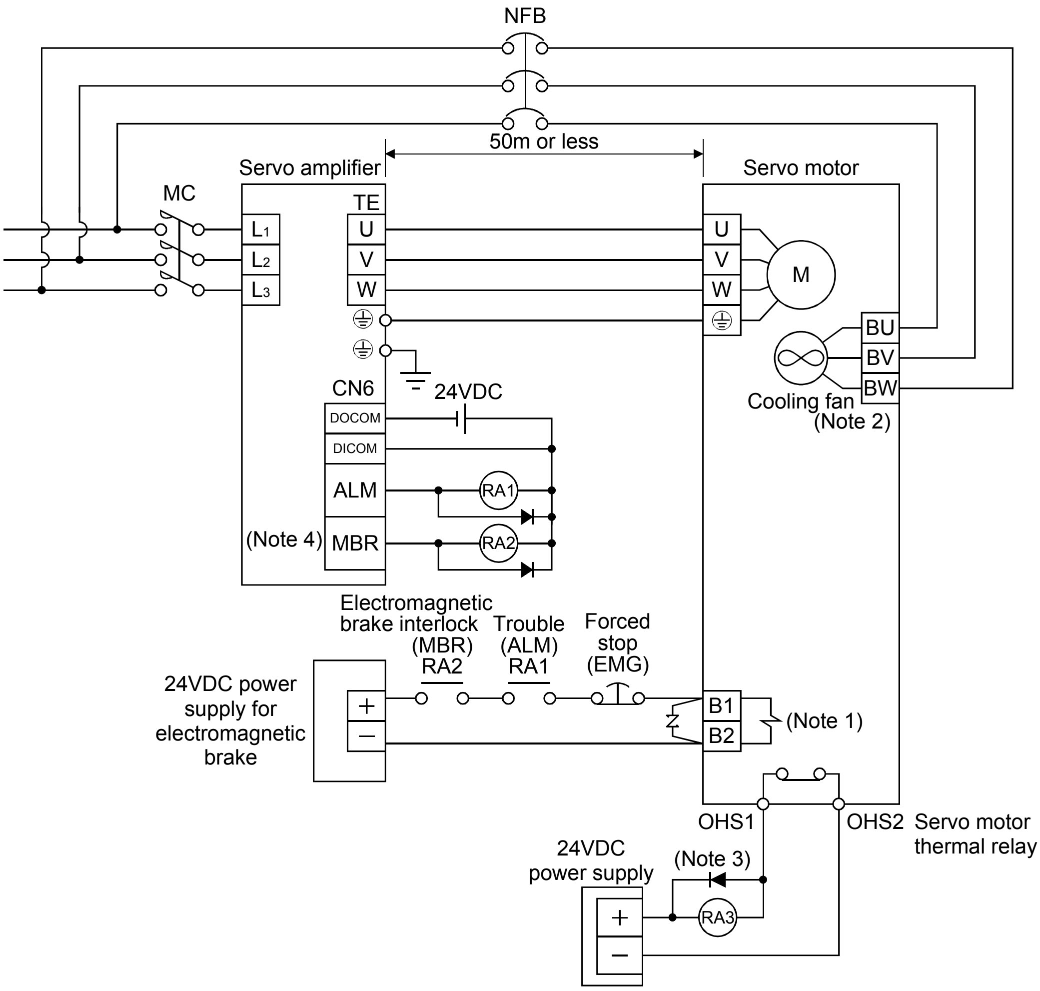
Note. For the motor with electromagnetic brake, supply electromagnetic brake power (24VDC). There is no polarity.

(3) HA-LP series servo motor

(a) Wiring diagrams

Refer to section 13.9 for the cables used for wiring.

1) 200V class



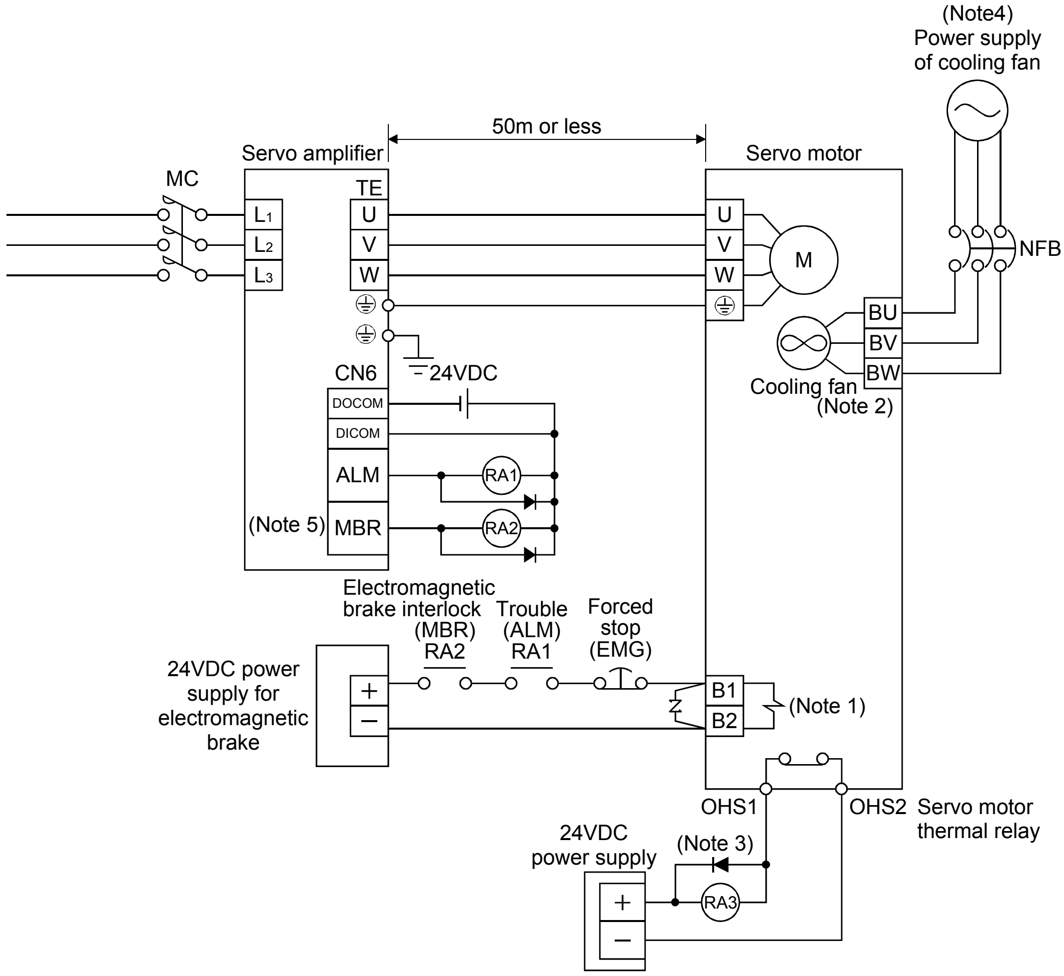
Note 1. There is no polarity in electromagnetic brake terminals B1 and B2.

2. Cooling fan power supply of the HA-LP601, HA-LP701M and HA-LP11K2 servo motor is 1-phase. Power supply specification of the cooling fan is different from that of the servo amplifier. Therefore, separate power supply is required.

3. Configure the power supply circuit which turns off the magnetic contactor after detection of servo motor thermal.

4. When using a servo motor with electromagnetic brake, assign the electromagnetic brake interlock (MBR) to external output signal in the parameters No. PD09 to PD11, Po08 and Po09.

2) 400V class



Note 1. There is no polarity in electromagnetic brake terminals B1 and B2.

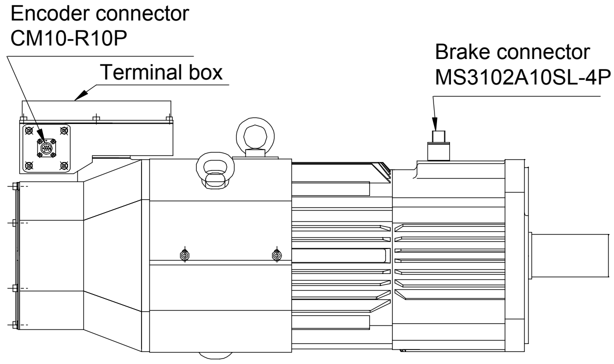
2. Cooling fan power supply of the HA-LP601, HA-LP701M and HA-LP11K2 servo motor is 1-phase. Power supply specification of the cooling fan is different from that of the servo amplifier. Therefore, separate power supply is required.

3. Configure the power supply circuit which turns off the magnetic contactor after detection of servo motor thermal.

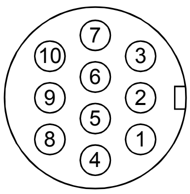
4. For the cooling fan power supply, refer to (3) (b) in this section.

5. When using a servo motor with electromagnetic brake, assign the electromagnetic brake interlock (MBR) to external output signal in the parameters No. PD09 to PD11, Po08 and Po09.

(b) Servo motor terminals

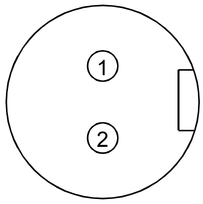


Encoder connector signal allotment
CM10-R10P



Terminal No.	Signal
1	MR
2	MRR
3	
4	BAT
5	LG
6	
7	
8	P5
9	
10	SHD

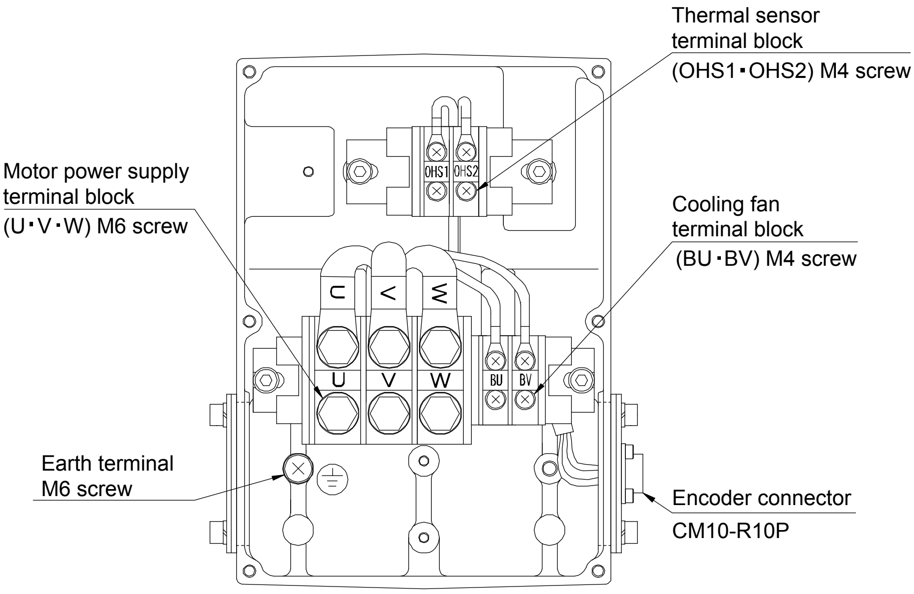
Brake connector signal allotment
MS3102A10SL-4P



Terminal No.	Signal
1	B1 (Note)
2	B2 (Note)

Note. For the motor with electromagnetic brake, supply electromagnetic brake power (24VDC). There is no polarity.

Terminal box inside (HA-LP601(4)・701M(4)・11K2(4))

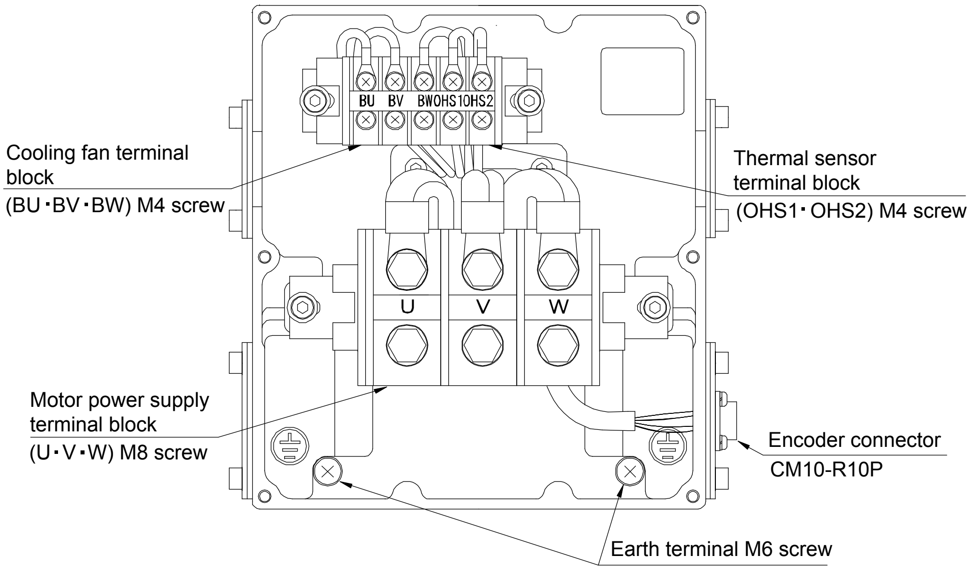


Terminal block signal arrangement

OHS1	OHS2

U	V	W	BU	BV

Terminal box inside (HA-LP801(4) · 12K1(4) · 11K1M(4) · 15K1M(4) · 15K2(4) · 22K2(4))

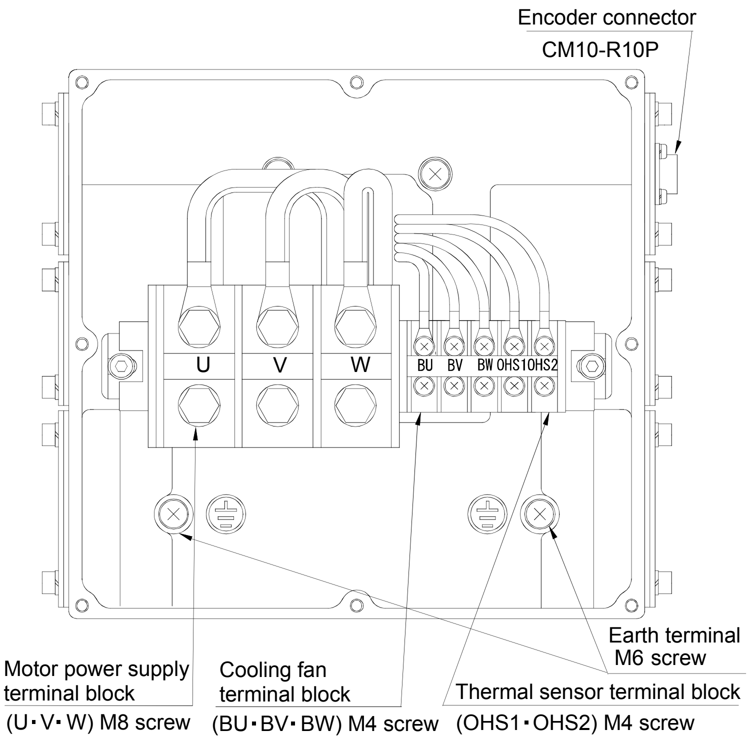


Terminal block signal arrangement

BU	BV	BW	OHS1	OHS2

U	V	W

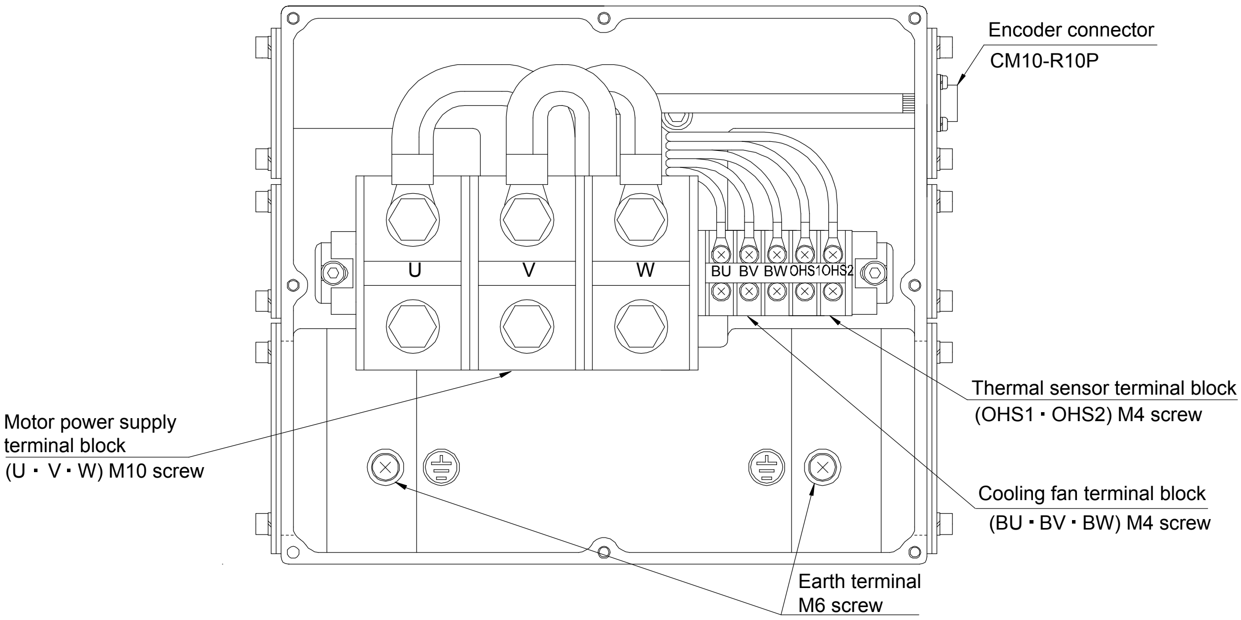
Terminal box inside (HA-LP15K1(4) · 20K1(4) · 22K1M(4))



Terminal block signal arrangement

U	V	W	BU	BV	BW	OHS1	OHS2

Terminal box inside (HA-LP25K1)



Terminal block signal arrangement

U	V	W	BU	BV	BW	OHS1	OHS2

<table>
<tr><th>Signal Name</th><th>Abbreviation</th><th>Description</th></tr>
<tr><td>Power supply</td><td>U・V・W</td><td>Connect to the motor output terminals (U, V, W) of the servo amplifier. During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.</td></tr>
<tr><td>Cooling fan</td><td>(Note)
BU・BV・BW</td><td>Supply power which satisfies the following specifications.
<table>
<tr><th>Servo motor</th><th>Voltage division</th><th>Voltage/ frequency</th><th>Power consumption [W]</th><th>Rated current [A]</th></tr>
<tr><td>HA-LP601, 701M, 11K2</td><td rowspan="4">200V class</td><td>1-phase 200 to 220VAC 50Hz
1-phase 200 to 230VAC 60Hz</td><td>42(50Hz)
54(60Hz)</td><td>0.21(50Hz)
0.25(60Hz)</td></tr>
<tr><td>HA-LP801, 12K1, 11K1M, 15K1M, 15K2, 22K2</td><td rowspan="3">3-phase 200 to 230VAC 50Hz/60Hz</td><td>62(50Hz)
76(60Hz)</td><td>0.18(50Hz)
0.17(60Hz)</td></tr>
<tr><td>HA-LP15K1, 20K1, 22K1M</td><td>65(50Hz)
85(60Hz)</td><td>0.20(50Hz)
0.22(60Hz)</td></tr>
<tr><td>HA-LP25K1</td><td>120(50Hz)
175(60Hz)</td><td>0.65(50Hz)
0.80(60Hz)</td></tr>
<tr><td>HA-LP6014, 701M4, 11K24</td><td rowspan="4">400V class</td><td>1-phase 200 to 220VAC 50Hz
1-phase 200 to 230VAC 60Hz</td><td>42(50Hz)
54(60hz)</td><td>0.21(50Hz)
0.25(60Hz)</td></tr>
<tr><td>HA-LP8014, 12K14, 11K1M4, 15K1M4, 15K24, 22K24</td><td>3-phase 380 to 440VAC 50Hz
3-phase 380 to 480VAC 60Hz</td><td>62(50Hz)
76(60Hz)</td><td>0.14(50Hz)
0.11(60Hz)</td></tr>
<tr><td>HA-LP15K14, 20K14, 22K1M4</td><td rowspan="2">3-phase 380 to 460VAC 50Hz
3-phase 380 to 480VAC 60Hz</td><td>65(50Hz)
85(60Hz)</td><td>0.12(50Hz)
0.14(60Hz)</td></tr>
<tr><td>HA-LP25K14</td><td>110(50Hz)
150(60Hz)</td><td>0.20(50Hz)
0.22(60Hz)</td></tr>
</table>
</td></tr>
<tr><td>Motor thermal relay</td><td>OHS1・OHS2</td><td>OHS1—OHS2 are opened when heat is generated to an abnormal temperature.
Maximum rating: 125VAC/DC, 3A or 250VAC/DC, 2A
Minimum rating: 6VAC/DC, 0.15A</td></tr>
<tr><td>Earth terminal</td><td>⏚</td><td>For grounding, connect to the earth of the control box via the earth terminal of the servo amplifier.</td></tr>
</table>

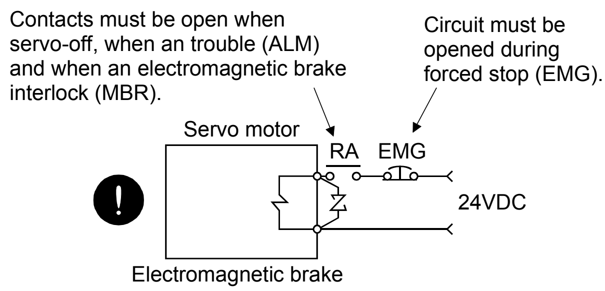
Note. There is no BW when the power supply of the cooling fan is a 1-phase.

3.11 Servo motor with electromagnetic brake

3.11.1 Safety precautions

CAUTION

- Configure the electromagnetic brake operation circuit so that it is activated not only by the servo amplifier signals but also by an external forced stop signal.



- The electromagnetic brake is provided for holding purpose and must not be used for ordinary braking.
- Before performing the operation, be sure to confirm that the electromagnetic brake operates properly.

POINT

- Refer to the Servo Motor Instruction Manual (Vol.2) for specifications such as the power supply capacity and operation delay time of the electromagnetic brake.

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

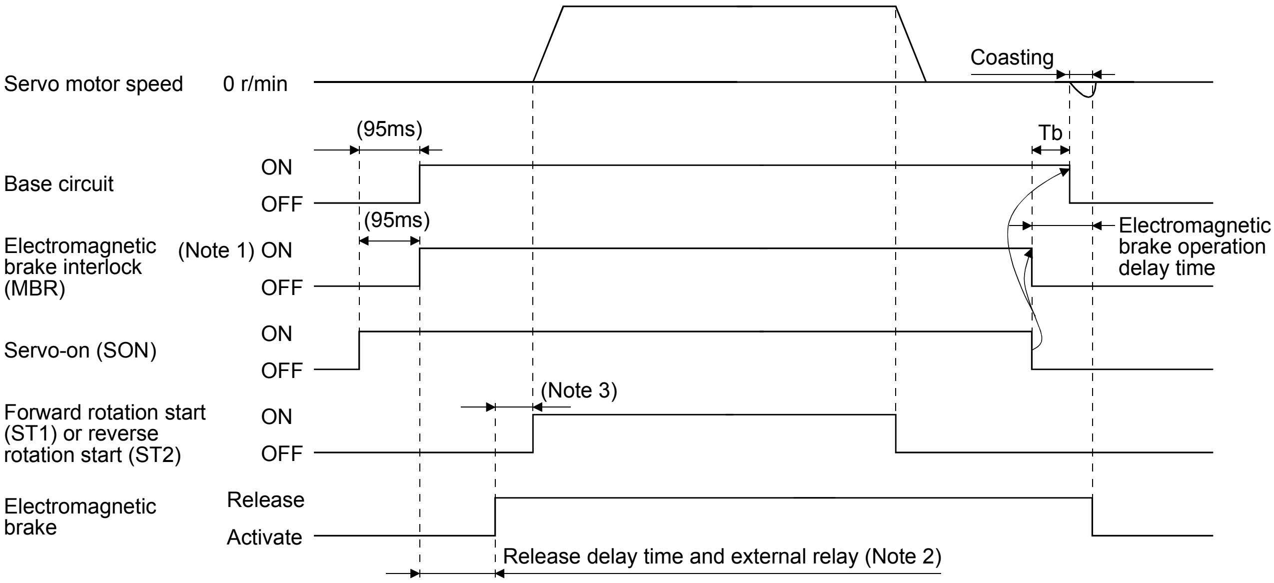
1) Set "□□□1"in parameter No. PA04 to make the electromagnetic brake interlock (MBR) valid.
2) Do not share the 24VDC interface power supply between the interface and electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake.
3) The brake will operate when the power (24VDC) switches off.
4) While the reset (RES) is on, the base circuit is shut off. When using the servo motor with a vertical shaft, use the electromagnetic brake interlock (MBR).
5) Switch off the servo-on (SON) after the servo motor has stopped.

Using parameter No. PC16 (electromagnetic brake sequence output), set a time delay (Tb) at servo-off from electromagnetic brake operation to base circuit shut-off as in the timing chart shown in section 3.11.2.

3.11.2 Timing charts

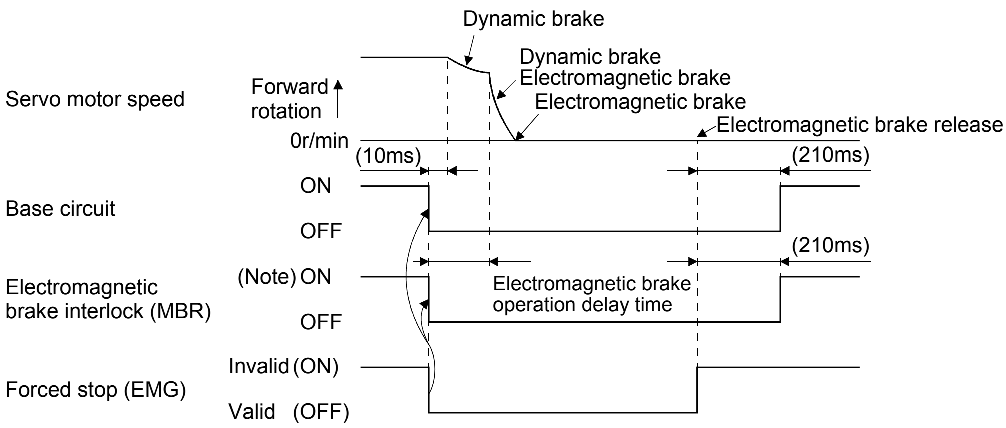
(1) Servo-on (SON) command (from controller) ON/OFF

Tb [ms] after the servo-on (SON) signal is switched off, the servo lock is released and the servo motor coasts. If the electromagnetic brake is made valid in the servo lock status, the brake life may be shorter. Therefore, when using the electromagnetic brake in a vertical lift application or the like, set Tb to about the same as the electromagnetic brake operation delay time to prevent a drop.



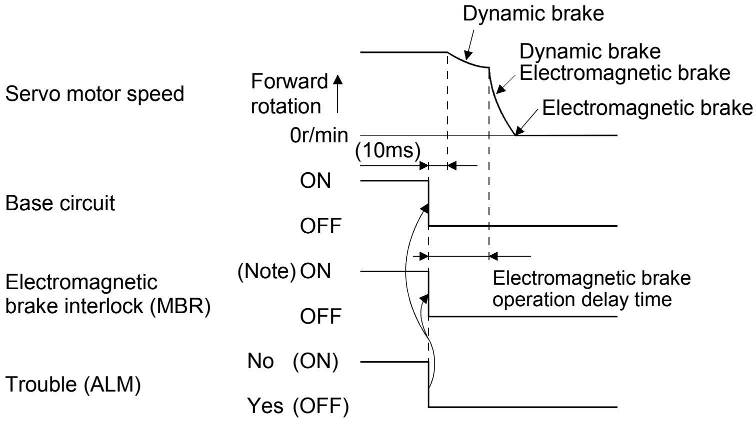
Note 1. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.
2. Electromagnetic brake is released after delaying for the release delay time of electromagnetic brake and operation time of external circuit relay. For the release delay time of electromagnetic brake, refer to the Servo Motor Instruction Manual (Vol.2).
3. After the electromagnetic brake is released, turn ON the ST1 or ST2.

(2) Forced stop (EMG) ON/OFF



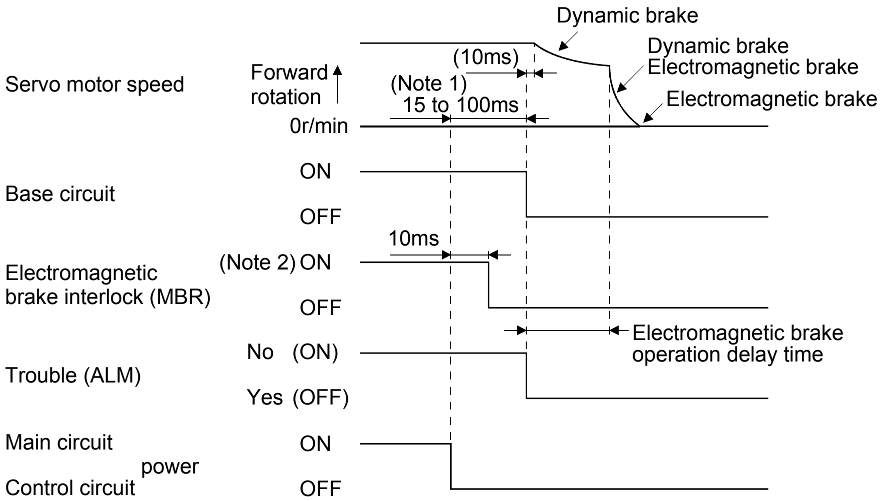
Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(3) Alarm occurrence



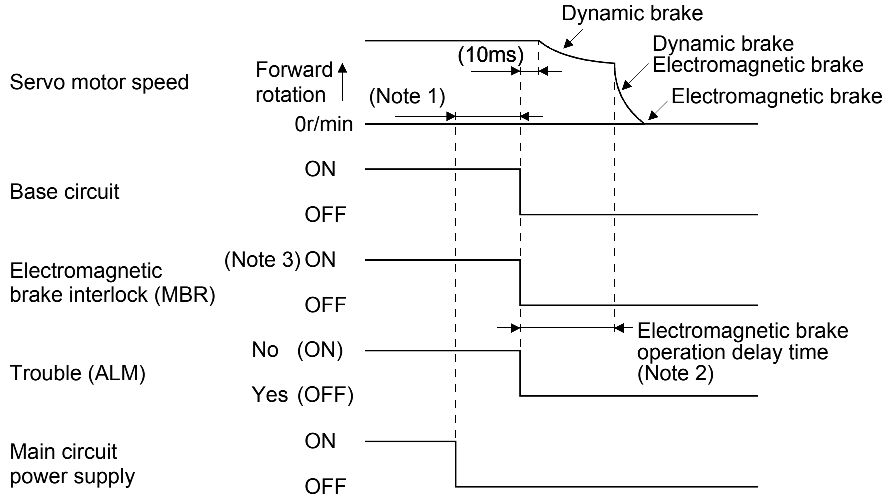
Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(4) Both main and control circuit power supplies off



Note 1. Changes with the operating status.
2. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(5) Only main circuit power supply off (control circuit power supply remains on)



Note 1. Changes with the operating status.

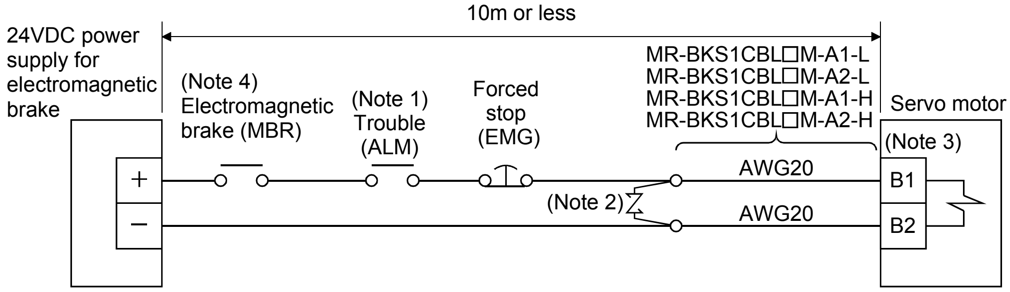
2. When the main circuit power supply is off in a motor stop status, the main circuit off warning (A.E9) occurs and the trouble (ALM) does not turn off.

3. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

3.11.3 Wiring diagrams (HF-MP series・HF-KP series servo motor)

POINT
・For HF-SP series・HC-RP series・HC-UP series・HC-LP series servo motors, refer to section 3.10.2 (2).

(1) When cable length is 10m or less



Note 1. Shut off the circuit on detection of the servo amplifier alarm.

2. Connect a surge absorber as close to the servo motor as possible.

3. There is no polarity in electromagnetic brake terminals (B1 and B2).

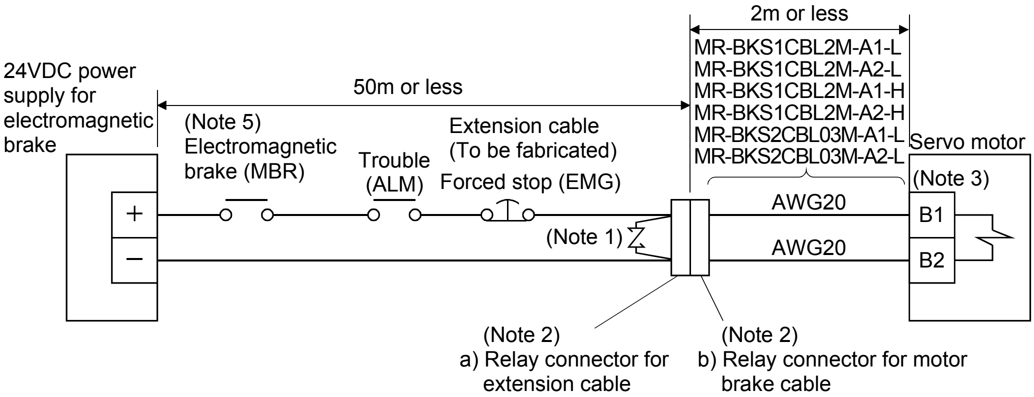
4. When using a servo motor with electromagnetic brake, assign the electromagnetic brake interlock (MBR) to external output signal in the parameters No. PD09 to PD11, Po08 and Po09.

When fabricating the motor brake cable MR-BKS1CBL-□M-H, refer to section 13.1.4.

(2) When cable length exceeds 10m

When the cable length exceeds 10m, fabricate an extension cable as shown below on the customer side. In this case, the motor brake cable should be within 2m long.

Refer to section 13.9 for the wire used for the extension cable.



Note 1. Shut off the circuit on detection of the servo amplifier alarm.

2. Connect a surge absorber as close to the servo motor as possible.

3. Use of the following connectors is recommended when ingress protection (IP65) is necessary.

Relay Connector	Description	Protective Structure
a) Relay connector for extension cable	CM10-CR2P-∗ (DDK) └ Wire size: S, M, L	IP65
b) Relay connector for motor brake cable	CM10-SP2S-∗ (DDK) └ Wire size: S, M, L	IP65

4. There is no polarity in electromagnetic brake terminals (B1 and B2).

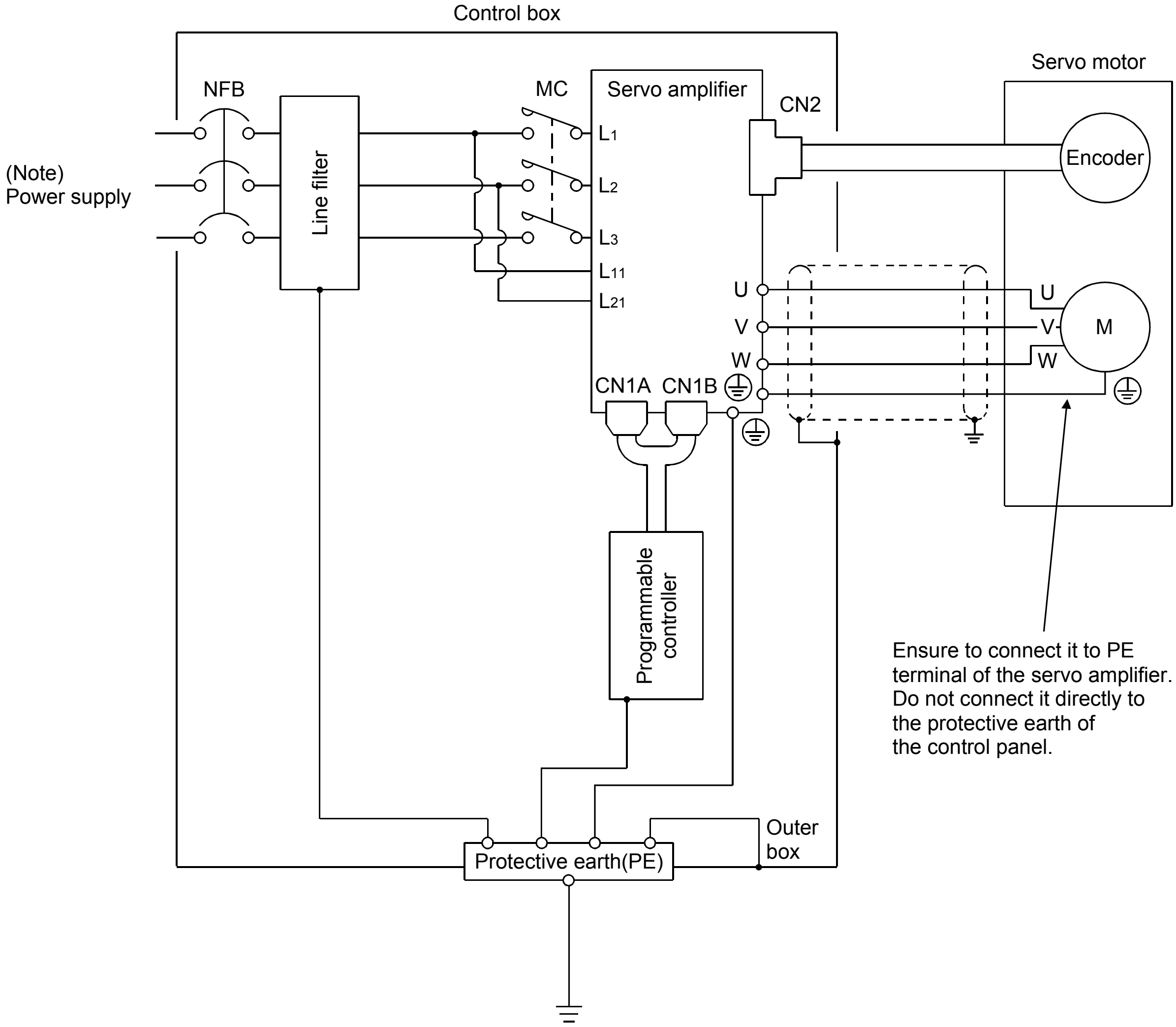
5. When using a servo motor with electromagnetic brake, assign the electromagnetic brake interlock (MBR) to external output signal in the parameters No. PD09 to PD11, Po08 and Po09.

3.12 Grounding

WARNING	· Ground the servo amplifier and servo motor securely. · To prevent an electric shock, always connect the protective earth (PE) terminal (terminal marked ⏚) of the servo amplifier with the protective earth (PE) of the control box.

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 the EMC Installation Guidelines (IB(NA)67310).



Note. For 1-phase 200V to 230VAC of 1-phase 100 to 120VAC, connect the power supply to L_1, L_2 and leave L_3 open.
There is no L_3 for 1-phase 100 to 120VAC power supply. Refer to section 1.2 for the power supply specification.

4. OPERATION

⚠ WARNING	· Do not operate the switches with wet hands. You may get an electric shock.

⚠ CAUTION	· Before starting operation, check the parameters. Some machines may perform unexpected operation. · Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with the servo amplifier heat sink, regenerative resistor, servo motor, etc. since they may be hot while power is on or for some time after power-off. Their temperatures may be high and you may get burnt or a parts may damaged. · During operation, never touch the rotating parts of the servo motor. Doing so can cause injury.

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

Wiring check	Check whether the servo amplifier and servo motor are wired correctly using visual inspection, DO forced output function (Section 6.7.4, 7.5.7 (4)), etc. (Refer to section 4.1.2.)
↓	
Surrounding environment check	Check the surrounding environment of the servo amplifier and servo motor. (Refer to section 4.1.3.)
↓	
Parameter setting	Set the parameters as necessary, such as the used control mode and regenerative option selection with the parameter unit or MR Configurator. (Refer to chapter 5.)
↓	
Test operation of servo motor alone in test operation mode	For the test operation, with the servo motor disconnected from the machine and operated at the speed as low as possible, and check whether the servo motor rotates correctly. (Refer to sections 6.7 and 7.5.7.)
↓	
Test operation of servo motor alone by commands	For the test operation with the servo motor disconnected from the machine and operated at the speed as low as possible, and check whether the servo motor rotates correctly.
↓	
Test operation with servo motor and machine connected	Connect the servo motor with the machine, give operation commands from the host command device, and check machine motions.
↓	
Gain adjustment	Make gain adjustment to optimize the machine motions. (Refer to chapter 8.)
↓	
Actual operation	
↓	
Stop	Stop giving commands and stop operation.

4.1.2 Wiring check

(1) Power supply system wiring

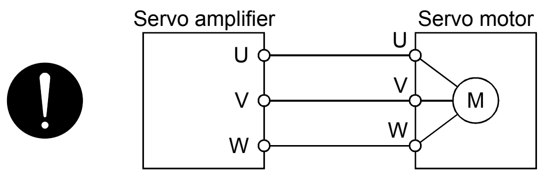
Before switching on the main circuit and control circuit power supplies, check the following items.

(a) Power supply system wiring

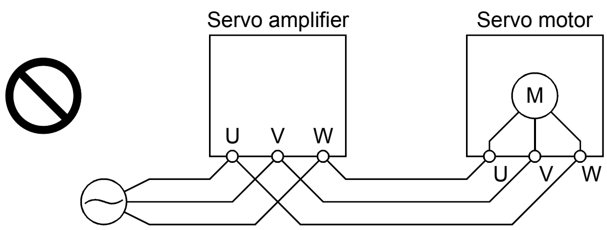
The power supplied to the power input terminals (L_1, L_2, L_3, L_{11}, L_{21}) of the servo amplifier should satisfy the defined specifications. (Refer to section 1.2.)

(b) Connection of servo amplifier and servo motor

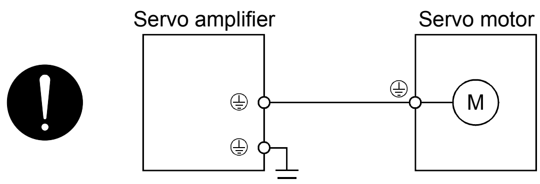
1) The servo motor power supply terminals (U, V, W) of the servo amplifier match in phase with the power input terminals (U, V, W) of the servo motor.



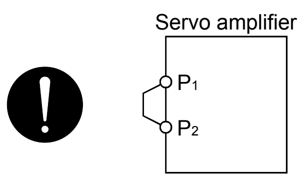
2) The power supplied to the servo amplifier should not be connected to the servo motor power supply terminals (U, V, W). To do so will fail the connected servo amplifier and servo motor.



3) The earth terminal (⏚) of the servo motor is connected to the PE terminal (⏚) of the servo amplifier.



4) P_1-P_2 (For 11kW or more, P_1-P) should be connected.



(c) When option and auxiliary equipment are used

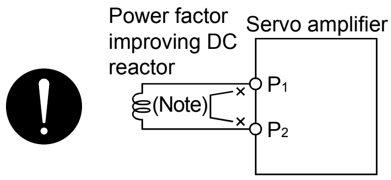
1) When regenerative option is used with under 3.5kW of 200V class and 2kW of 400V class

- The lead between P terminal and D terminal of CNP2 connector should not be connected.
- The generative option should be connected to P terminal and C terminal.
- A twisted cable should be used. (Refer to section 13.2.)

2) When regenerative option is used with over 5kW of 200V class and 3.5kW of 400V class
- The lead of built-in regenerative resistor connected to P terminal and C terminal of TE1 terminal block should not be connected.
- The generative option should be connected to P terminal and C terminal.
- A twisted cable should be used when wiring is over 5m and under 10m. (Refer to section 13.2.)

3) When brake unit and power regenerative converter are used over 5kW
- The lead of built-in regenerative resistor connected to P terminal and C terminal of TE1 terminal block should not be connected.
- Brake unit, power regenerative converter or power regeneration common converter should be connected to P terminal and N terminal. (Refer to section 13.3 to 13.5.)

4) The power factor improving DC reactor should be connected P_1 and P_2 (For 11kW or more, P_1 and P). (Refer to section 13.11.)



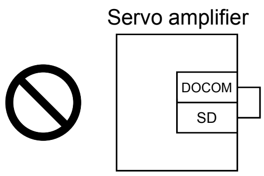
Note. Always disconnect P_1 and P_2 (For 11kW or more, P_1 and P).

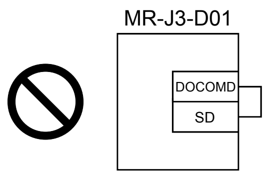
(2) I/O signal wiring

(a) The I/O signals should be connected correctly.
Use DO forced output to forcibly turn on/off the pins of the CN6 and CN10 connector. This function can be used to perform a wiring check. (Refer to section 6.7.4.) In this case, switch on the control circuit power supply only.

(b) 24VDC or higher voltage is not applied to the pins of connectors CN6 and CN10.

(c) SD and DOCOM, SD and DOCOMD are not shorted.





4.1.3 Surrounding environment

(1) Cable routing

(a) The wiring cables are free from excessive force.

(b) The encoder cable should not be used in excess of its flex life. (Refer to section 12.4.)

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

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

4.2 Startup

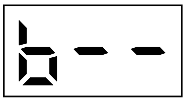
4.2.1 Power on and off procedures

(1) Power-on

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

1) Switch off the servo-on (SON).
2) Make sure that the Forward rotation start (ST1) and Reverse rotation start (ST2) 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 servo amplifier display shows "b- -" (if the servo amplifier has the station number of 1).



In the absolute position detection system, first power-on results in the absolute position lost (A25) alarm and the servo system cannot be switched on.
The alarm can be deactivated then switching power off once and on again.
Also in the absolute position detection system, if power is switched on at the servo motor speed of 3000r/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 the Forward rotation start (ST1) and Reverse rotation start (ST2) are off.
2) Switch off the Servo-on (SON).
3) Switch off the main circuit power supply and control circuit power supply.

4.2.2 Stop

In any of the following statuses, the servo amplifier interrupts and stops the operation of the servo motor.
Refer to section 3.11 for the servo motor equipped with electromagnetic brake.

(a) Servo-on (SON) OFF
The base circuit is shut off and the servo motor coasts.

(b) Alarm occurrence
When an alarm occurs, the base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop.

(c) Forced stop (EMG) OFF
The base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop. The servo forced stop warning (AE6) occurs.

(d) Forward rotation stroke end (LSP), reverse rotation stroke end (LSN) OFF
The droop pulse value is erased and the servo motor is stopped and servo-locked. It can be run in the opposite direction.

4.2.3 Test operation

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

Test operation of servo motor alone in JOG operation of test operation mode

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 6.7 and 7.5.7 for the test operation mode.

↓

Test operation of servo motor alone by commands

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

1) Switch on the Forced stop (EMG) and Servo-on (SON). When the servo amplifier is put in a servo-on status, the Ready (RD) switches on.
2) Switch on the Forward rotation stroke end (LSP) or Reverse rotation stroke end (LSN).
3) When the point table is designated to switch on the forward rotation (ST1) or reverse rotation (ST2), the servo motor starts rotating. Give a low speed command at first and check the rotation direction, etc. of the servo motor. If the servo motor does not operate in the intended direction, check the input signal.

↓

Test operation with servo motor and machine connected

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

1) Switch on the Forced stop (EMG) and Servo-on (SON). When the servo amplifier is put in a servo-on status, the Ready (RD) switches on.
2) Switch on the Forward rotation stroke end (LSP) or Reverse rotation stroke end (LSN).
3) When the point table is specified from the command device and the forward rotation start (ST1) or reverse rotation start (ST2) is turned 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 command device.

4.2.4 Parameter setting

POINT

- The encoder cable MR-EKCBL□M-L/H for the HF-MP series・HF-KP series servo motor requires the parameter No. PC22 setting to be changed depending on its length. Check whether the parameter is set correctly. If it is not set correctly, the encoder error 1 (A16) will occur at power-on.

Encoder Cable	Parameter No. PC22 Setting
MR-EKCBL20M-L/H	0 □□□ (initial value)
MR-EKCBL30M-H	1 □□□
MR-EKCBL40M-H	
MR-EKCBL50M-H	

The servo amplifier can be used by merely changing the basic setting parameters (No. PA □□) mainly.
As necessary, set the gain filter parameters (No. PB □□), extension setting parameters (No. PC □□) and I/O setting parameters (No. PD □□).

Parameter Group	Main Description
Basic setting parameter (No. PA □□)	Set the basic setting parameters first. Generally, operation can be performed by merely setting this parameter group. In this parameter group, set the following items. Control mode selection (select the position control mode) Regenerative option selection Absolute position detection system selection Setting of command input pulses per revolution Electronic gear setting Auto tuning selection and adjustment In-position range setting Torque limit setting Command pulse input form selection Servo motor rotation direction selection Encoder output pulse setting
Gain filter parameter (No. PB □□)	If satisfactory operation cannot be achieved by the gain adjustment made by auto tuning, execute in-depth gain adjustment using this parameter group. This parameter group must also be set when the gain switching function is used.
Extension setting parameter (No. PC □□)	This parameter group is unique to MR-J3-□T servo amplifier.
I/O setting parameter (No. PD □□)	Used when changing the I/O devices of the servo amplifier.
(Note) Option unit parameter (No. Po □□)	Used when setting the MR-J3-D01 extension I/O unit.

Note. The parameter No. PA19 setting must be changed when this parameter group is used.

4.2.5 Point table setting

Set necessary items to the point table before starting operation. The following table indicates the items that must be set.

Name	Description
Position data	Set the position data for movement.
Servo motor speed	Set the command speed of the servo motor for execution of positioning.
Acceleration time constant	Set the acceleration time constant.
Deceleration time constant	Set the deceleration time constant.
Dwell	Set the waiting time when performing automatic continuous operation.
Auxiliary function	Set when performing automatic continuous operation.
M code	Code to be output when the positioning is completed.

Refer to section 4.5.2, 4.5.3 for details of the point table.

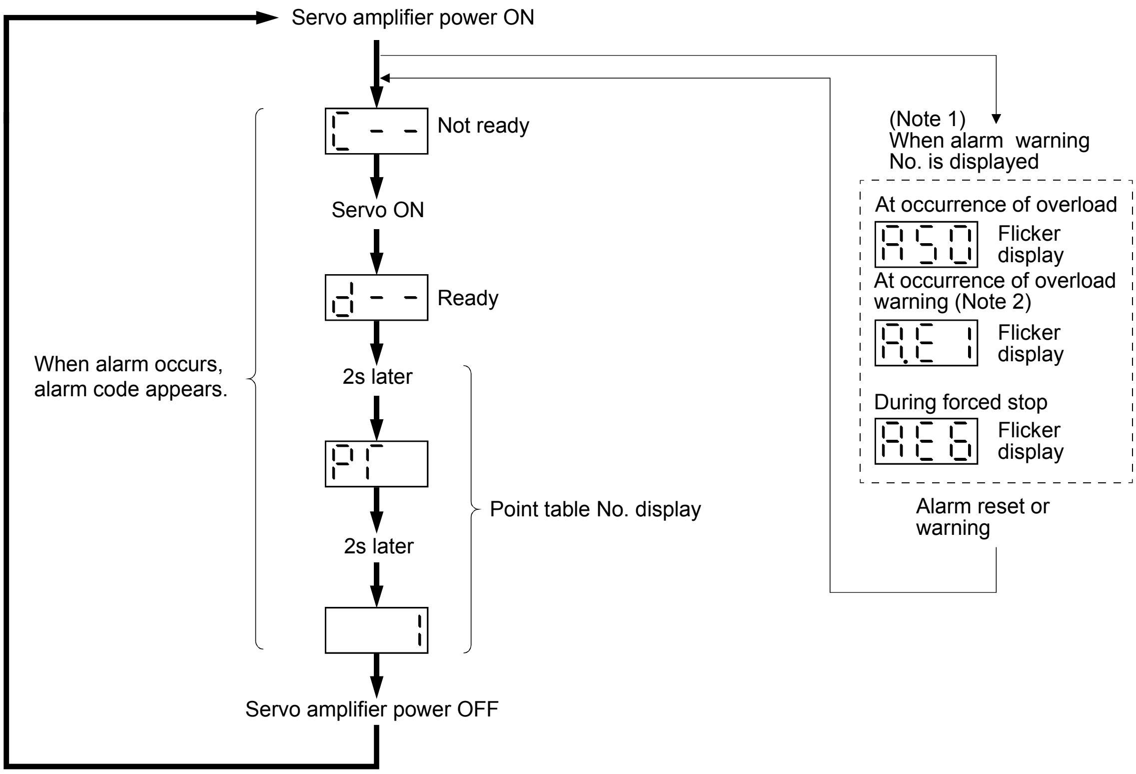
4.2.6 Actual operation

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.

4.3 Servo amplifier display

On the servo amplifier display (three-digit, seven-segment display), check the station number, and diagnose a fault at occurrence of an alarm.

(1) Display sequence



Note 1. Only alarm and warning No. are displayed, but no station No. is displayed.
2. If warning other than AE6 occurs during the servo on, flickering the second place of decimal point indicates that it is during the servo on.

(2) Indication list

Indication	Status	Description
d # #	Ready	The servo was switched on after completion of initialization and the servo amplifier is ready to operate. (This is indicated for 2 seconds.)
C # #	Not ready	The servo amplifier is being initialized or an alarm has occurred.
(Note 1) $ $ $	Ready for operation	Two seconds have passed after the servo amplifier is ready to operate by turning ON the servo-on (SON).
(Note 2) A * *	Alarm・Warning	The alarm No./warning No. that occurred is displayed. (Refer to section 10.2.)
8 8 8	CPU error	CPU watchdog error has occurred.
(Note 3) b 0 0.	(Note 3) Test operation mode	JOG operation・positioning operation・programmed operation・DO forced output・single-step feed
d # #. C # #.		Motor-less operation

Note 1. $$$ indicates numbers from 0 to 255, and the number indicates the executing point table number.
2. ＊＊ indicates the warning/alarm No.
3. Requires MR Configurator or MR-PRU03 parameter module.

4.4 Operation mode and selection method

This servo has the operation modes indicated in the following table. Select an operation mode to be used with a parameter and input devices. Parameters and input devices filled with a diagonal line are not required to set.

Operation mode \ Selection item of operation mode				Parameter No. Po10 setting	Input device setting (Note) MD0	D10 to D17	SP0 to SP3	Refer to
Automatic operation mode	Automatic operation with a point table	One-time positioning operation		□□□1	ON	Option		Section 4.5.2 (1)
		Automatic continuous operation	Speed changing operation					Section 4.5.2 (2) (b)
			Automatic continuous positioning operation					Section 4.5.2 (2) (c)
	Automatic operation by BCD (3 digits × 2) input with the MR-DS60 6-digit digital switch			□□□2	ON		Option	Section 4.5.3
	Automatic operation by BCD (3 digits × 2) input with the program controller							Section 4.5.4
Manual operation mode	JOG operation				OFF			Section 4.6.1
	Manual pulse generator operation							Section 4.6.2
Home position return mode	Dog type				ON	All OFF	All OFF	Section 4.7.2
	Count type							Section 4.7.3
	Data setting type							Section 4.7.4
	Stopper type							Section 4.7.5
	Home position ignorance (Servo-on position as home position)							Section 4.7.6
	Dog type rear end reference							Section 4.7.7
	Count type front end reference							Section 4.7.8
	Dog cradle type							Section 4.7.9
	Dog style right-before Z-phase reference							Section 4.7.10
	Dog type front end reference							Section 4.7.11
	Dogless Z-phase reference							Section 4.7.12
Automatic positioning function to the home position					ON	All OFF	All OFF	Section 4.7.14
Roll feed display function								Section 4.8

Note. MD0: Automatic/manual selection, D10 to D17: Point table No. selection 1 to 8, SP0 to SP3: Speed selection 1 to 4

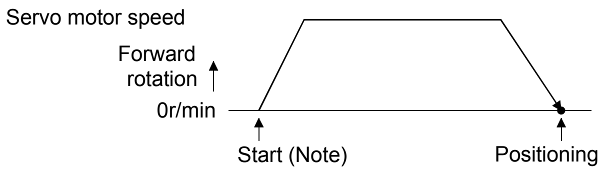
4.5 Automatic operation mode

4.5.1 What is the automatic operation mode?

(1) Concept of Automatic operation

Automatic operation is a positioning function to automatically start and stop at a target position with one-time start signal. The data required for positioning is set with the point table.

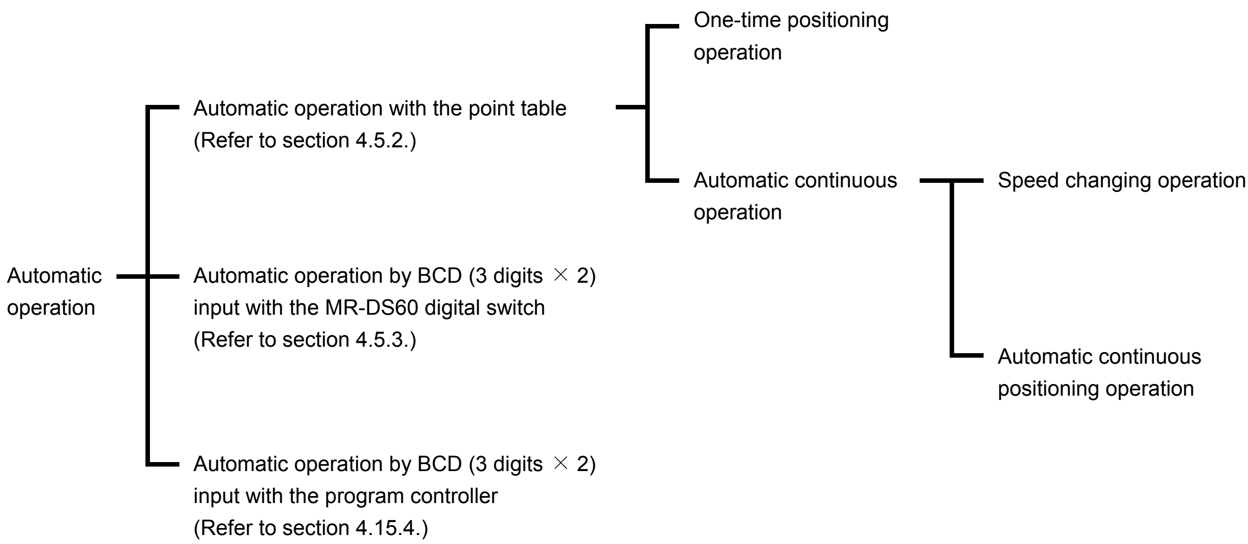
The position data can be set with the digital switch or from the program controller. (Refer to section 4.5.3. and 4.5.4.)



Note. For the start, use the forward rotation start (ST1) or reverse rotation start (ST2).

(2) Automatic operation types

With this servo, the following automatic operations are available.



There are two types of command systems. the absolute value command system which requires specifying the positioning addresses to move to for each automatic operation and the incremental value command system which requires specifying the moving distance from the current position to the target position.

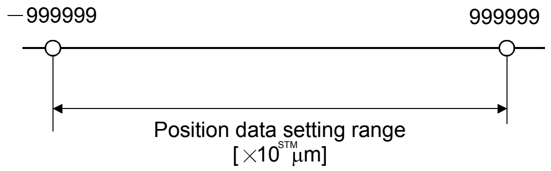
(3) Command system

After selection of preset point tables using the input signals or communication, operation is started by the forward rotation start (ST1) or reverse rotation start (ST2). Automatic operation has the absolute value command system, incremental value command system.

(a) Absolute value command system

As position data, set the target address to be reached.

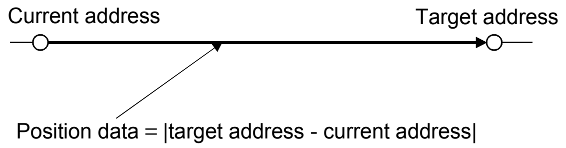
Setting range: −999999 to 999999 [$\times 10^{STM}$ μm] (STM = feed length multiplication parameter No.PA05)



(b) Incremental value command system

As position data, set the moving distance from the current address to the target address.

Setting range: 0 to 999999 [$\times 10^{STM}$ μm] (STM = feed length multiplication parameter No.PA05)



4.5.2 Automatic operation using point table

(1) One-time positioning operation

(a) Absolute value command system

1) Point table

Set the point table values using the MR Configurator or the MR-PRU03 parameter unit.
Set the position data, motor speed, acceleration time constant, deceleration time constant, dwell, auxiliary function and M code to the point table. The following table gives a setting example.

Name	Setting range	Unit	Description
Position data	−999999 to 999999	$\times 10^{STM}$μm	(1) When using this point table as absolute value command system Set the target address (absolute value). (2) When using this point table as incremental value command system Set the moving distance. A "-" sign indicates a reverse rotation command.
Motor speed	0 to permissible speed	r/min	Set the command speed of the servo motor for execution of positioning. The setting should be equal to or less than the instantaneous permissible speed of the servo motor.
Acceleration time constant	0 to 20000	ms	Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the time until the servo motor running at rated speed comes to a stop.
Dwell	0 to 20000	ms	When the dwell is set, the position command of the selected point table is completed, and after the set dwell has elapsed, the position command of the next point table is started. Set "0" in the auxiliary function to make the dwell invalid. Set "1" in the auxiliary function and 0 in the dwell to perform speed change operation.
Auxiliary function	0 to 3		(1) When using this point table in the absolute value command system 0: Automatic operation is performed in accordance with a single point table chosen. 1: Operation is performed in accordance with consecutive point tables without a stop. (2) When using this point table in the incremental value command system 2: Automatic operation is performed in accordance with a single point table chosen. 3: Operation is performed in accordance with consecutive point tables without a stop. When a different rotation direction is set, smoothing zero (command output) is confirmed and the rotation direction is then reversed. Setting "1" in point table No.255 results in an error. For full information, refer to (2) in this section.
M code	00 to 99		The first and second digits of the M code respectively are output in 4-bit binary.

2) Parameter setting

Set the following parameters to perform automatic operation.
Select the absolute value command system with parameter No.PA01 (Control mode).

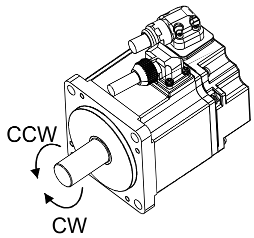
Parameter No. PA01

| | | | 0 |

Absolute value command system (initial value)

Choose the servo motor rotation direction at the time when the forward rotation start (ST1) is switched on with parameter No.PA14 (Rotation direction selection).

Parameter No. PA14 setting	Servo motor rotation direction when forward rotation start (ST1) is switched on
0	CCW rotation with + position data CW rotation with − position data
1	CW rotation with + position data CCW rotation with − position data



Set the unit multiplication factor (STM) of position data with parameter No.PA05 (Feed function selection).

Parameter No.PA05 setting	Feed unit [μm]	Position data input range [mm]
□□□0	1	−999.999 to +999.999
□□□1	10	−9999.99 to +9999.99
□□□2	100	−99999.9 to +99999.9
□□□3	1000	−999999 to +999999

3) Operation

Choosing the point table using DI0 to DI7 and turning ST1 ON starts positioning to the position data at the preset speed, acceleration time constant and deceleration time constant. At this time, reverse rotation start (ST2) is invalid.

Item	Setting method	Description
Automatic operation mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
Point table selection	Point table No. selection 1 (DI0) Point table No. selection 2 (DI1) Point table No. selection 3 (DI2) Point table No. selection 4 (DI3) Point table No. selection 5 (DI4) Point table No. selection 6 (DI5) Point table No. selection 7 (DI6) Point table No. selection 8 (DI7)	Refer to the text
Start	Forward rotation start (ST1)	Turn ST1 ON to start.

Select a point table using the point table No. selection 1(DI0) to 8(DI7) as shown in the following table.

Input device								Point table No. to be selected
DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0	
0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	1	0	2
0	0	0	0	0	0	1	1	3
0	0	0	0	0	1	0	0	4
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
1	1	1	1	1	1	1	0	254
1	1	1	1	1	1	1	1	255

(b) Incremental value command system

1) Point table

Set the point table values using the MR Configurator or the MR-PRU03 parameter unit.

Set the position data, motor speed, acceleration time constant, deceleration time constant, dwell, auxiliary function and M code to the point table. The following table gives a setting example.

Name	Setting range	Unit	Description
Position data	0 to 999999	$\times 10^{STM}\mu m$	Set the moving distance. The unit can be changed using feed length multiplication factor selection of parameter No. PA05.
Servo motor speed	0 to permissible speed	r/min	Set the command speed of the servo motor for execution of positioning. The setting should be equal to or less than the instantaneous permissible speed of the servo motor.
Acceleration time constant	0 to 20000	ms	Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the time until the servo motor running at rated speed comes to a stop.
Dwell	0 to 20000	ms	When the dwell is set, the position command of the selected point table is completed, and after the set dwell has elapsed, the position command of the next point table is started. Set "0" in the auxiliary function to make the dwell invalid. Set "1" in the auxiliary function and 0 in the dwell to perform speed change operation.
Auxiliary function	0・1		0: Automatic operation is performed in accordance with a single point table chosen. 1: Operation is performed in accordance with consecutive point tables without a stop. When a different rotation direction is set, smoothing zero (command output) is confirmed and the rotation direction is then reversed. Setting "1" in point table No.255 results in an error. For full information, refer to (2) in this section.
M code	00 to 99		The first and second digits of the M code respectively are output in 4-bit binary.

2) Parameter setting

Set the following parameters to perform automatic operation.

Select the incremental value command system with parameter No.PA01 (Control mode).

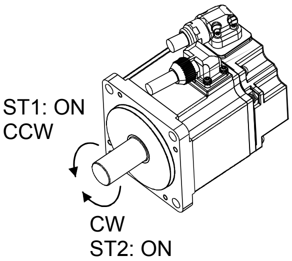
Parameter No. PA01

| | | | 1 |

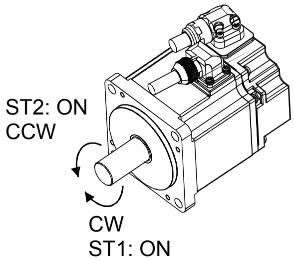
Incremental value command system

Choose the servo motor rotation direction at the time when the forward rotation start (ST1) signal or reverse rotation start (ST2) signal is switched on with parameter No.PA14 (Rotation direction selection).

Parameter No.PA14 setting	Servo motor rotation direction	
	Forward rotation start (ST1) ON	Reverse rotation start (ST2) ON
0	CCW rotation (address incremented)	CW rotation (address decremented)
1	CW rotation (address incremented)	CCW rotation (address decremented)



Parameter No.PA14: 0



Parameter No.PA14: 1

Set the unit multiplication factor (STM) of position data with parameter No.PA05 (Feed function selection).

Parameter No.PA05 setting	Feed unit [μm]	Position data input range [mm]
□□□0	1	0 to 999.999
□□□1	10	0 to 9999.99
□□□2	100	0 to 99999.9
□□□3	1000	0 to 999999

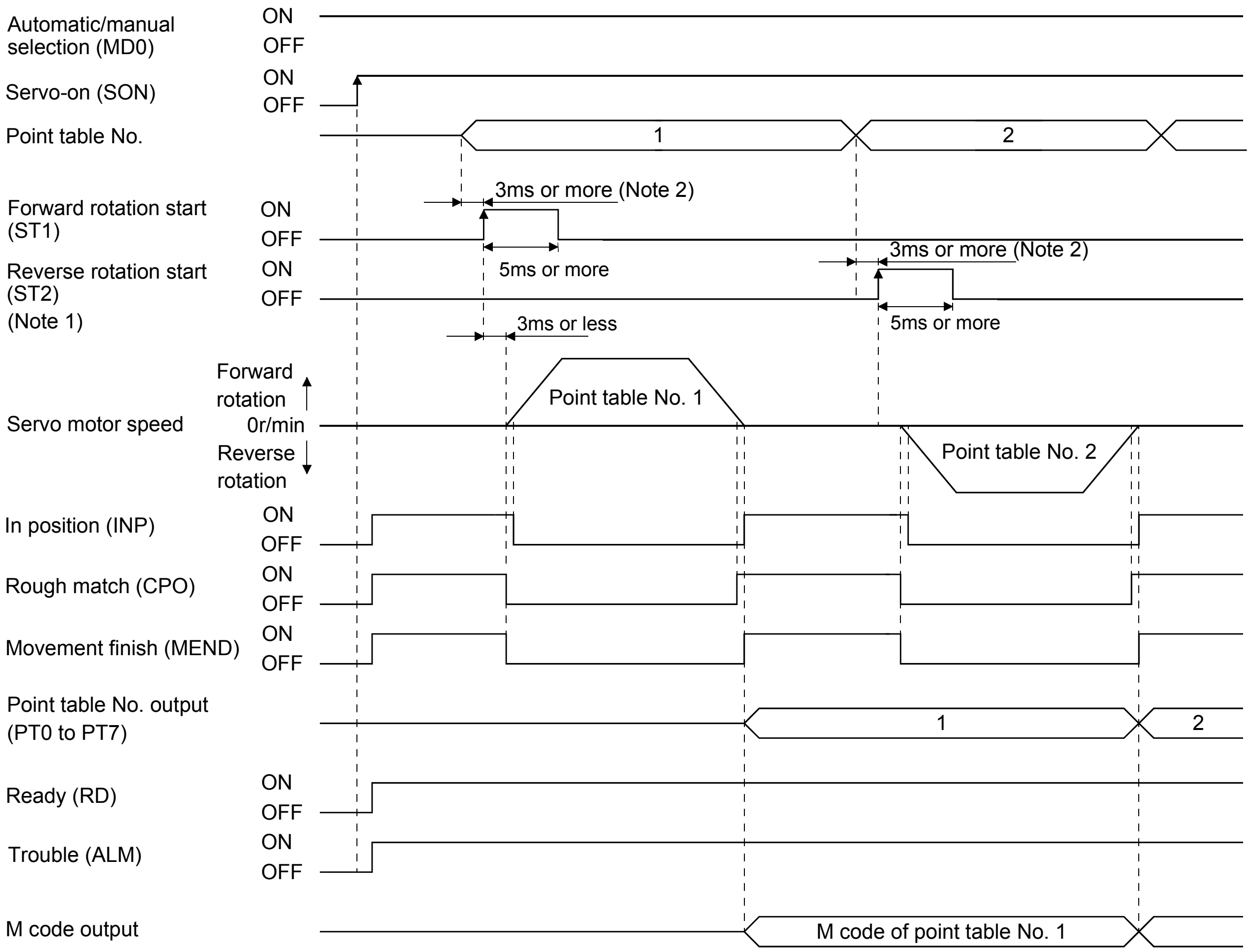
3) Operation

Choosing the point table using DI0 to DI7 and turning ST1 ON starts a motion in the forward rotation direction over the moving distance of the position data at the preset speed and acceleration time constant. Turning ST2 ON starts a motion in the reverse rotation direction according to the values set to the selected point table.

Item	Setting method	Description
Automatic operation mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
Point table selection	Point table No. selection 1 (DI0) Point table No. selection 2 (DI1) Point table No. selection 3 (DI2) Point table No. selection 4 (DI3) Point table No. selection 5 (DI4) Point table No. selection 6 (DI5) Point table No. selection 7 (DI6) Point table No. selection 8 (DI7)	Refer to this text
Start	Forward rotation start (ST1)	Turn ST1 ON to start motion in forward rotation direction.
	Reverse rotation start (ST2)	Turn ST2 ON to start motion in reverse rotation direction.

(c) Automatic operation timing chart

The timing chart is shown below.



Note 1. Reverse rotation start (ST2) is invalid in the absolute value command system.

2. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

(2) Automatic continuous operation

(a) What is automatic continuous operation?

By merely choosing one point table and making a start (ST1 or ST2), operation can be performed in accordance with the point tables having consecutive numbers.

Automatic operation is available in two types. varied speed operation and automatic continuous positioning operation.

Either type may be selected as follows.

1) In absolute value command specifying system

Automatic continuous operation
- Speed changing operation
- Automatic continuous positioning operation

Point table setting		
Dwell	Auxiliary function	
	When position data is absolute value	When position data is incremental value
0	1	3
1 or more	1	3

2) In incremental value command system

Automatic continuous operation
- Speed changing operation
- Automatic continuous positioning operation

Point table setting	
Dwell	Auxiliary function
0	1
1 or more	1

(b) Varied speed operation

By setting "1" to the auxiliary function of up to point table No.254, operation can be performed at a maximum of 255 speeds. Set "0" to the auxiliary function of the last point table.

When performing varied speed operation, always set "0" to the dwell. If "1" or more is set, automatic continuous positioning operation is made valid.

The following table gives a setting example.

Point table No.	Dwell [ms] (Note 1)	Auxiliary function	Variable speed operation
1	0	1	Consecutive point table data
2	0	1	
3	0	0 (Note 2)	
4	0	1	Consecutive point table data
5	0	1	
6	0	1	
7	0	0 (Note 2)	

Note 1. Always set "0".

2. Always set "0" or "2" to the auxiliary function of the last point table among the consecutive point tables.

1) Absolute value command specifying system

This system is an auxiliary function for point tables to perform automatic operation by specifying the absolute value command or incremental value command.

・Positioning in single direction

The operation example given below assumes that the set values are as indicated in the following table. Here, the point table No. 1 uses the absolute value command system, the point table No. 2 the incremental value command system, the point table No. 3 the absolute value system, and the point table No. 4 the incremental value command system.

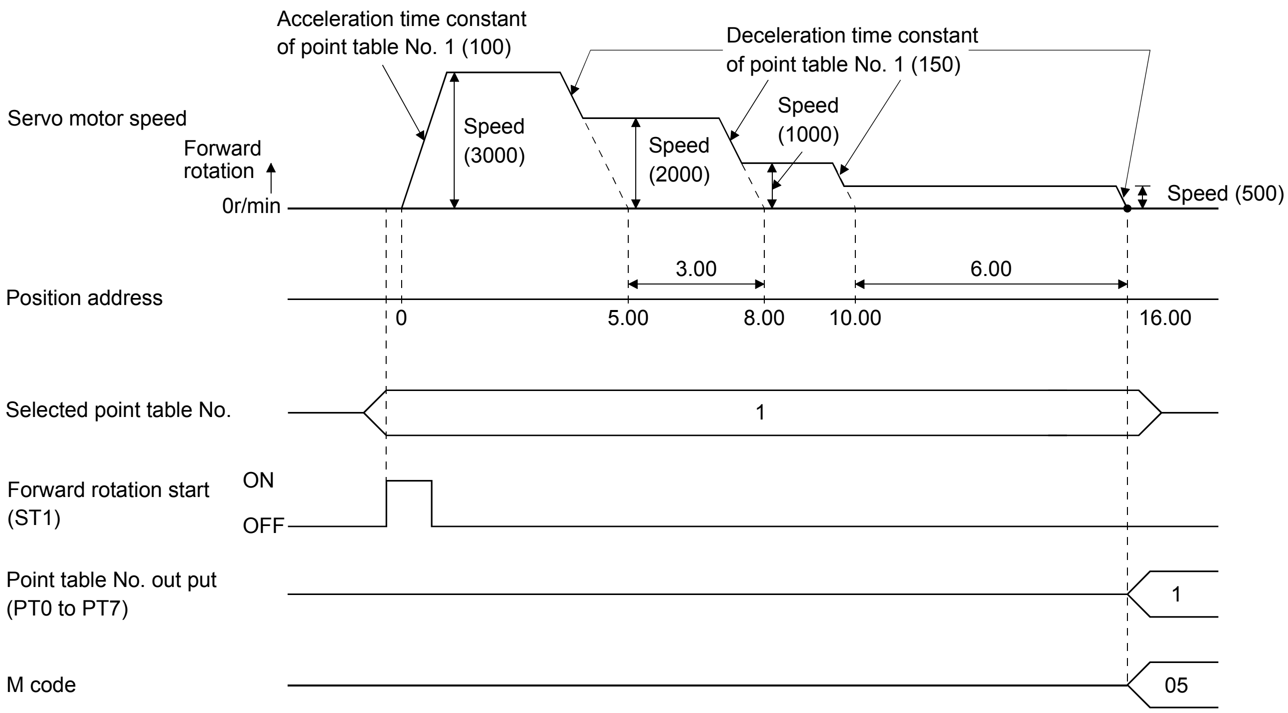
Point table No.	Position data [$\times 10^{STM}\mu m$]	Servo motor speed [r/min]	Acceleration time constant [ms]	Deceleration time constant [ms]	Dwell [ms] (Note 1)	Auxiliary function	M code
1	5.00	3000	100	150	0	1	05
2	3.00	2000	Invalid	Invalid	0	3	10
3	10.00	1000	Invalid	Invalid	0	1	15
4	6.00	500	Invalid	Invalid	0	0 (Note 2)	20

Note 1. Always set "0".

2. Always set "0" or "2" to the auxiliary function of the last point table among the consecutive point tables.

0: When point table is used in absolute value command system

1: When point table is used in incremental value command system



・Positioning that reverses the direction midway

The operation example given below assumes that the set values are as indicated in the following table. Here, the point table No. 1 uses the absolute value command system, the point table No. 2 the incremental value command system, and the point table No. 3 the absolute value system.

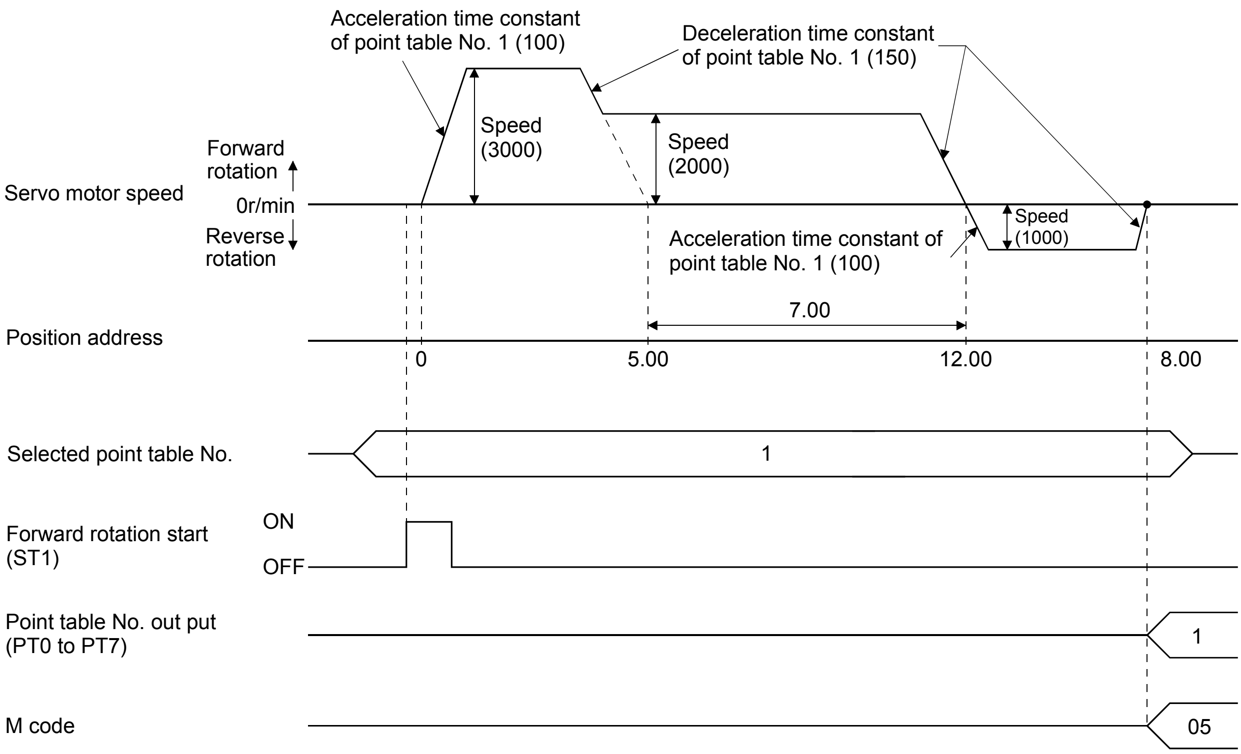
Point table No.	Position data [$\times 10^{STM}\mu m$]	Servo motor speed [r/min]	Acceleration time constant [ms]	Deceleration time constant [ms]	Dwell [ms] (Note 1)	Auxiliary function	M code
1	5.00	3000	100	150	0	1	05
2	7.00	2000	Invalid	Invalid	0	1	10
3	8.00	1000	Invalid	Invalid	0	0 (Note 2)	15

Note 1. Always set "0".

2. Always set "0" or "2" to the auxiliary function of the last point table among the consecutive point tables.

0: When point table is used in absolute value command system

1: When point table is used in incremental value command system



2) Incremental value command system

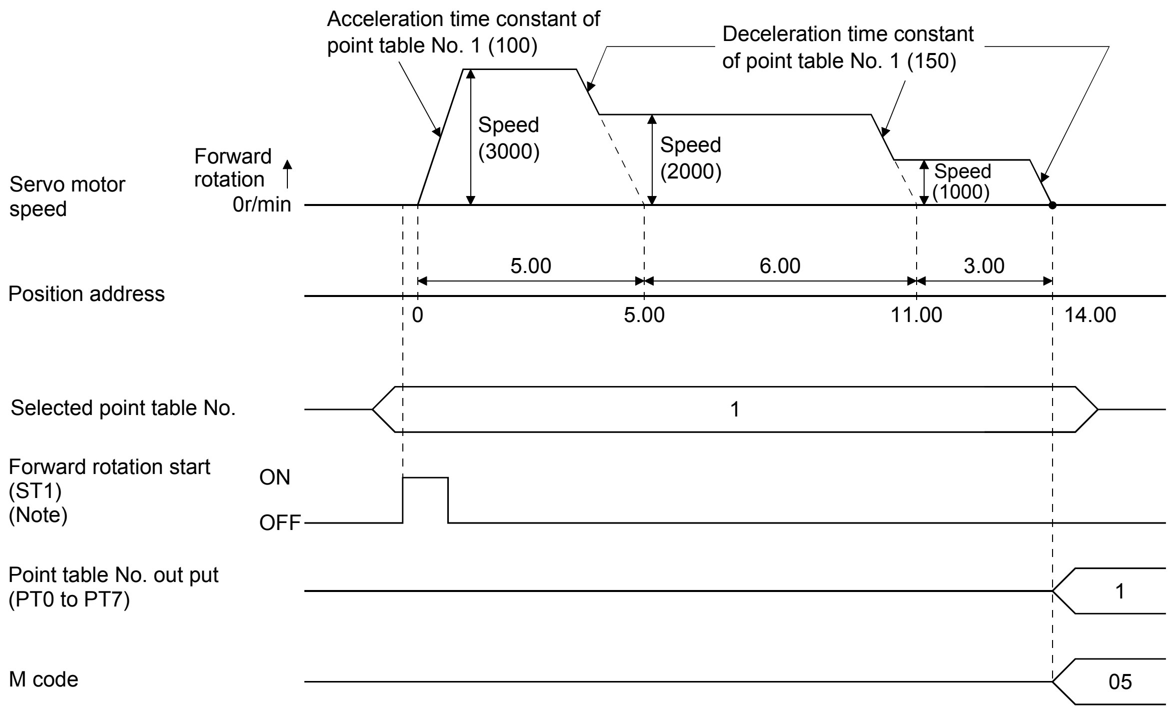
The position data of the incremental value command system is the sum of the position data of the consecutive point tables.

The operation example given below assumes that the set values are as indicated in the following table.

Point table No.	Position data [$\times 10^{STM}\mu m$]	Servo motor speed [r/min]	Acceleration time constant [ms]	Deceleration time constant [ms]	Dwell [ms] (Note 1)	Auxiliary function	M code
1	5.00	3000	100	150	0	1	05
2	6.00	2000	Invalid	Invalid	0	1	10
3	3.00	1000	Invalid	Invalid	0	0 (Note 2)	15

Note 1. Always set "0".

2. Always set "0" to the auxiliary function of the last point table among the consecutive point tables.



Note. Turning on Reverse rotation start (ST2) starts positioning in the reverse rotation direction.

(c) Automatic continuous positioning operation

By setting "1" or "3" to the auxiliary function of the point table, the continuous positioning to the next point table No. can be executed.

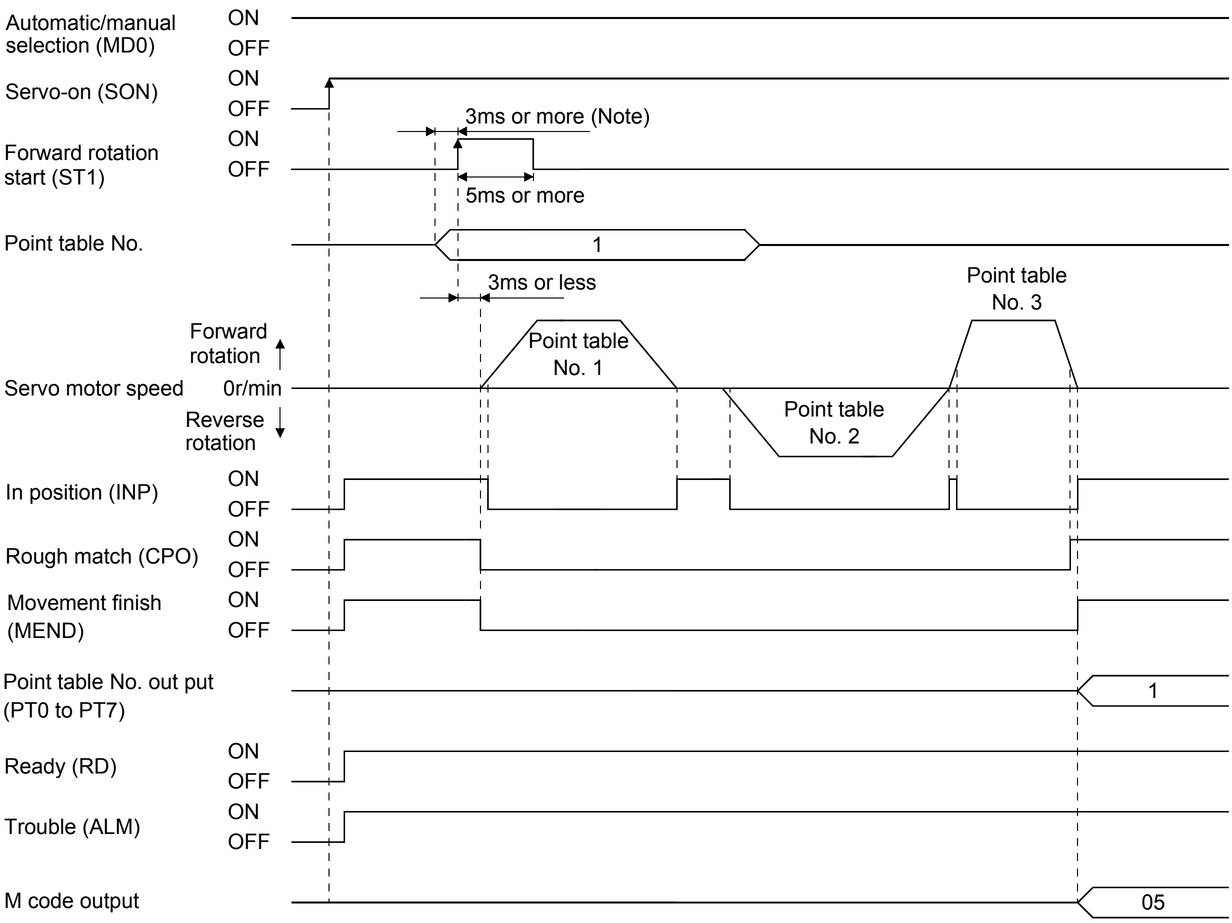
By setting "1" or "3" to the auxiliary function up to the point table No. 254, a continuous automatic positioning is available at a maximum of 255 speeds. Set "0" to the auxiliary function of the last point table.

As an example, the operation in the absolute value command system is shown using the setting values in the following table.

Here, the point table No.1 uses the absolute value command system, the point table No.2 the incremental value command system, and the point table No.3 the absolute value command system.

Point table No.	Position data [$10^{STM}\mu m$]	Servo motor speed [r/min]	Acceleration time constant [ms]	Deceleration time constant [ms]	Dwell [ms]	Auxiliary function	M code
1	5.00	3000	100	150	100	1	05
2	−6.00	2000	100	100	0	3	15
3	3.00	3000	50	50	0	0 (Note)	25

Note. Always set "0" or "2" to the auxiliary function of the last point table among the consecutive point tables.
0: When point table is used in absolute value command system
2: When point table is used in incremental value command system



Note. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

(3) Temporary stop/restart on automatic operation

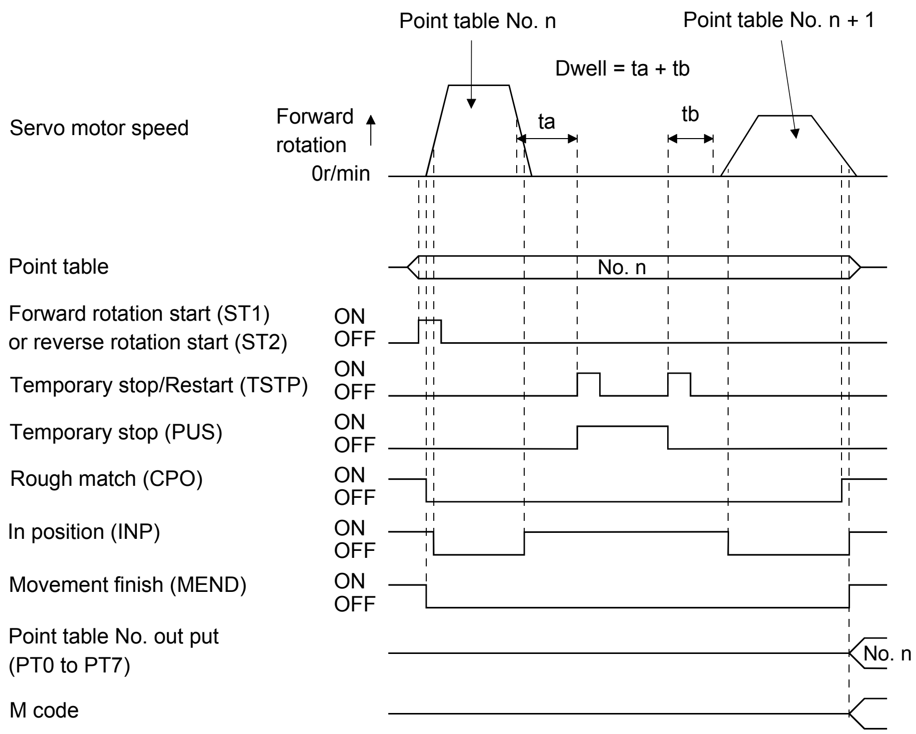
When TSTP is turned ON during automatic operation, the motor is decelerated to a temporary stop at the deceleration time constant in the point table being executed. When TSTP is turned ON again, the remaining distance is executed.

If the forward/reverse rotation start signal (ST1 or ST2) is ignored if it is switched on during a temporary stop.

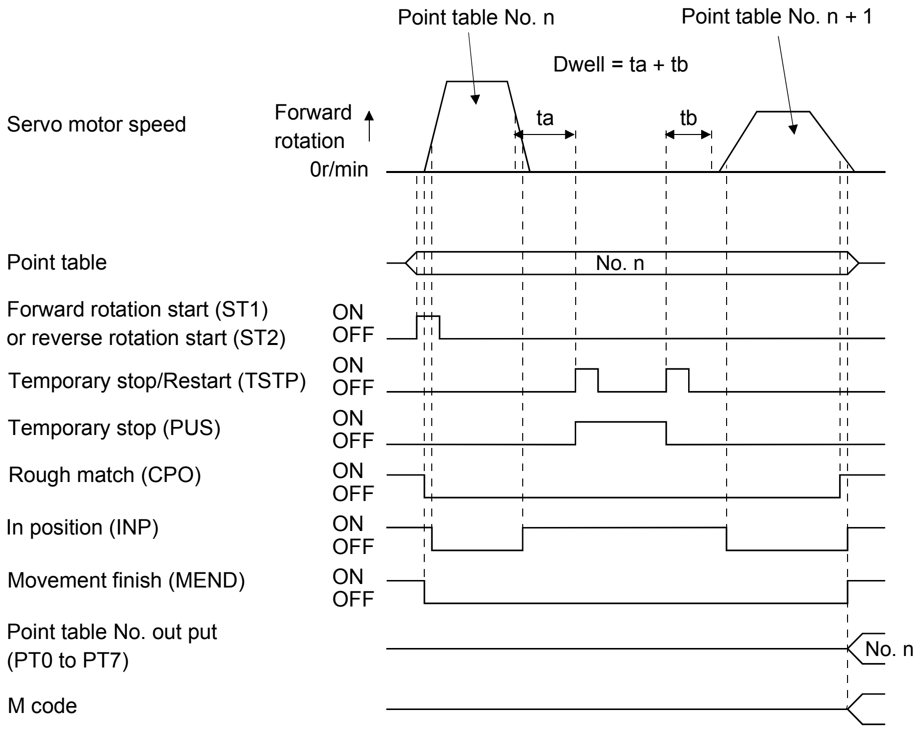
The remaining moving distance is cleared when the operation mode is changed from the automatic mode to the manual mode during a temporary stop.

The temporary stop/restart input is ignored during zeroing and jog operation.

(a) When the servo motor is rotating



2) During dwell



4.5.3 Automatic operation by BCD (3 digits × 2) input with the MR-DS60 digital switch

The positioning is executed based on the positioning data set with the MS-DS60 digital switch and the selected speed command. For the connection example of the MR-DS60 digital switch to the servo amplifier, refer to section 3.2.2.

(1) Parameter setting

Set the parameter No. Po10 to ensure that the BCD (3 digits × 2) can be used. Set the parameters referring to the following table as required.

No.	Name	Digit to be set	Setting item	Setting value	Description
Po10	Function selection O-1	□□□■	Operation system	□□□2	Make sure to set the operation system. Make the I/O devices required for the BCD input valid. For devices to be valid, refer to section 3.4.
		■□□□	Strobe signal	2□□□ (initial value)	The strobe (STRB) is not used. Do not change the initial value.
		□■□□	Symbol of the positioning data in the BCD positioning	□0□□	Uses the 6-digit positioning data without symbol (+/−).
				□1□□ (initial value)	Uses the 6-digit positioning data with symbol (+/−).
PA01	Control mode	□□□■	Command system (Refer to section 5.1.3.)	□□□0 (initial value)	Selects the absolute value command system.
				□□□1	Selects the incremental value command system.
PA05	Feeding function selection (Feed length multiplication STM)	□□□■	Feed length multiplication (Refer to section 5.1.7.)		Refer to section 5.1.7.
PA14	Rotation direction selection		Servo motor rotation direction (Refer to section 5.1.12.)	0 (initial value)	Forward rotation start (ST1) ON: rotates in the CCW direction. Reverse rotation start (ST2) ON: rotates in the CW direction.
				1	Forward rotation start (ST1) ON: rotates in the CW direction. Reverse rotation start (ST2) ON: rotates in the CCW direction

(2) Operation

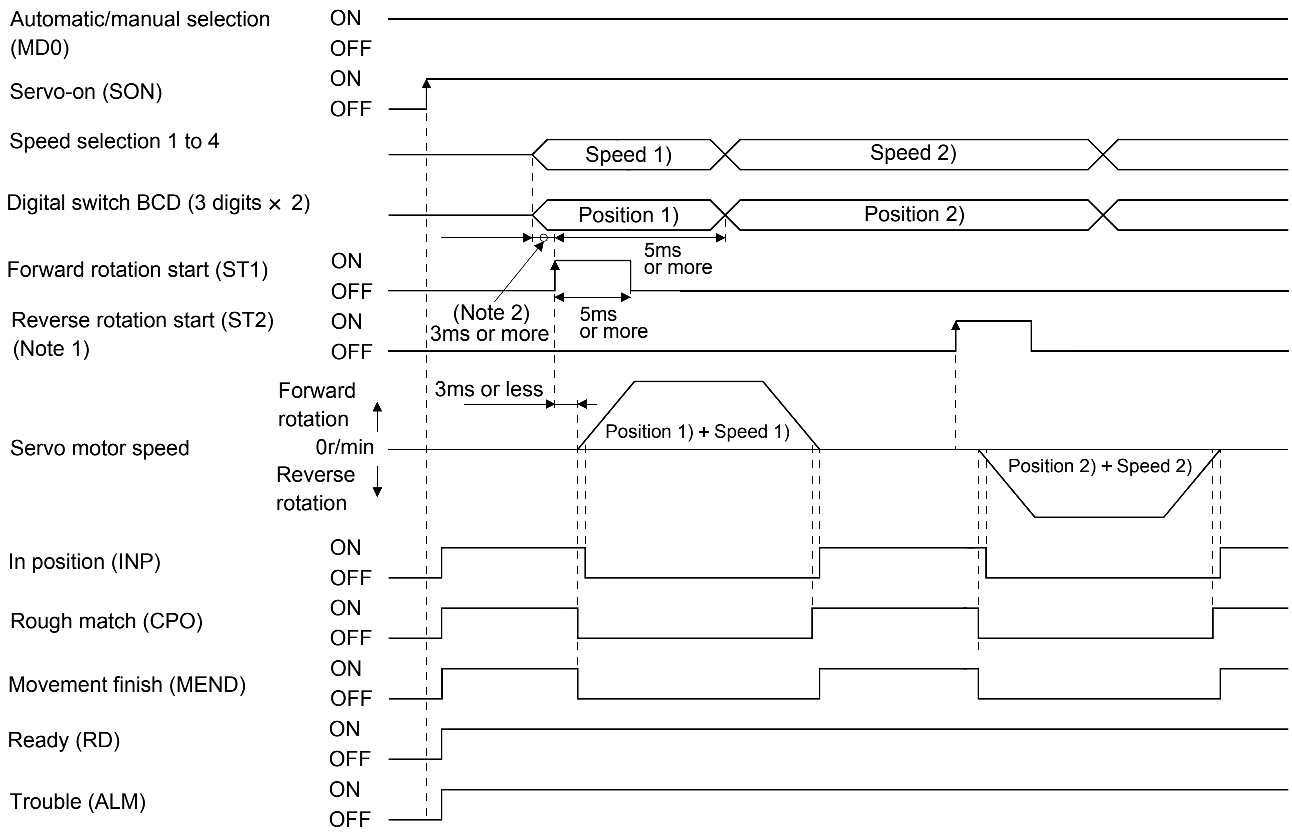
When the positioning data is set with the MS-DS60 and the forward rotation start (ST1) is turned ON, operation is performed in the forward direction for the moving distance of the positioning data under the conditions of the motor speed and the acceleration and deceleration time constants set in the point tables selected with SP0 to 3. In the incremental command system, operation is performed in the reverse direction when the reverse rotation start (ST2) is turned ON.

Select the point table with SP0 to 3 as shown below and execute the positioning based on the set motor speed, acceleration and deceleration time constants.

(Note) Device				Point table No. to be selected
SP3	SP2	SP1	SP0	
0	0	0	1	1
0	0	1	0	2
⋮	⋮	⋮	⋮	⋮
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

Note. 0: OFF
1: ON

(3) Timing chart



Note 1. Reverse rotation start (ST2) is invalid in the absolute value command system.

2. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the position data earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

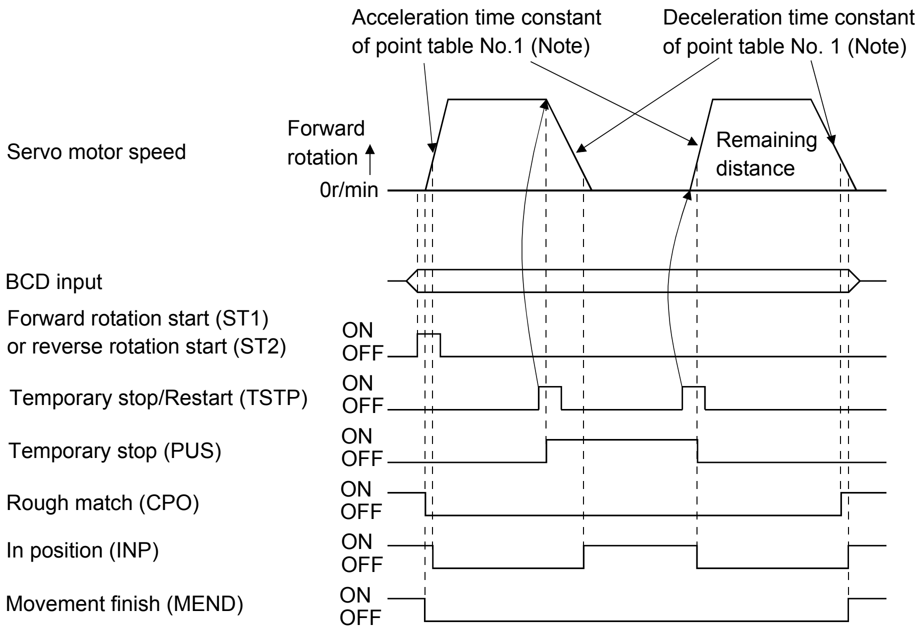
(4) Temporary stop/restart on automatic operation

When TSTP is turned ON during automatic operation, the motor is decelerated to a temporary stop at the deceleration time constant in the point table being executed. When TSTP is turned ON again, the remaining distance is executed.

If the forward/reverse rotation start signal (ST1 or ST2) is ignored if it is switched on during a temporary stop.

The remaining moving distance is cleared when the operation mode is changed from the automatic mode to the manual mode during a temporary stop.

The temporary stop/restart input is ignored during zeroing and jog operation.



Note. When the Speed selection 1 to 4 (SP0 to SP3) are used, these constants will be the acceleration/deceleration time constants of the point tables selected at a start.

4.5.4 Automatic operation by BCD (3 digits × 2) input with the programmable controller

The positioning is executed the positioning based on the positioning data set with the programmable controller and the selected speed command. For the connection example of the programmable controller to the servo amplifier, refer to section 3.2.3.

(1) Parameter setting

Set the parameter No.Po10 to enable to use the BCD (3 digits × 2) input and the strobe (STRB). Set the parameters referring to the following table as required.

No.	Name	Digit to be set	Setting item	Setting value	Description
Po10	Function selection O-1	□□□■	Operation system	□□□2	Make sure to set the operation system. Make the I/O devices required for the BCD input valid. For devices to be valid, refer to section 3.4.
		■□□□	Strobe signal	0□□□	Make sure to set the strobe (STRB). A strobe signal is required if the programmable controller is used.
		□■□□	Symbol of the positioning data in the BCD positioning	□0□□	Uses the 6-digit positioning data without symbol (+/−).
				□1□□ (initial value)	Uses the 6-digit positioning data with symbol (+/−).
PA01	Control mode	□□□■	Command system (Refer to section 5.1.3.)	□□□0 (initial value)	Selects the absolute value command system.
				□□□1	Selects the incremental value command system.
PA05	Feeding function selection (Feed length multiplication STM)	□□□■	Feed length multiplication (Refer to section 5.1.7.)		Refer to section 5.1.7.
PA14	Rotation direction selection		Servo motor rotation direction (Refer to section 5.1.12.)	0 (initial value)	Forward rotation start (ST1) ON: rotates in the CCW direction. Reverse rotation start (ST2) ON: rotates in the CW direction.
				1	Forward rotation start (ST1) ON: rotates in the CW direction. Reverse rotation start (ST2) ON: rotates in the CCW direction

(2) Operation

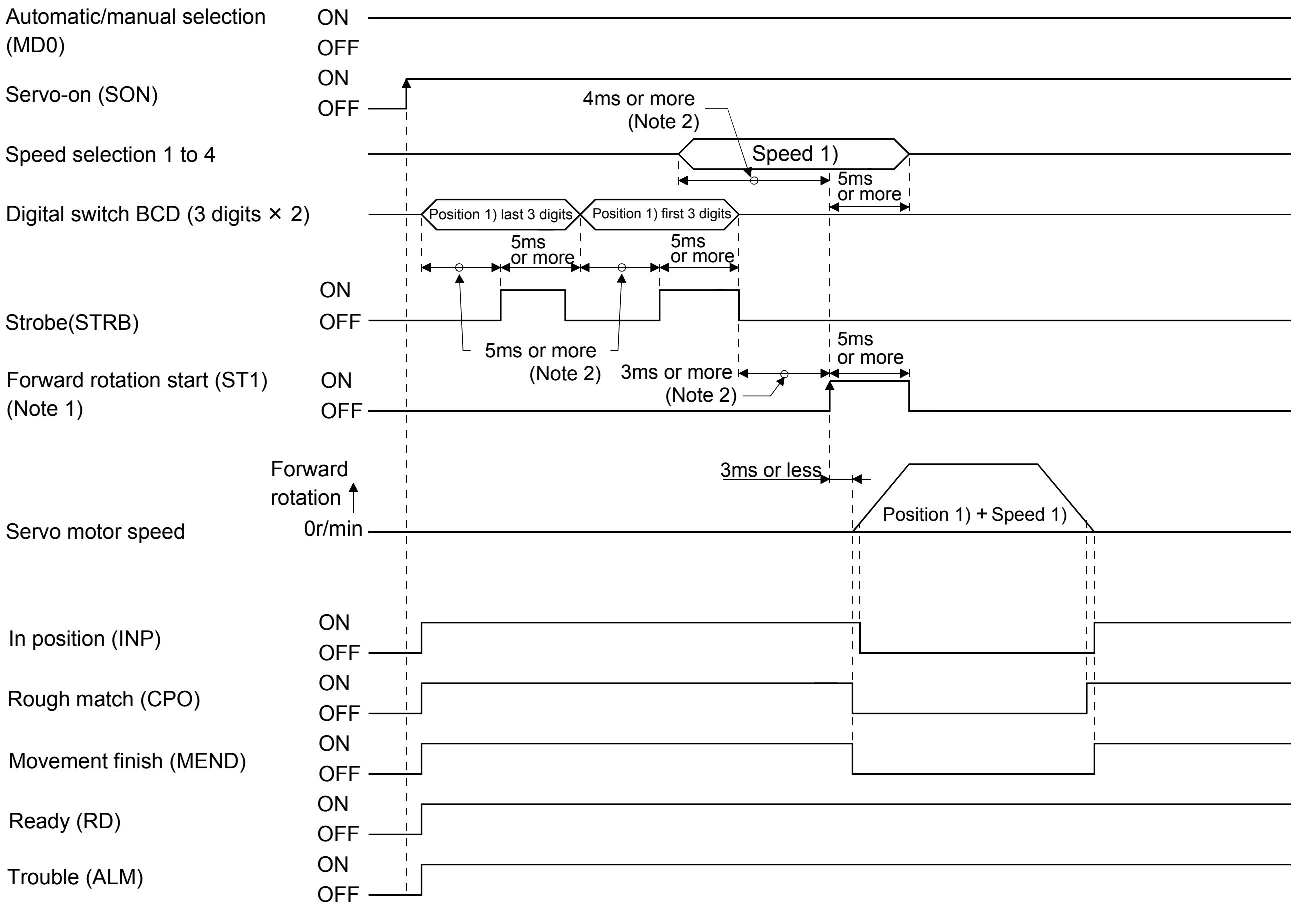
When the positioning data is set with the programmable controller and the forward rotation start (ST1) is turned ON, operation is performed in the forward rotation direction for the moving distance of the positioning data under the conditions of the motor speed and the acceleration and deceleration time constants set to the point tables selected with SP0 to 3. In the incremental command system, operation is performed in the reverse direction when the reverse rotation start (ST2) is turned ON.

Select the point table with SP0 to 3 as shown below and execute the positioning based on the set motor speed, acceleration and deceleration time constants.

(Note) Device				Point table No. to be selected
SP3	SP2	SP1	SP0	
0	0	0	1	1
0	0	1	0	2
⋮	⋮	⋮	⋮	⋮
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

Note. 0: OFF
1: ON

(3) Timing chart



Note 1. In the incremental system, the reverse rotation start (ST2) can also be used. In this case, the same timing chart as ST1 can be applied.

2. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the position data earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

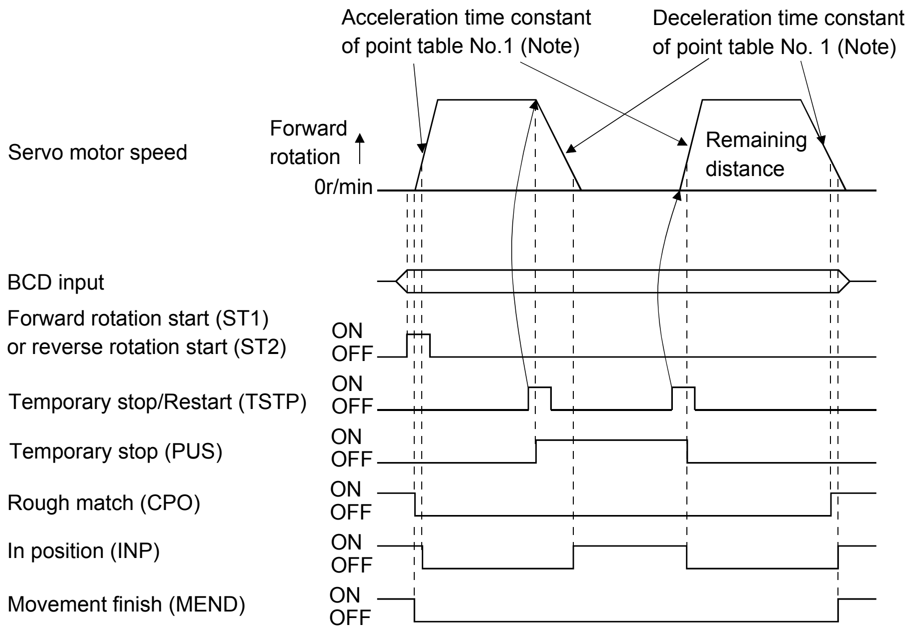
(4) Temporary stop/restart on automatic operation

When TSTP is turned ON during automatic operation, the motor is decelerated to a temporary stop at the deceleration time constant in the point table being executed. When TSTP is turned ON again, the remaining distance is executed.

If the forward/reverse rotation start signal (ST1 or ST2) is ignored if it is switched on during a temporary stop.

The remaining moving distance is cleared when the operation mode is changed from the automatic mode to the manual mode during a temporary stop.

The temporary stop/restart input is ignored during zeroing and jog operation.



Note. When the Speed selection 1 to 4 (SP0 to SP3) are used, these constants will be the acceleration/deceleration time constants of the point tables selected at a start.

4.6 Manual operation mode

For machine adjustment, home position matching, etc., jog operation or a manual pulse generator may be used to make a motion to any position.

4.6.1 JOG operation

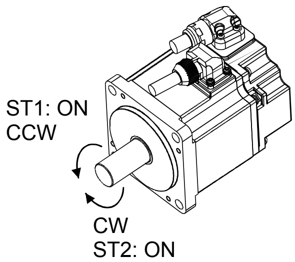
(1) Setting

Set the input device and parameters as follows according to the purpose of use. In this case, the point table No. selection 1 to 8 (DI0 to DI7) are invalid.

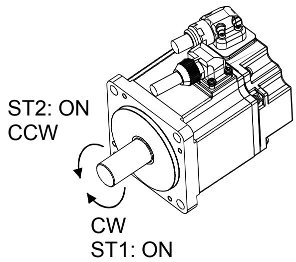
Item	Device/Parameter used	Description
Manual operation mode selection	Automatic/manual selection (MD0)	Turn MD0 OFF.
Servo motor rotation direction	Parameter No.PA14	Refer to (2) in this section.
Jog speed	Parameter No.PC12	Set the speed of the servo motor.
Acceleration/deceleration time constant	Point table No.1	Use the acceleration/deceleration time constants in point table No.1.

(2) Servo motor rotation direction

Parameter No. PA14 setting	Servo motor rotation direction	
	Forward rotation start (ST1) ON	Reverse rotation start (ST2) ON
0	CCW rotation	CW rotation
1	CW rotation	CCW rotation



Parameter No.PA14: 0

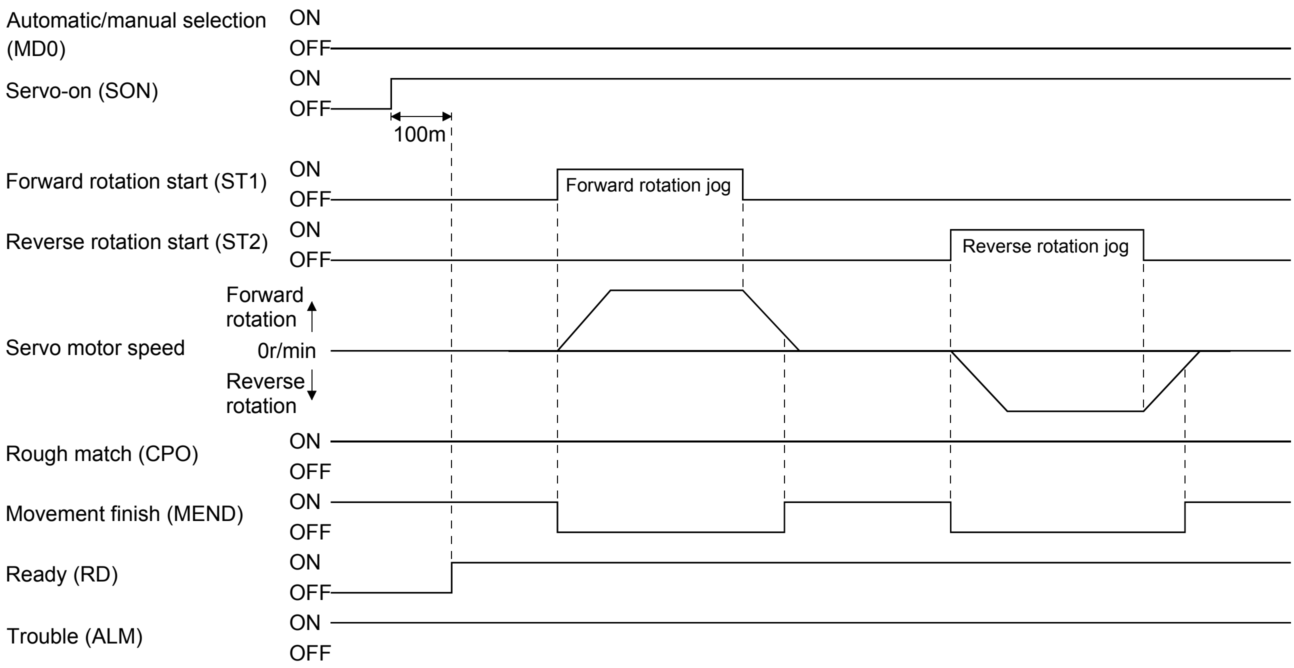


Parameter No.PA14: 1

(3) Operation

By turning ST1 ON, operation is performed under the conditions of the jog speed set in the parameter and the acceleration and deceleration time constants in set point table No.1. For the rotation direction, refer to (2) in this section. By turning ST2 ON, the servo motor rotates in the reverse direction to forward rotation start (ST1).

(4) Timing chart



4.6.2 Manual pulse generator

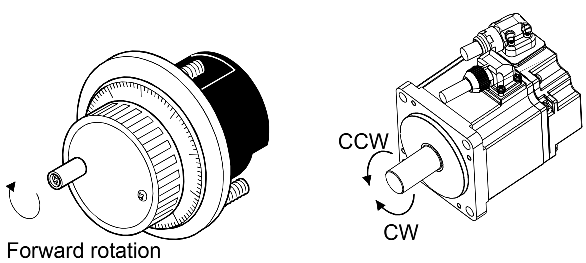
(1) Setting

Set the input device and parameters as follows according to the purpose of use. In this case, the point table No. selection 1 to 8 (DI0 to DI7) are invalid.

Item	Device/Parameter used	Description
Manual operation mode selection	Automatic/manual selection (MD0)	Turn MD0 OFF.
Manual pulse generator multiplication	Parameter No.PA05	For more information, refer to (3) in this section.
Servo motor rotation direction	Parameter No.PA14	Refer to (2) in this section.

(2) Servo motor rotation direction

Parameter No. PA14 setting	Servo motor rotation direction	
	Manual pulse generator: forward rotation	Manual pulse generator: reverse rotation
0	CCW rotation	CW rotation
1	CW rotation	CCW rotation



(3) Manual pulse generator multiplication

(a) Using the parameter for setting

Use parameter No. PA05 to set the multiplication ratio of the servo motor rotation to the manual pulse generator rotation.

Parameter No. PA05 setting	Multiplication ratio of servo motor rotation to manual pulse generator rotation	Moving distance
□□0□	1 time	1[μm]
□□1□	10 times	10[μm]
□□2□	100 times	100[μm]

(b) Using the input devices for setting (devices)

(Note) Pulse generator multiplication 2 (TP1)	(Note) Pulse generator multiplication 1 (TP0)	Multiplication ratio of servo motor rotation to manual pulse generator rotation	Moving distance
0	0	Parameter No. PA05 setting valid	
0	1	1 time	1[μm]
1	0	10 times	10[μm]
1	1	100 times	100[μm]

Note. 0: OFF
1: ON

(4) Operation

Turn the manual pulse generator to rotate the servo motor. For the rotation direction of servo motor, refer to (2) in this section.

4.7 Manual home position return mode

4.7.1 Outline of home position return

Home position return is performed to match the command coordinates with the machine coordinates. In the incremental system, home position return is required every time input power is switched on. In the absolute position detection system, once home position return is done at the time of installation, the current position is retained if power is switched off. Hence, home position return is not required when power is switched on again.
This servo amplifier has the home position return methods given in this section. Choose the most appropriate method for your machine structure and application.
This servo amplifier has the home position return automatic return function which executes home position return by making an automatic return to a proper position if the machine has stopped beyond or at the proximity dog. Manual motion by jog operation or the like is not required.

(1) Home position return types

Choose the optimum home position return according to the machine type, etc.

Type	Home position return method	Features
Dog type home position return	With deceleration started at the front end of a proximity dog, the position where the first Z-phase signal is given past the rear end of the dog or a motion has been made over the home position shift distance starting from the Z-phase signal is defined as a home position.(Note)	・General home position return method using a proximity dog. ・Repeatability of home position return is excellent. ・The machine is less burdened. ・Used when the width of the proximity dog can be set greater than the deceleration distance of the servo motor.
Count type home position return	With deceleration started at the front end of a proximity dog, the position where the first Z-phase signal is given after advancement over the preset moving distance after the proximity dog or a motion has been made over the home position shift distance starting from the Z-phase signal is defined as a home position.	・Home position return method using a proximity dog. ・Used when it is desired to minimize the length of the proximity dog.
Data setting type home position return	An arbitrary position is defined as a home position.	・No proximity dog required.
Stopper type home position return	The position where the machine stops when its part is pressed against a machine stopper is defined as a home position.	・Since the machine part collides with the machine be fully lowered. ・The machine and stopper strength must be increased.
Home position ignorance (Servo-on position as home position)	The position where servo is switched on is defined as a home position.	
Dog type rear end reference	The position where the axis, which had started decelerating at the front end of a proximity dog, has moved the after-proximity dog moving distance and home position shift distance after it passed the rear end is defined as a home position.	・The Z-phase signal is not needed.
Count type front end reference	The position where the axis, which had started decelerating at the front end of a proximity dog, has moved the after-proximity dog moving distance and home position shift distance is defined as a home position.	・The Z-phase signal is not needed.
Dog cradle type	The position where the first Z-phase signal is issued after detection of the proximity dog front end is defined as a home position.	
Dog type first Z-phase reference	After the proximity dog front end is detected, the current position moves away from the proximity dog in the reverse direction. In this movement, the home position is defined to be where the first Z-phase signal is issued or the position that is the home position shift distance away from where the first Z-phase signal is issued.	
Dog type front end reference	The home position is defined to be where the axis has moved the after-proximity dog moving distance and home position shift distance from the front end of a proximity dog.	・The Z-phase signal is not needed.
Dogless Z-phase reference	The home position is defined to be where the first Z-phase signal is issued or the position that is the home position shift distance away from where the first Z-phase signal is issued.	

Note. The Z-phase signal is a signal recognized in the servo amplifier once per servo motor revolution and cannot be used as an output signal.

(2) Home position return parameter

When performing home position return, set each parameter as follows.

(a) Choose the home position return method with parameter No. PC02 (Home position return type).

Parameter No.PC02

0	0	0	

Home position return method
0: Dog type
1: Count type
2: Data setting type
3: Stopper type
4: Home position ignorance (Servo-on position as home position)
5: Dog type rear end reference
6: Count type front end reference
7: Dog cradle type
8: Dog type first Z-phase reference
9: Dog type front end reference
A: Dogless Z-phase reference

(b) Choose the starting direction of home position return with parameter No. PC03 (Home position return direction). Set "0" to start home position return in the direction in which the address is incremented from the current position, or "1" to start home position return in the direction in which the address is decremented.

Parameter No.PC03

0	0	0	

Home position return direction
0: Address increment direction
1: Address decrement direction

(c) Choose the polarity at which the proximity dog is detected with parameter No. PD16 (Input polarity setting). Set "0" to detect the dog when the proximity dog device (DOG) is OFF, or "1" to detect the dog when the device is ON.

Parameter No.PD16

0	0	0	

Proximity dog input polarity
0: OFF indicates detection of the dog.
1: ON indicates detection of the dog.

(3) Instructions

1) Before starting home position return, always make sure that the limit switch operates.
2) Confirm the home position return direction. Incorrect setting will cause the machine to run reversely.
3) Confirm the proximity dog input polarity. Not doing so may cause unexpected operation.

4.7.2 Dog type home position return

A home position return method using a proximity dog. With deceleration started at the front end of the proximity dog, the position where the first Z-phase signal is given past the rear end of the dog or a motion has been made over the home position shift distance starting from the Z-phase signal is defined as a home position.

(1) Devices, parameters

Set the input devices and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Dog type home position return	Parameter No.PC02	□□□0 :Dog type home position return is selected.
Home position return direction	Parameter No.PC03	Refer to (2) in this section and choose home position return direction.
Dog input polarity	Parameter No.PD16	Refer to (2) in this section and choose dog input polarity.
Home position return speed	Parameter No.PC04	Set speed until detection of dog.
Creep speed	Parameter No.PC05	Set speed after detection of dog.
Home position shift distance	Parameter No.PC06	Set when shifting the home position starting at the first Z-phase signal after passage of proximity dog rear end.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constants of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

(2) Length of proximity dog

To ensure that the Z-phase signal of the servo motor is generated during detection of the proximity dog (DOG), the proximity dog should have the length which satisfies formulas (4.1) and (4.2).

$$L_1 \geq \frac{V}{60} \cdot \frac{td}{2} \quad \text{.......} \quad (4.1)$$

L_1 : Proximity dog length [mm]

V : Home position return speed [mm/min]

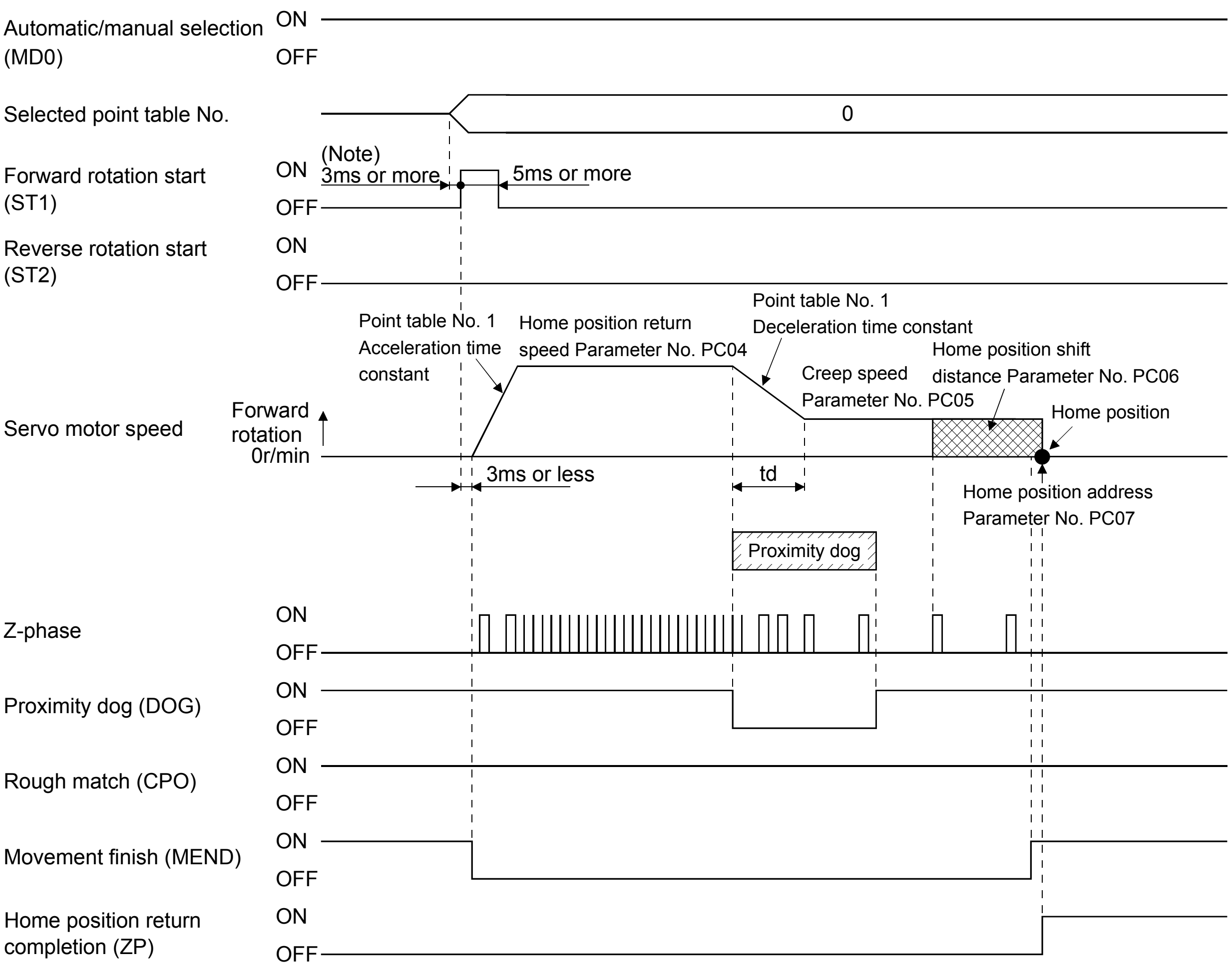
td : Deceleration time [s]

$$L_2 \geq 2 \cdot \Delta S \quad \text{.......} \quad (4.2)$$

L_2 : Proximity dog length [mm]

ΔS : Moving distance per servo motor revolution [mm]

(3) Timing chart



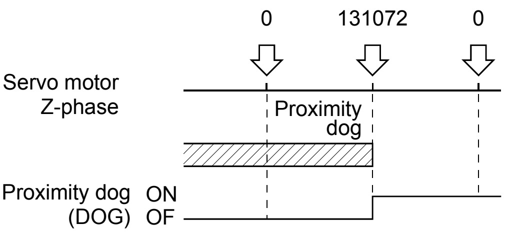
Note. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

(4) Adjustment

In dog type home position return, adjust to ensure that the Z-phase signal is generated during dog detection. Locate the rear end of the proximity dog (DOG) at approximately the center of two consecutive Z-phase signals.

The position where the Z-phase signal is generated can be monitored in "Within one-revolution position" of "Status display" of the MR Configurator or the parameter unit.



4.7.3 Count type home position return

In count type home position return, a motion is made over the distance set in parameter No.PC08 (moving distance after proximity dog) after detection of the proximity dog front end. The position where the first Z-phase signal is given after that is defined as a home position. Hence, if the proximity dog (DOG) is 10ms or longer, there is no restriction on the dog length. This home position return method is used when the required proximity dog length cannot be reserved to use dog type home position return or when the proximity dog (DOG) is entered electrically from a controller or the like.

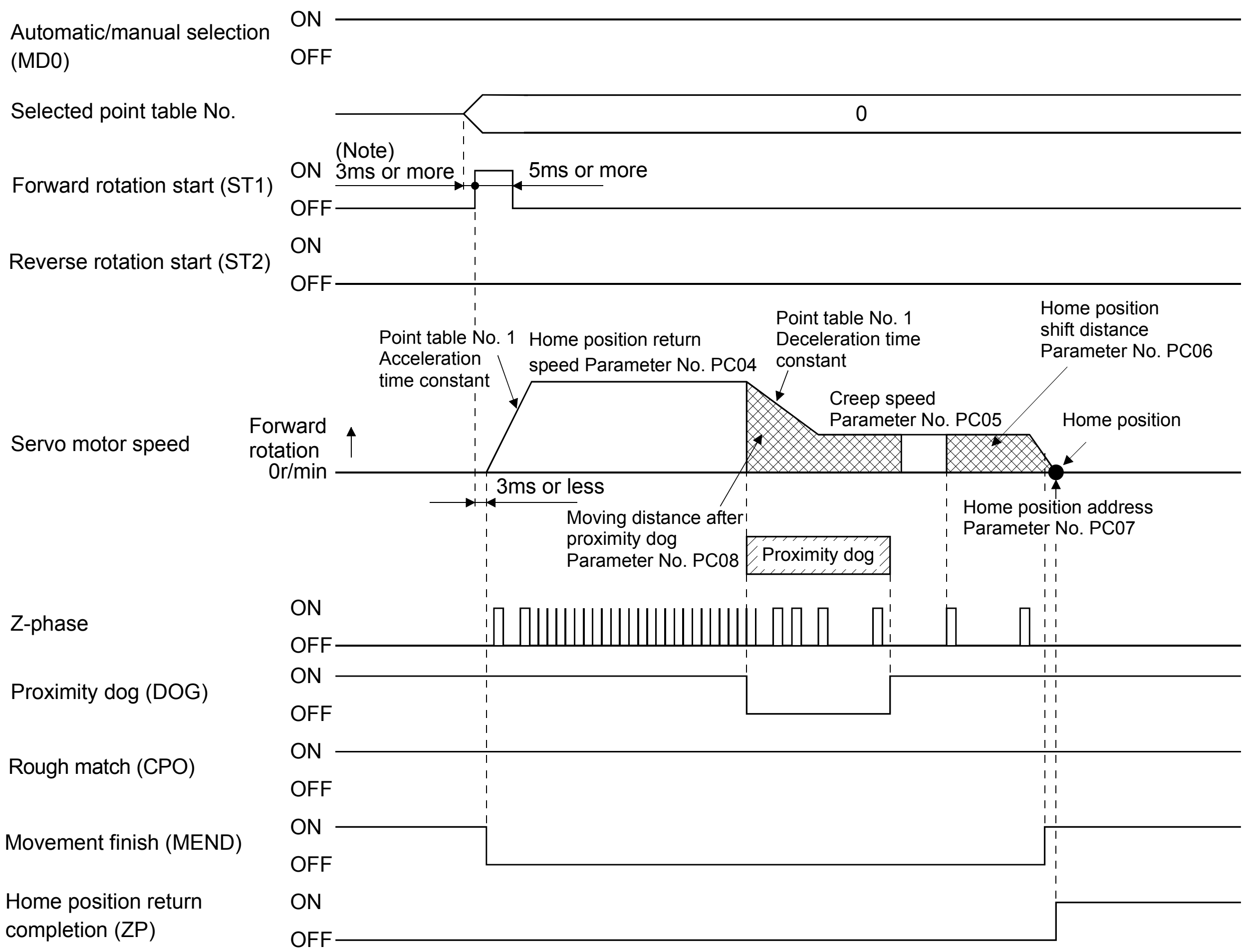
(1) Devices, parameters

Set the input devices and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Count type home position return	Parameter No.PC02	□□□1: Count type home position return is selected.
Home position return direction	Parameter No.PC03	Refer to (2) in this section and choose home position return direction.
Dog input polarity	Parameter No.PD16	Refer to (2) in this section and choose dog input polarity.
Home position return speed	Parameter No.PC04	Set speed until detection of dog.
Creep speed	Parameter No.PC05	Set speed after detection of dog.
Home position shift distance	Parameter No.PC06	Set when shifting the home position, starting at the first Z-phase signal given after passage of the proximity dog front end and movement over the moving distance.
Moving distance after proximity dog	Parameter No.PC08	Set the moving distance after passage of proximity dog front end.
Home position return acceleration/deceleration time constants	Parameter No.1	Use the acceleration/deceleration time constants of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

(2) Timing chart



Note. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

4.7.4 Data setting type home position return

Data setting type home position return is used when it is desired to determine any position as a home position. JOG operation can be used for movement.

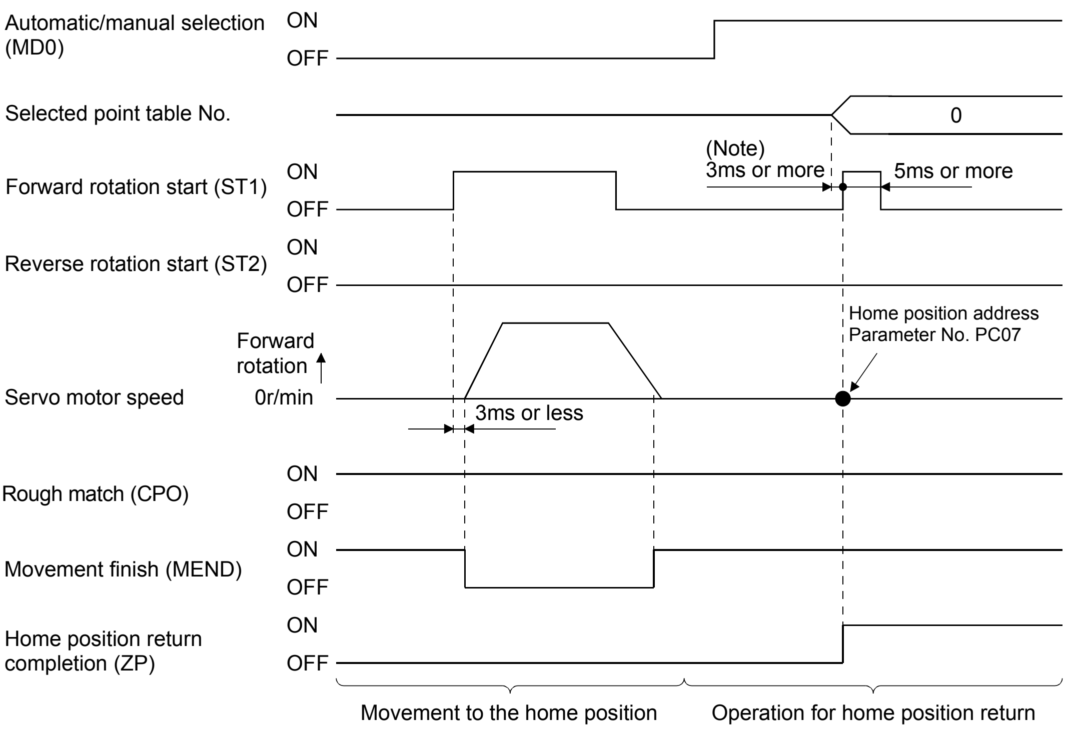
(1) Devices, parameters

Set the input devices and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Data setting type home position return	Parameter No.PC02	□□□2: Data setting type home position return is selected.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

(2) Timing chart



Note. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

4.7.5 Stopper type home position return

In stopper type home position return, a machine part is pressed against a stopper or the like by jog operation to make a home position return and that position is defined as a home position.

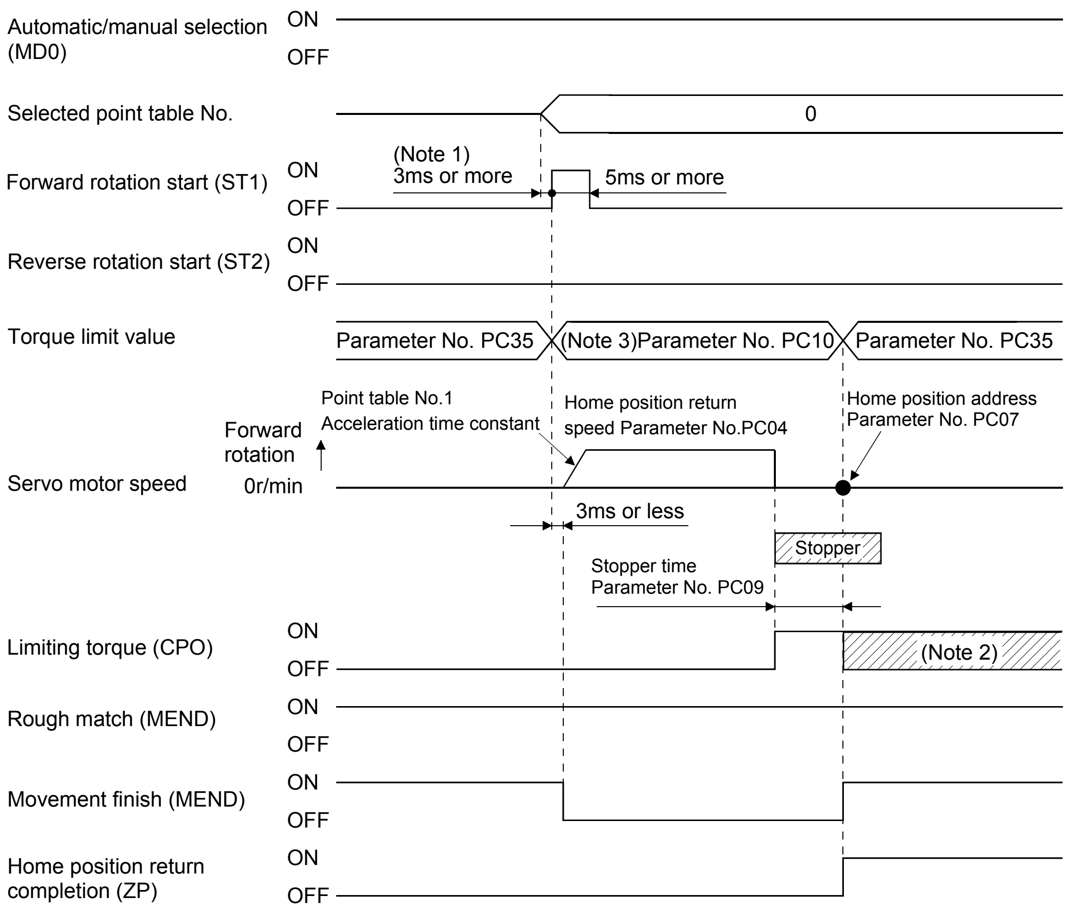
(1) Devices, parameters

Set the input devices and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Stopper type home position return	Parameter No.PC02	□□□3: Stopper type home position return is selected.
Home position return direction	Parameter No.PC03	Refer to (2) in this section and choose the home position return direction.
Home position return speed	Parameter No.PC04	Set the speed till contact with the stopper.
Stopper time	Parameter No.PC09	Time from when the part makes contact with the stopper to when home position return data is obtained to output home position return completion (ZP).
Stopper type home position return torque limit	Parameter No.PC10	Set the servo motor torque limit value for execution of stopper type home position return.
Home position return acceleration time constant	Point table No.1	Use the acceleration time constant of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

(2) Timing chart



Note 1. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

2. TLC turns ON when the torque reaches to the value set in the forward torque limit (parameter No. PA11), reverse torque limit (parameter No.PA12), internal torque limit 2 (parameter No. PC35), or analog torque limit (TLA).

3. The torque limit that is enabled at this point is as follows.

(Note) I/O devices		Limit value status			Torque limit to be enabled
TL1	TL				
0	0				Parameter No.PC10
0	1	TLA	>	Parameter No.PC10	Parameter No.PC10
		TLA	<	Parameter No.PC10	TLA
1	0	Parameter No.PC35	>	Parameter No.PC10	Parameter No.PC10
		Parameter No.PC35	<	Parameter No.PC10	Parameter No.PC35
1	1	TLA	>	Parameter No.PC10	Parameter No.PC10
		TLA	<	Parameter No.PC10	TLA

Note. 0: OFF
1: ON

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

4.7.6 Home position ignorance (servo-on position defined as home position)

The position where servo is switched on is defined as a home position.

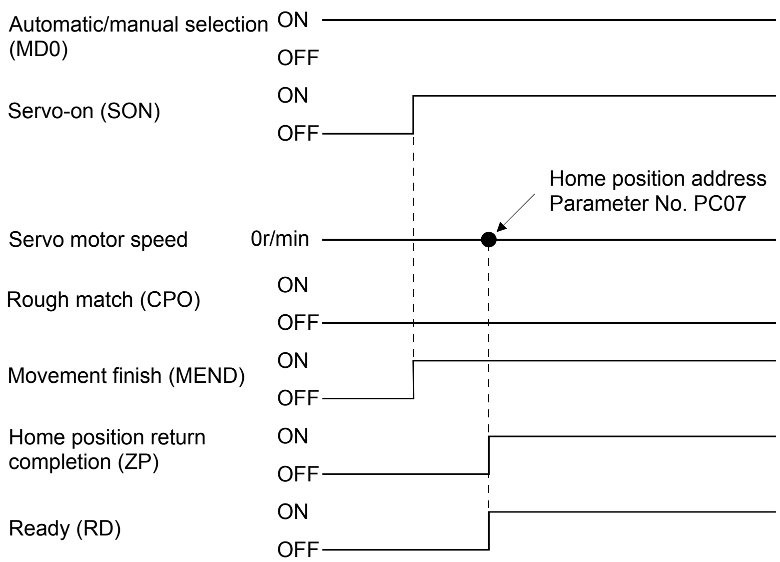
(1) Devices, parameter

Set the input devices and parameter as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Home position ignorance	Parameter No.PC02	□□□4: Home position ignorance is selected.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

(2) Timing chart



The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

4.7.7 Dog type rear end reference home position return

POINT

- This home position return method depends on the timing of reading Proximity dog (DOG) that has detected the rear end of a proximity dog. Hence, if a home position return is made at the creep speed of 100r/min, an error of ±400 pulses will occur in the home position. The error of the home position is larger as the creep speed is higher.

The position where the axis, which had started decelerating at the front end of a proximity dog, has moved the after-proximity dog moving distance and home position shift distance after it passed the rear end is defined as a home position. A home position return that does not depend on the Z-phase signal can be made.

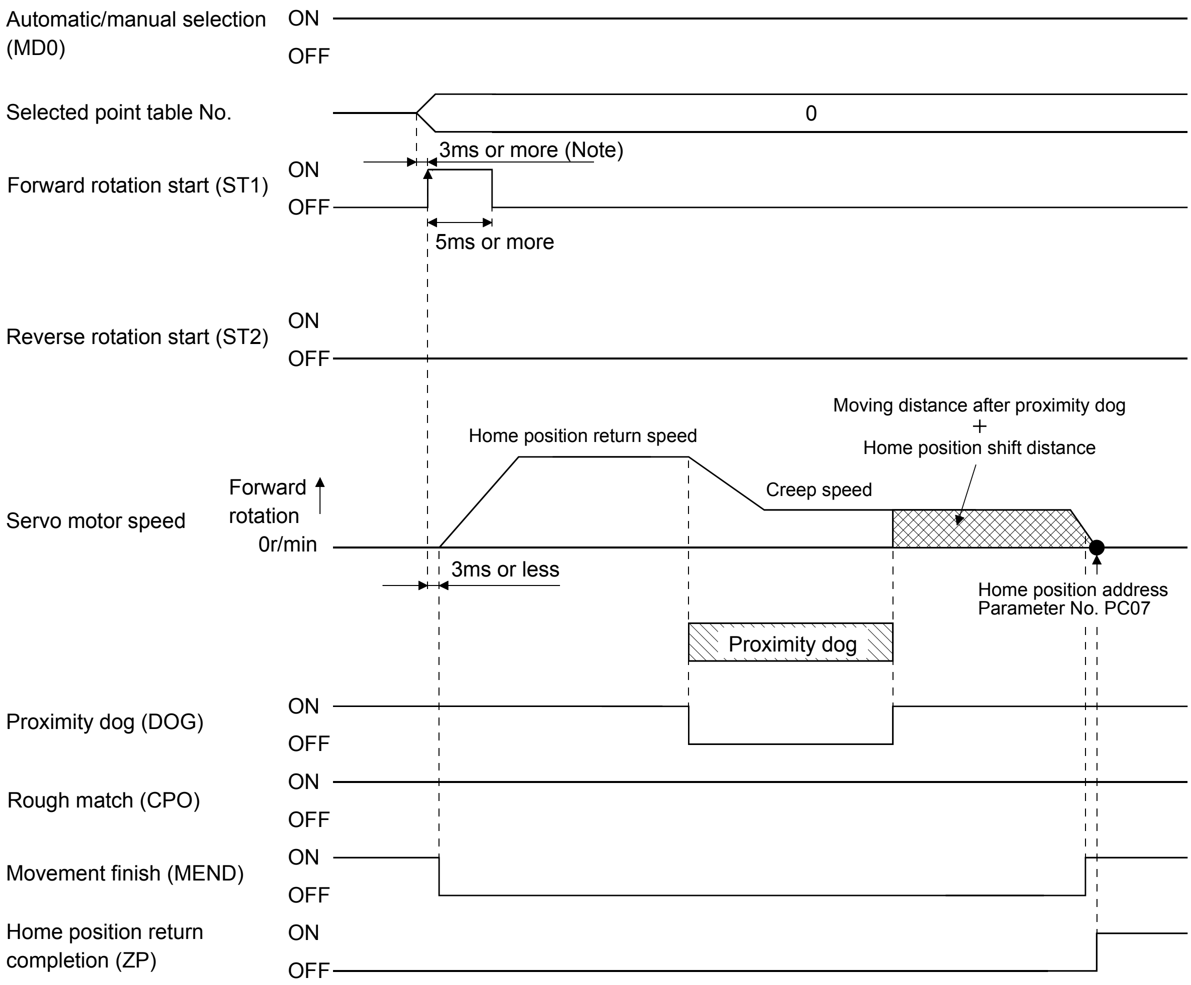
(1) Devices, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Dog type rear end reference home position return	Parameter No.PC02	□□□5: Select the dog type rear end reference.
Home position return direction	Parameter No.PC03	Refer to (2) in this section and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to (2) in this section and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from where the axis has passed the proximity dog rear end.
Moving distance after proximity dog	Parameter No.PC08	Set the moving distance after the axis has passed the proximity dog rear end.
Home position return acceleration/ deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

(2) Timing chart



Note. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

The parameter No.PC17 (home position return position data) setting value is the positioning address after the home position return is completed.

4.7.8 Count type front end reference home position return

POINT
· This home position return method depends on the timing of reading Proximity dog (DOG) that has detected the front end of a proximity dog. Hence, if a home position return is made at the home position return speed of 100r/min, an error of ±400 pulses will occur in the home position. The error of the home position is larger as the home position return speed is higher.

The position where the axis, which had started decelerating at the front end of a proximity dog, has moved the after-proximity dog moving distance and home position shift distance is defined as a home position. A home position return that does not depend on the Z-phase signal can be made. The home position may change if the home position return speed varies.

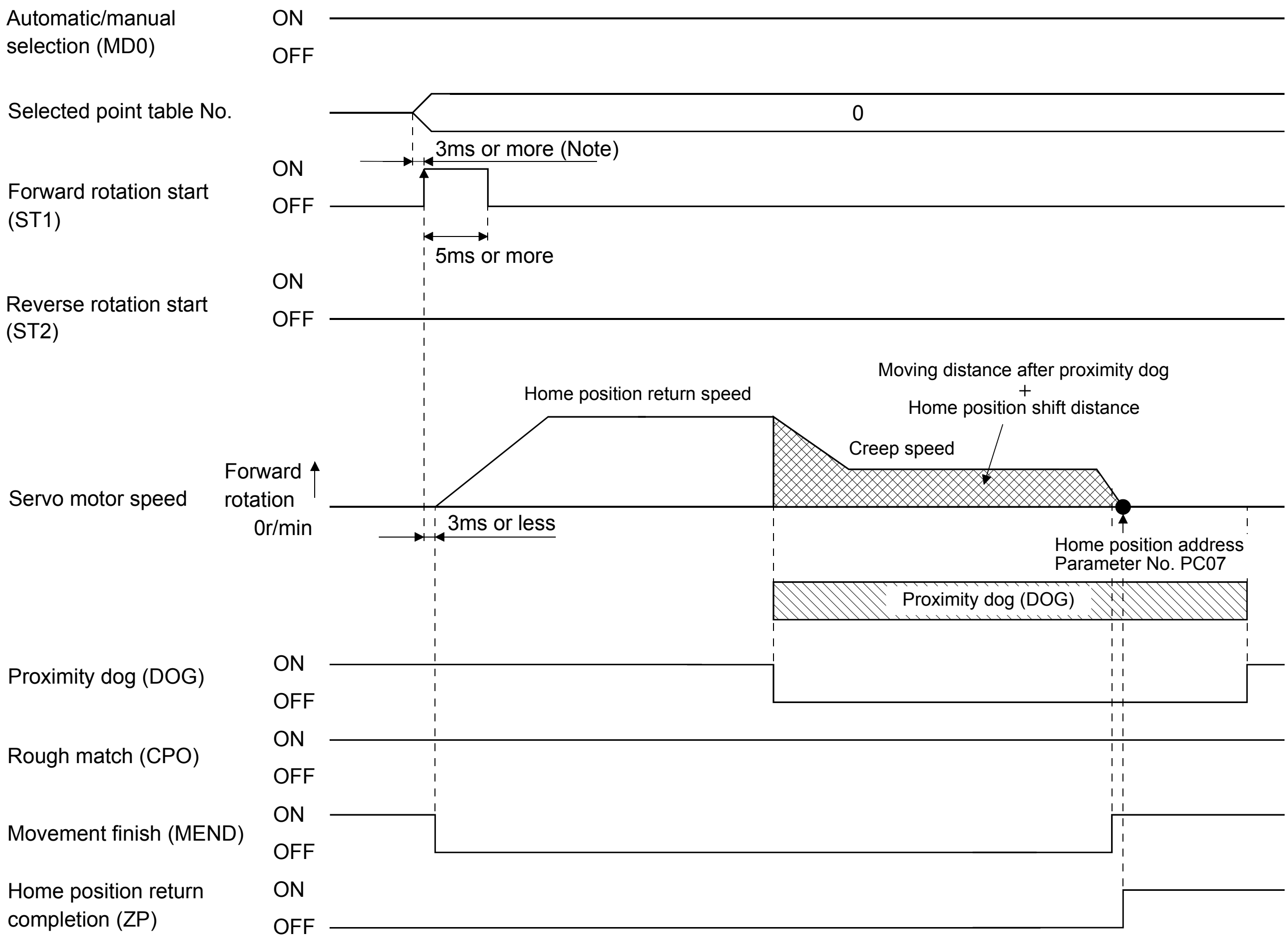
(1) Devices, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Count type dog front end reference home position return	Parameter No.PC02	□□□6: Select the count type dog front end reference.
Home position return direction	Parameter No.PC03	Refer to (2) in this section and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to (2) in this section and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from where the axis has passed the proximity dog rear end.
Moving distance after proximity dog	Parameter No.PC08	Set the moving distance after the axis has passed the proximity dog rear end.
Home position return acceleration/ deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

(2) Timing chart



Note. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

4.7.9 Dog cradle type home position return

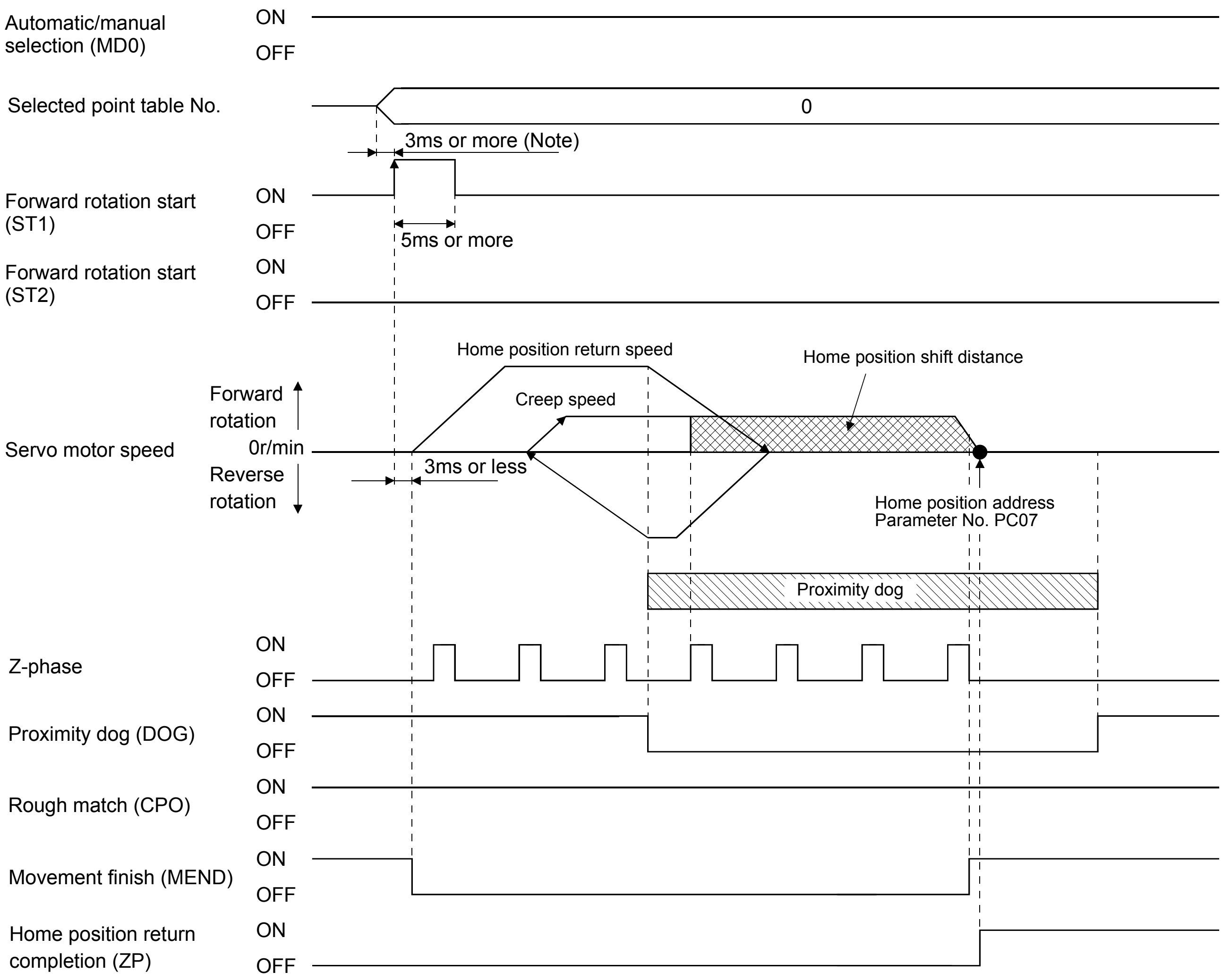
The position where the first Z-phase signal is issued after detection of the proximity dog front end can be defined as a home position.

(1) Devices, parameters
Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Dog cradle type home position return	Parameter No.PC02	□□□7: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to (2) in this section and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to (2) in this section and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

(2) Timing chart



Note. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

4.7.10 Dog type first Z-phase reference home position return

After the proximity dog front end is detected, the current position moves in the reverse direction at creep speed. After this moving away from the proximity dog, the home position is determined to be where the first Z-phase pulse is issued.

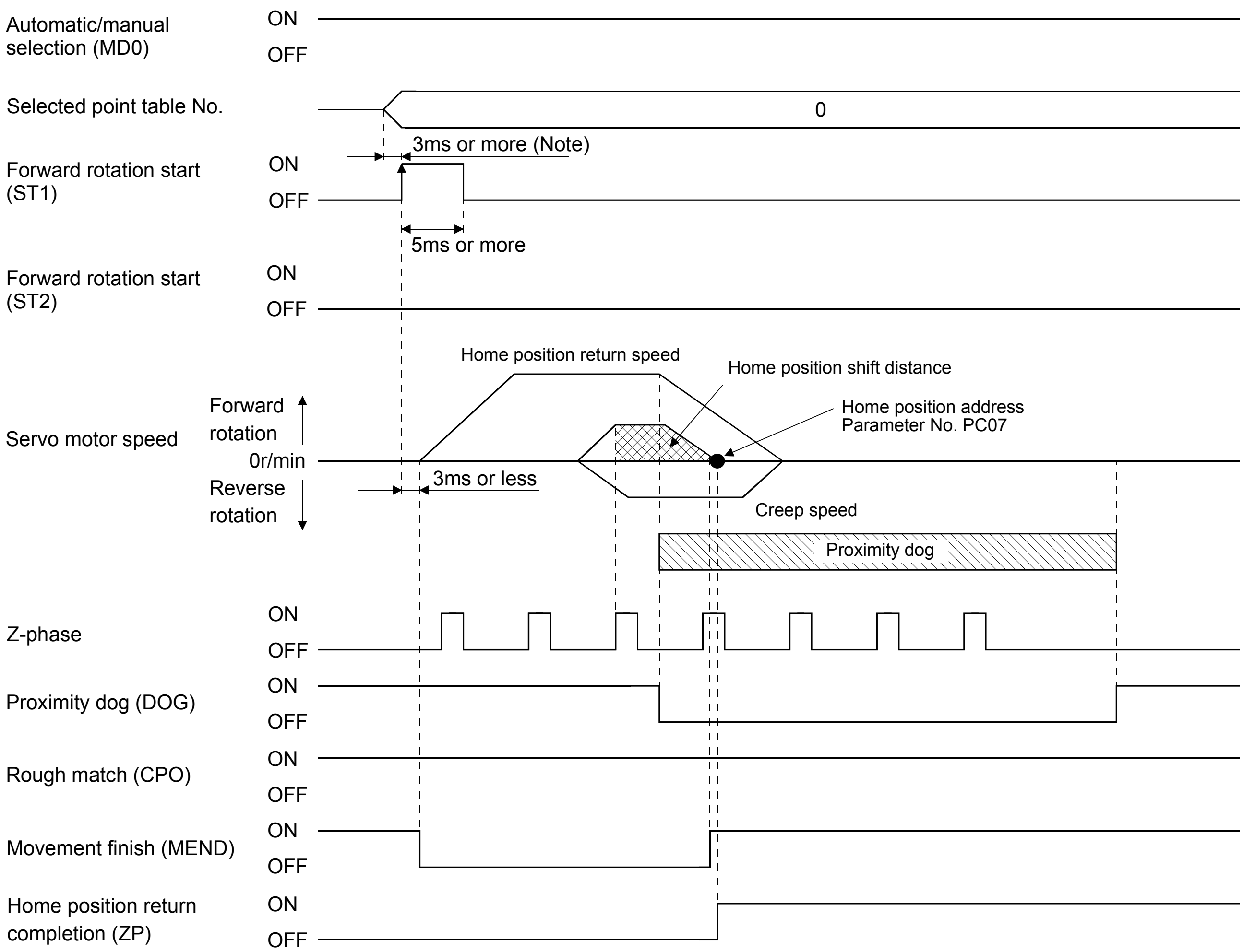
(1) Devices, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Dog cradle type home position return	Parameter No.PC02	□□□8: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to (2) in this section and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to (2) in this section and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

(2) Timing chart



Note. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

4.7.11 Dog type front end reference home position return method

POINT
・This home position return method depends on the timing of reading Proximity dog (DOG) that has detected the front end of a proximity dog. Hence, if a home position return is made at the creep speed of 100r/min, an error of ±400 pulses will occur in the home position. The error of the home position is larger as the creep speed is higher.

The home position is defined to be where the axis has moved the after-proximity dog moving distance and home position shift distance from the front end of a proximity dog. A home position return that does not depend on the Z-phase signal can be made. The home position may change if the creep speed varies.

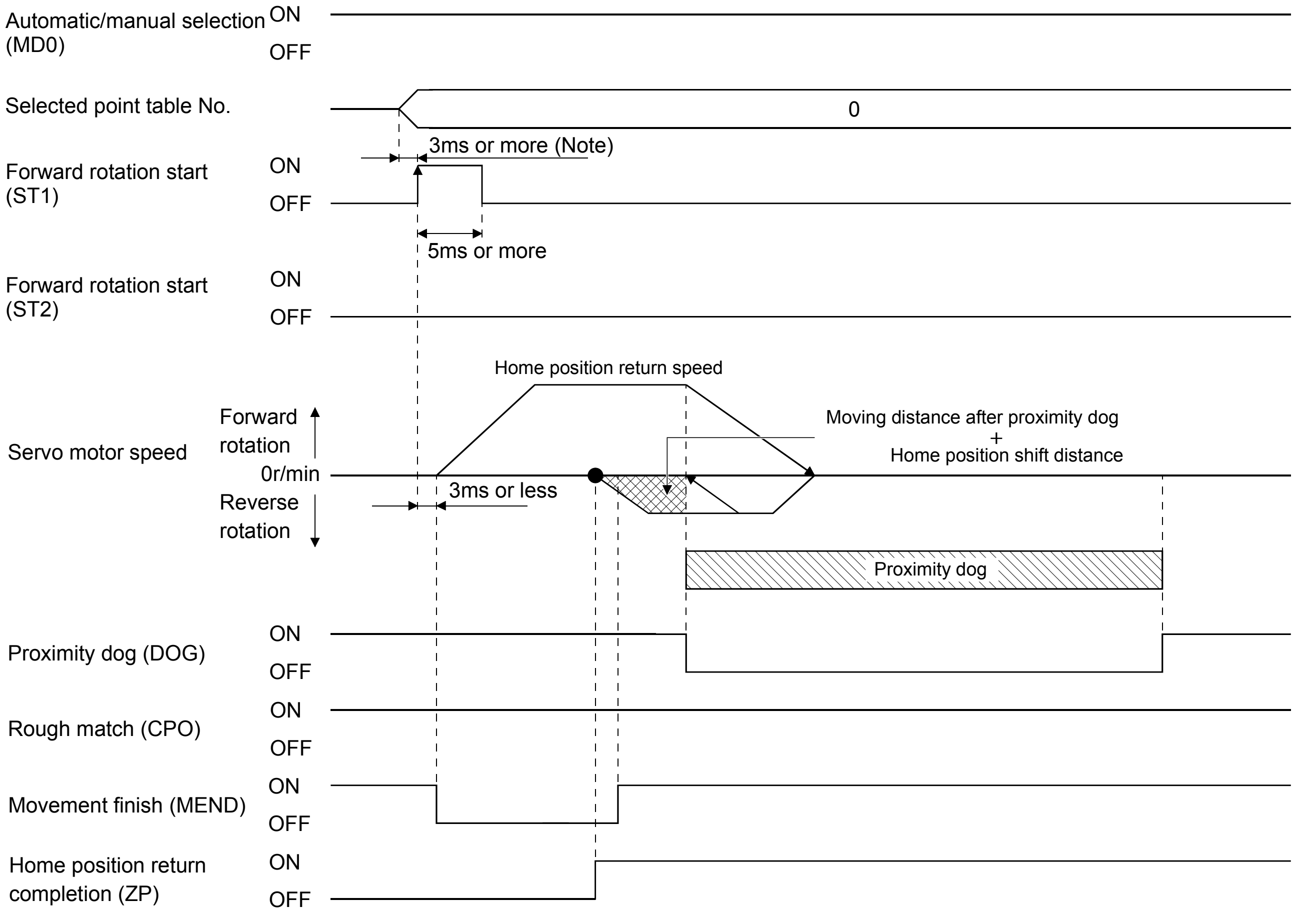
(1) Devices, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Dog cradle type home position return	Parameter No.PC02	□□□9: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to (2) in this section and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to (2) in this section and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

(2) Timing chart



Note. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

4.7.12 Dogless Z-phase reference home position return method

The home position is determined to be where the first Z-phase pulse is issued after the home position return is started.

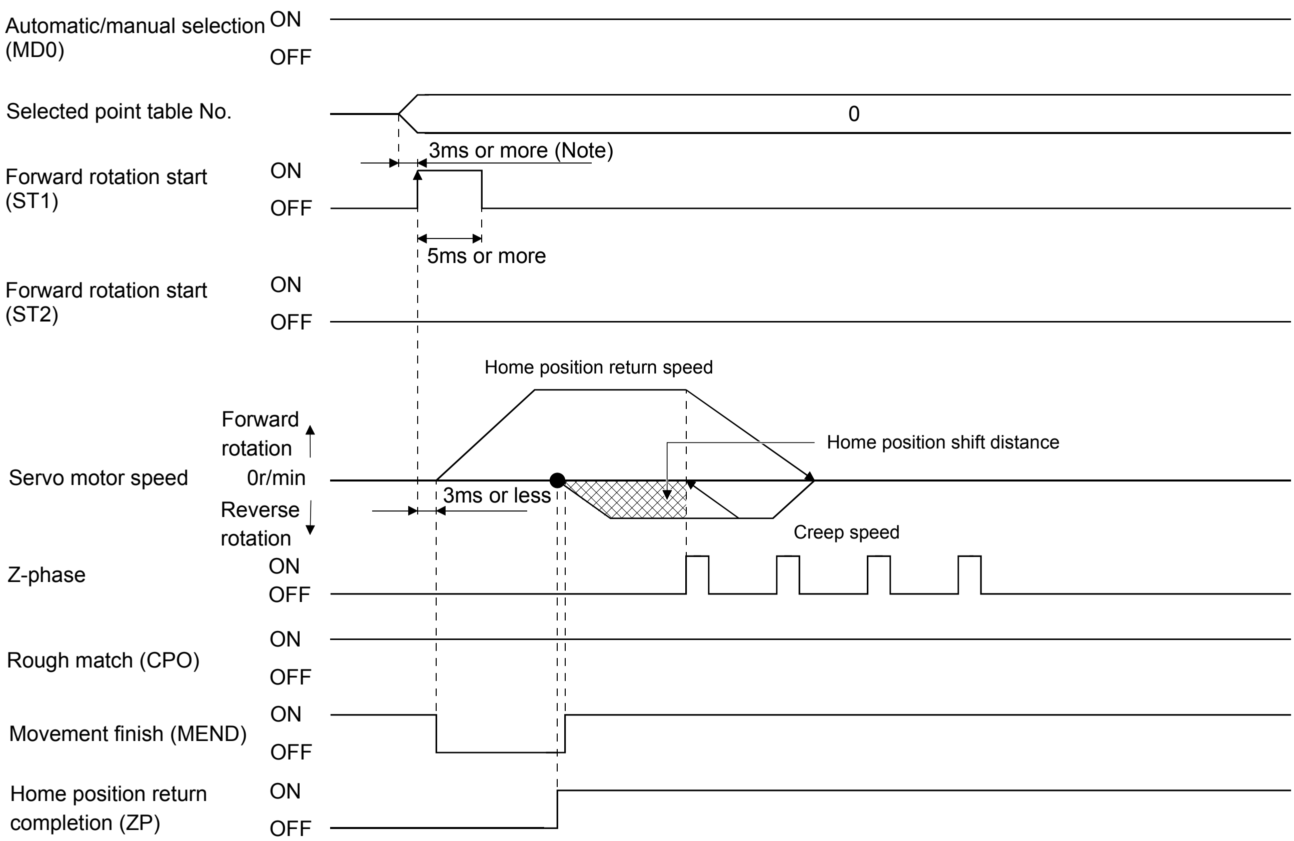
(1) Devices, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Dog cradle type home position return	Parameter No.PC02	□□□A: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to (2) in this section and select the home position return direction.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

(2) Timing chart



Note. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

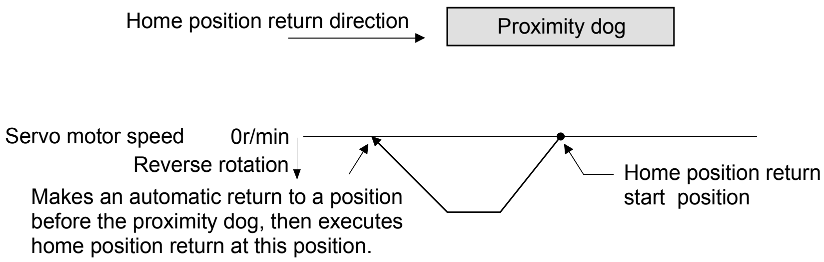
The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

4.7.13 Home position return automatic return function

If the current position is at or beyond the proximity dog in the home position return using the proximity dog, this function starts home position return after making a return to the position where the home position return can be made.

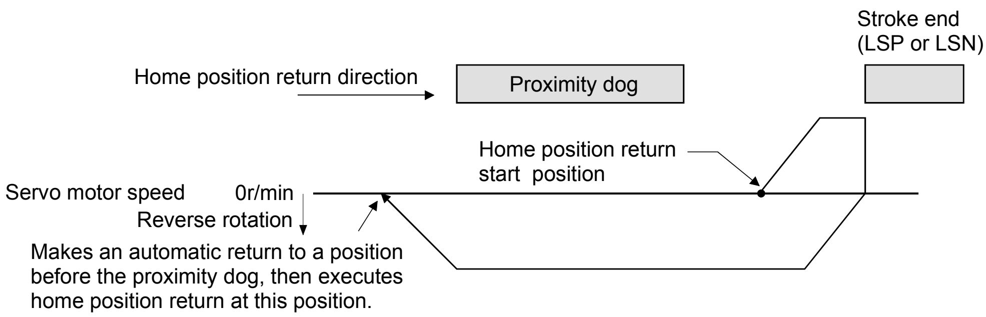
(1) When the current position is at the proximity dog

When the current position is at the proximity dog, an automatic return is made before home position return.



(2) When the current position is beyond the proximity dog

At a start, a motion is made in the home position return direction and an automatic return is made on detection of the stroke end (LSP or LSN). The motion stops past the front end of the proximity dog, and home position return is resumed at that position. If the proximity dog cannot be detected, the motion stops on detection of the LSP or LSN switch and A90 occurs.



Software limit cannot be used with these functions.

4.7.14 Automatic positioning function to the home position

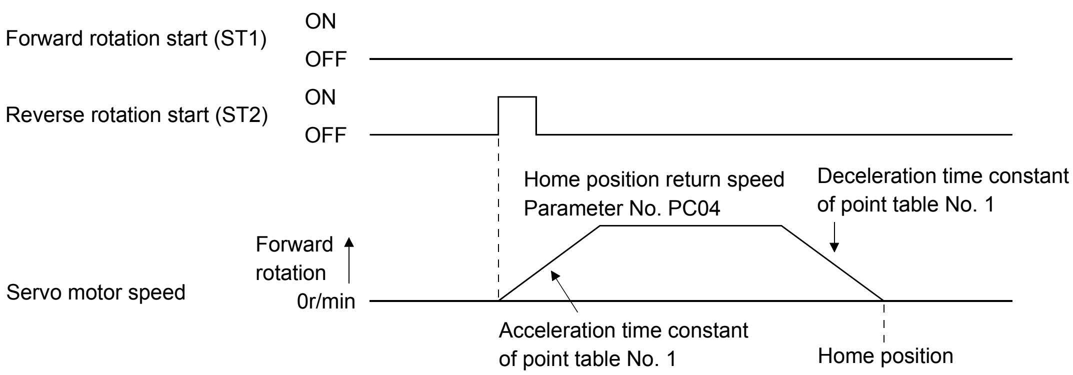
POINT
・You cannot perform automatic positioning from outside the position data setting range to the home position. In this case, make a home position return again using a manual home position return.

If this function is used when returning to the home position again after performing a manual home position return after a power-on and deciding the home position, automatic positioning can be carried out to the home position at high speed. In an absolute position system, manual home position return is not required after power-on.
Please perform a manual home position return beforehand after a power-on.
Set the input signals and parameter as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Turn MD0 ON.
	(Note) Point table No. selection 1 to 8 (DI0 to DI7)	DI0 to DI7 are turned off.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.

Note. This setting is for when the point table is used. When using the BCD input, turn SP0 to 3 OFF.

Set up the home position return speed of the automatic positioning function to the home position by parameter No.PC04. Use the data of point table No.1 to set the acceleration time constant and deceleration time constant. When reverse rotation start (ST2) is ON, it will position automatically at the home position.



4.8 Roll feed display function in roll feed mode

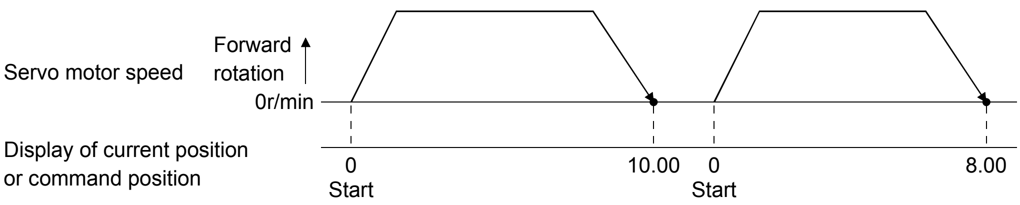
With the roll feed display function, the servo amplifier can operate in the roll feed mode. The roll feed mode uses the incremental system.

(1) Parameter settings

No.	Name	Digit to be set	Setting item	Setting value	Description
PA03	Absolute position detection system	□□□■	Operation system	□□□0 (initial value)	Make sure to set the incremental system. The absolute position detection system cannot be used.
PC28	Function selection C-7	□□■□	Selection between current position display and command position display	□□1□	Select roll feed display

(2) Roll feed display function

At start up, the roll feed display function clears the status display of the current position and command position to zero.



(3) Operation procedure

Changes are made only on the status display of the current position and commanded position. The same operation procedure as that in each operation mode can be used.

Operation procedure		Details
Automatic operation	Automatic operation according to the point table	Section 4.5.2
	Automatic operation by BCD (3 digits × 2) input with the MR-DS60 digital switch	Section 4.5.3
	Automatic operation by BCD (3 digits × 2) input with the programmable controller	Section 4.5.4
Manual operation	JOG operation	Section 4.6.1
	Manual pulse generator operation	Section 4.6.2
Home position return mode		Section 4.7

4.9 Absolute position detection system

CAUTION	・If an absolute position erase alarm (A25) or an absolute position counter warning (AE3) has occurred, always perform home position setting again. Not doing so can cause runaway.

POINT

- If the encoder cable is disconnected, absolute position data will be lost in the following servo motor series: HF-MP, HF-KP, HC-SP, HC-RP, HC-UP, HC-LP, and HA-LP. After disconnecting the encoder cable, always execute home position setting and then positioning operation.
- When the following parameters are changed, the home position is lost when turning on the power after the change. Execute the home position return again when turning on the power.
  - Parameter No. PA06 (Electronic gear numerator)
  - Parameter No. PA07 (Electronic gear denominator)
  - Parameter No. PA14 (Rotation direction selection)
  - Parameter No. PC07 (Home position return position data)

This servo amplifier contains a single-axis controller. Also, all servo motor encoders are compatible with an absolute position system. Hence, an absolute position detection system can be configured up by merely loading an absolute position data back-up battery and setting parameter values.

(1) Restrictions

An absolute position detection system cannot be built under the following conditions.

1) Stroke-less coordinate system, e.g. rotary shaft, infinite positioning.

2) Operation performed in incremental value command type positioning system.

(2) Specifications

Item	Description
System	Electronic battery backup system
Battery	1 piece of lithium battery (primary battery, nominal + 3.6V) Type: MR-J3BAT
Maximum revolution range	Home position ± 32767 rev.
(Note 1) Maximum speed at power failure	3000r/min
(Note 2) Battery backup time	Approx. 10,000 hours (battery life with power off)
Battery storage period	5 years from date of manufacture

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like.

2. Time to hold data by a battery with power off. It is recommended to replace the battery in three years independently of whether power is kept on or off.

(3) Structure

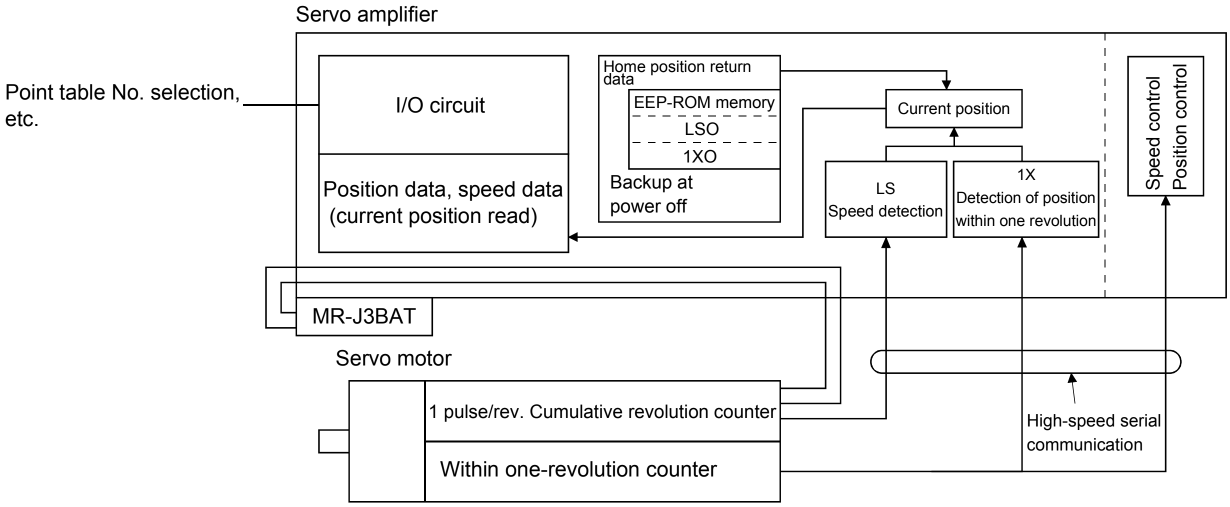
Component	Description
Servo amplifier	Use standard models.
Servo motor	Use standard models.
Battery	MR-J3BAT
Encoder cable	Use a standard model. (Refer to section 13.1)

(4) Outline of absolute position detection data communication

For normal operation, as shown below, 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 general-purpose programmable controller power is on or off. Therefore, once the home position is defined at the time of machine installation, home position return is not needed when power is switched on thereafter.

If a power failure or a fault occurs, restoration is easy.



(5) Battery installation procedure

WARNING	・Before installing a battery, turn off the main circuit power while keeping the control circuit power on. 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, always confirm from the front of the servo amplifier whether the charge lamp is off or not.

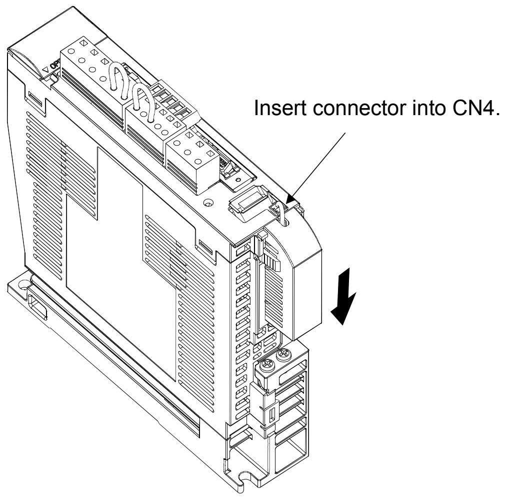
POINT

- 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.
- Before starting battery changing procedure, make sure that the main circuit power is switched OFF with the control circuit power ON. When battery is changed with the control power OFF, the absolute position data is lost.

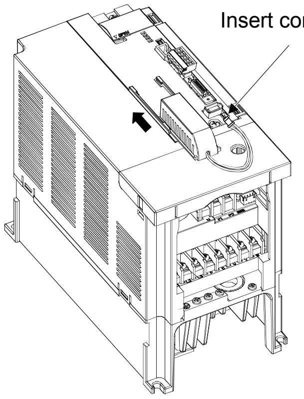
(a) For MR-J3-350T or less and MR-J3-200T4 or less

POINT

- For the servo amplifier with a battery holder on the bottom, ground wiring is not possible with a battery installed. Insert the battery after executing the earth wiring of the servo amplifier.



(b) For MR-J3-500T or more and MR-J3-350T4 or more



(c) Parameter setting

Set parameter No.PA03 (Absolute position detection system) as indicated below to make the absolute position detection system valid.

Parameter No.PA03

			1

Selection of absolute position detection system
0: Incremental system
1: Absolute position detection system

MEMO

5. PARAMETERS

⚠ CAUTION

- When using the MR-J3-□T servo amplifier with the MR-J3-D01 extension I/O unit, always refer to the parameters indicated in this chapter. Some parameters have different functions when they are used with the MR-J3-□T servo amplifier alone.
- Never adjust or change the parameter values extremely as it will make operation instable.

POINT

- For any parameter whose symbol is preceded by *, set the parameter value and switch power off once, then switch it on again to make that parameter setting valid.

In this servo amplifier, the parameters are classified into the following groups on a function basis.

Parameter group	Main description
Basic setting parameters (No. PA □□)	Make basic setting with these parameters. Generally, the operation is possible only with these parameter settings.
Gain/filter parameters (No. PB □□)	Use these parameters when making gain adjustment manually.
Extension setting parameters (No. PC □□)	These parameters are inherent to the MR-J3-□T servo amplifier.
I/O setting parameters (No. PD □□)	Use these parameters when changing the I/O devices of the servo amplifier.
Option unit parameters (No. Po □□)	These parameters are for MR-J3-D01 extension I/O unit.

Mainly setting the basic setting parameters (No. PA □□) allows the setting of the basic parameters at the time of introduction.

5.1 Basic setting parameters (No.PA□□)

5.1.1 Parameter list

No.	Symbol	Name	Initial value	Unit
PA01	*STY	Control mode	0000h	
PA02	*REG	Regenerative option	0000h	
PA03	*ABS	Absolute position detection system	0000h	
PA04	*AOP1	Function selection A-1	0000h	
PA05	*FTY	Feeding function selection	0000h	
PA06	*CMX	Electronic gear numerator	1	
PA07	*CDV	Electronic gear denominator	1	
PA08	ATU	Auto tuning	0001h	
PA09	RSP	Auto tuning response	12	
PA10	INP	In-position range	100	μm
PA11	TLP	Forward torque limit	100.0	%
PA12	TLN	Reverse torque limit	100.0	%
PA13		For manufacturer setting	0002h	
PA14	*POL	Rotation direction selection	0	
PA15	*ENR	Encoder output pulses	4000	pulse/rev
PA16		For manufacturer setting	0	
PA17			0000h	
PA18			0000h	
PA19	*BLK	Parameter write inhibit	000Ch	

5.1.2 Parameter write inhibit

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA19	*BLK	Parameter write inhibit	000Ch		Refer to the text.

> **POINT**
> - This parameter is made valid when power is switched off, then on after setting, or when the controller reset has been performed.

In the factory setting, this servo amplifier allows changes to the basic setting parameter, gain/filter parameter and extension setting parameter settings. With the setting of parameter No. PA19, write can be disabled to prevent accidental changes.
The following table indicates the parameters which are enabled for reference and write by the setting of parameter No. PA19. Operation can be performed for the parameters marked ○ .

Parameter No. PA19 setting	Setting operation	Basic setting parameters No. PA□□	Gain/filter parameters No. PB□□	Extension setting parameters No. PC□□	I/O setting parameters No. PD□□	Option unit parameters No. Po□□
0000h	Reference	○				
	Write	○				
000Bh	Reference	○	○	○		
	Write	○	○	○		
000Ch (initial value)	Reference	○	○	○	○	
	Write	○	○	○	○	
100Bh	Reference	○				
	Write	Parameter No. PA19 only				
100Eh	Reference	○	○	○	○	○
	Write	Parameter No. PA19 only				

5.1.3 Selection of command system

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA01	*STY	Control mode	0000h		Refer to the text.

> **POINT**
> - This parameter is made valid when power is switched off, then on after setting, or when the controller reset has been performed.

Select the command system.

Parameter No. PA01

0	0	0	

Selection of command system
(Refer to section 4.5)
0: Absolute value command system
1: Incremental value command system

5.1.4 Selection of regenerative option

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA02	*REG	Regenerative option	0000h		Refer to the text.

> **POINT**
> - This parameter is made valid when power is switched off, then on after setting.
> - Wrong setting may cause the regenerative option to burn.
> - If the regenerative option selected is not for use with the servo amplifier, parameter error (A37) occurs.

Set this parameter when using the regenerative option, brake unit, power regeneration converter, or power regeneration common converter.

Parameter No. PA02

0	0		

Selection of regenerative option
00: Regenerative option is not used
- For MR-J3-10T, regenerative resistor is not used.
- For MR-J3-20T・40T・60T(4) to 700T(4) built-in regenerative resistor is used.
- Supplied regenerative resistors or regenerative option is used with the MR-J3-11KT(4) to 22KT(4) servo amplifier.

01: FR-BU2-(H)・FR-RC-(H)・FR-CV-(H)
02: MR-RB032
03: MR-RB12
04: MR-RB32
05: MR-RB30
06: MR-RB50(Cooling fan is required)
08: MR-RB31
09: MR-RB51(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)
FA:When regenerative resistors or regenerative option supplied to MR-J3-11KT(4) to 22KT(4) are cooled by cooling fans to increase

5.1.5 Using absolute position detection system

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA03	*ABS	Absolute position detection system	0000h		Refer to the text.

POINT
- This parameter is made valid when power is switched off, then on after setting, or when the controller reset has been performed.

Set this parameter when using the absolute position detection system.

Parameter No. PA03

0	0	0	

Selection of absolute position detection system (refer to Section 4.9)
0: Used in incremental system
1: Used in absolute position detection system

5.1.6 Follow-up for absolute value command system in incremental system

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA04	*AOP1	Function selection A-1	0000h		Refer to the text.

POINT
- This parameter is made valid when power is switched off, then on after setting, or when the controller reset has been performed.

If this parameter is made valid, the home position is not lost in the servo-off or forced stop state, and the operation can be resumed when the servo-on (SON) or forced stop (EMG) is deactivated.

Parameter No. PA04

0	0	0	

Servo-on (SON) -off, forced stop (EMG) -off follow-up for absolute value command in incremental system
0: Invalid
1: Valid
Normally, when this servo amplifier is used in the absolute value command method of the incremental system, placing it in a servo off or forced stop status will erase the home position.
When "1" is set in this parameter, the home position will not be erased if the servo amplifier is placed in a servo-off or forced stop status.
The operation can be resumed when the servo-on (SON) or forced stop (EMG) is deactivated.

5.1.7 Feeding function selection

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA05	*FTY	Feeding function selection	0000h		Refer to the text.

POINT

- This parameter is made valid when power is switched off, then on after setting, or when the controller reset has been performed.

Select the feed length multiplication and the manual pulse generator input multiplication.

Parameter No.PA05

0	0		

Setting value	Feed length multiplication factor (STM) [times]	Feed unit [μm]	Position data input range [mm]	
			Absolute value command system	Incremental value command system
0	1	1	−999.999 to +999.999	0 to +999.999
1	10	10	−9999.99 to +9999.99	0 to +9999.99
2	100	100	−99999.9 to +99999.9	0 to +99999.9
3	1000	1000	− 999999 to +999999	0 to + 999999

Manual pulse generator multiplication factor
0: 1 time
1: 10 times
2: 100 times

5.1.8 Electronic gear

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA06	*CMX	Electronic gear numerator	1		0 to 65535
PA07	*CDV	Electronic gear denominator	1		0 to 65535

⚠ CAUTION

- False setting will result in unexpected fast rotation, causing injury.

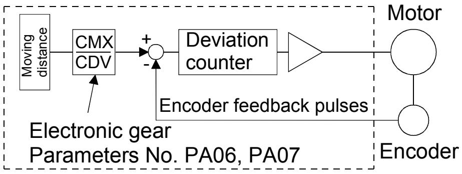
POINT

- This parameter is made valid when power is switched off, then on after setting, or when the controller reset has been performed.
- The range of the electronic gear setting is $\frac{1}{10} < \frac{CMX}{CDV} < 2000$. If you set any value outside this range, a parameter error (A37) occurs.
- Setting "0" in parameter No.PA06 automatically sets the encoder resolution pulse.

(1) Concept of electronic gear

Use the electronic gear (parameters No.PA06, PA07) to make adjustment so that the servo amplifier setting matches the moving distance of the machine. Also, by changing the electronic gear value, the machine can be moved at any multiplication ratio to the moving distance on the servo amplifier.

$$\frac{CMX}{CDV} = \frac{\text{Parameters No. PA06}}{\text{Parameters No. PA07}}$$



The following examples are used to explain how to calculate the electronic gear value.

POINT

- The following specification symbols are needed for electronic gear calculation.

Pb : Ball screw lead [mm]

n : Reduction ratio

Pt : Servo motor resolution [pulse/rev]

ΔS : Travel per servo motor revolution [mm/rev]

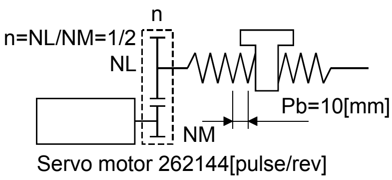
(a) Ball screw setting example

Machine specifications

Ball screw lead: Pb = 10 [mm]

Reduction ratio: n = 1/2

Servo motor resolution: Pt = 262144 [pulse/rev]



$$\frac{CMX}{CDV} = \frac{p_t}{\Delta S} = \frac{p_t}{n \cdot p_b \cdot 1000} = \frac{262144}{1/2 \cdot 10 \cdot 1000} = \frac{262144}{5000} = \frac{32768}{625}$$

Hence, set 32768 to CMX and 625 to CDV.

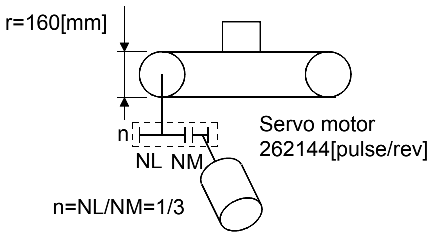
(b) Conveyor setting example

Machine specifications

Pulley diameter: r = 160 [mm]

Reduction ratio: n = 1/3

Servo motor resolution: Pt = 262144 [pulse/rev]



$$\frac{CMX}{CDV} = \frac{p_t}{\Delta S} = \frac{p_t}{n \cdot r \cdot \pi \cdot 1000} = \frac{262144}{1/3 \cdot 160 \cdot \pi \cdot 1000} = \frac{262144}{167551.61} \fallingdotseq \frac{32768}{20944}$$

Reduce CMX and CDV to the setting range or less, and round off the first decimal place.

Hence, set 32768 to CMX and 20944 to CDV.

5.1.9 Auto tuning

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA08	ATU	Auto tuning mode	0001h		Refer to the text.
PA09	RSP	Auto tuning response	12		1 to 32

Make gain adjustment using auto tuning. Refer to section 9.2 for details.

(1) Auto tuning mode (parameter No. PA08)

Select the gain adjustment mode.

Parameter No. PA08

0 0 0 □

Gain adjustment mode setting

Setting	Gain adjustment mode	Automatically set parameter No. (Note)
0	Interpolation mode	PB06・PB08・PB09・PB10
1	Auto tuning mode 1	PB06・PB07・PB08・PB09・PB10
2	Auto tuning mode 2	PB07・PB08・PB09・PB10
3	Manual mode	

Note. The parameters have the following names.

Parameter No.	Name
PB06	Ratio of load inertia moment to servo motor inertia moment
PB07	Model loop gain
PB08	Position loop gain
PB09	Speed loop gain
PB10	Speed integral compensation

(2) Auto tuning response (parameter No. PA09)

If the machine hunts or generates large gear sound, decrease the set value. To improve performance, e.g. shorten the settling time, increase the set value.

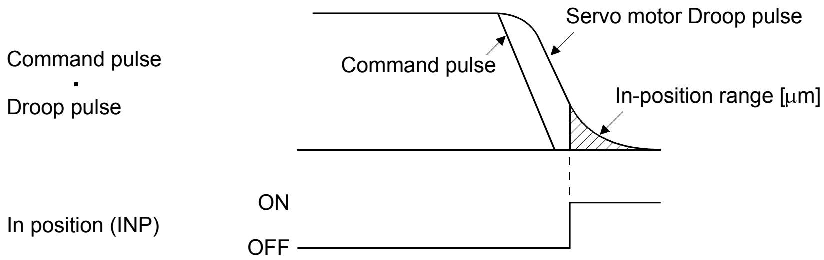
Setting	Response	Guideline for machine resonance frequency [Hz]
1	Low response	10.0
2	↑	11.3
3		12.7
4		14.3
5		16.1
6		18.1
7		20.4
8		23.0
9		25.9
10		29.2
11		32.9
12		37.0
13		41.7
14	↓	47.0
15	Middle	52.9
16	response	59.6

Setting	Response	Guideline for machine resonance frequency [Hz]
17	Low response	67.1
18	↑	75.6
19		85.2
20		95.9
21		108.0
22		121.7
23		137.1
24		154.4
25		173.9
26		195.9
27		220.6
28		248.5
29		279.9
30	↓	315.3
31	Middle	355.1
32	response	400.0

5.1.10 In-position range

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA10	INP	In-position range	100	μm	0 to 10000

Set the range, where In position (INP) and Movement finish (MEND) are output, in the command pulse unit before calculation of the electronic gear. With the setting of parameter No. PC24, the range can be changed to the encoder output pulse unit.



5.1.11 Torque limit

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA11	TLP	Forward rotation torque limit	100.0	%	0 to 100.0
PA12	TLN	Reverse rotation torque limit	100.0	%	0 to 100.0

The torque generated by the servo motor can be limited.
When torque is output with the analog monitor output, the smaller torque of the values in the parameter No.PA11 (forward rotation torque limit) and parameter No. PA12 (reverse rotation torque limit) is the maximum output voltage (8V).

(1) Forward rotation torque limit (parameter No. PA11)
Set this parameter on the assumption that the maximum torque is 100[%]. Set this parameter when limiting the torque of the servo motor in the CCW driving mode or CW regeneration mode. Set this parameter to "0.0" to generate no torque.

(2) Reverse rotation torque limit (parameter No. PA12)
Set this parameter on the assumption that the maximum torque is 100[%]. Set this parameter when limiting the torque of the servo motor in the CW driving mode or CCW regeneration mode. Set this parameter to "0.0" to generate no torque.

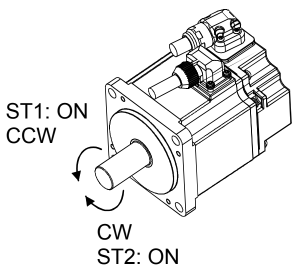
5.1.12 Selection of servo motor rotation direction

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA14	*POL	Rotation direction selection	0		0・1

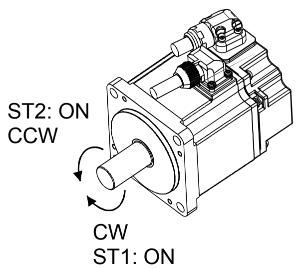
> POINT
> ・This parameter is made valid when power is switched off, then on after setting, or when the controller reset has been performed.

Select the servo motor rotation direction when the forward rotation start (ST1) or reverse rotation direction (ST2) is turned ON.

Parameter No. PA14 Setting	Servo motor rotation direction	
	Forward rotation start (ST1) ON	Reverse rotation start (ST2) ON
0	Rotates in the CCW direction. (Address increases.)	Rotates in the CW direction. (Address decreases.)
1	Rotates in the CW direction. (Address increases.)	Rotates in the CCW direction. (Address decreases.)



Parameter No.PA14: 0



Parameter No.PA14: 1

5.1.13 Encoder output pulse

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA15	*ENR	Encoder output pulse	4000	pulse/rev	1 to 65535

> POINT
> ・This parameter is made valid when power is switched off, then on after setting, or when the controller reset has been performed.

Used to set the encoder pulses (A-phase, B-phase) output by the servo amplifier.
Set the value 4 times greater than the A-phase or B-phase pulses.
You can use parameter No. PC19 to choose the output pulse setting or output division ratio setting.
The number of A/B-phase pulses actually output is 1/4 times greater than the preset number of pulses.
The maximum output frequency is 4.6Mpps (after multiplication by 4). Use this parameter within this range.

(1) For output pulse designation

Set " □ □ 0 □ " (initial value) in parameter No. PC19.

Set the number of pulses per servo motor revolution.

Output pulse = set value [pulses/rev]

For instance, set "5600" to Parameter No. PA15, the actually output A/B-phase pulses are as indicated below.

$$\text{A}\cdot\text{B-phase output pulses} = \frac{5600}{4} = 1400\text{[pulse]}$$

(2) For output division ratio setting

Set " □ □ 1 □ " in parameter No. PC19.

The number of pulses per servo motor revolution is divided by the set value.

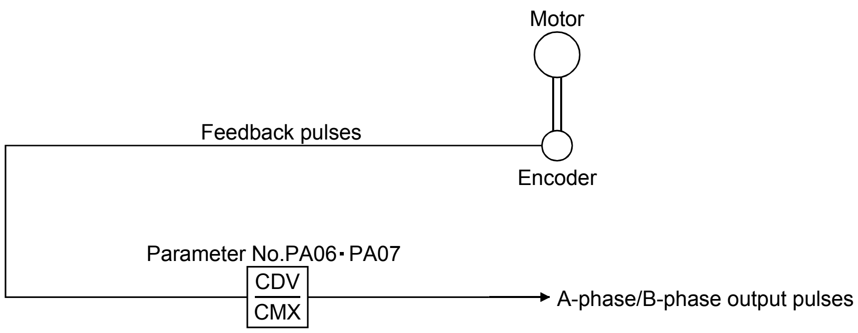
$$\text{Output pulse} = \frac{\text{Resolution per servo motor revolution}}{\text{Set value}} \text{ [pulses/rev]}$$

For instance, set "8" to Parameter No. PA15, the actually output A/B-phase pulses are as indicated below.

$$\text{A}\cdot\text{B-phase output pulses} = \frac{262144}{8} \cdot \frac{1}{4} = 8192\text{[pulse]}$$

(3) When outputting pulse train similar to command pulses

Set parameter No. PC19 to " □ □ 2 □ ". The feedback pulses from the servo motor encoder are processed and output as shown below. The feedback pulses can be output in the same pulse unit as the command pulses.

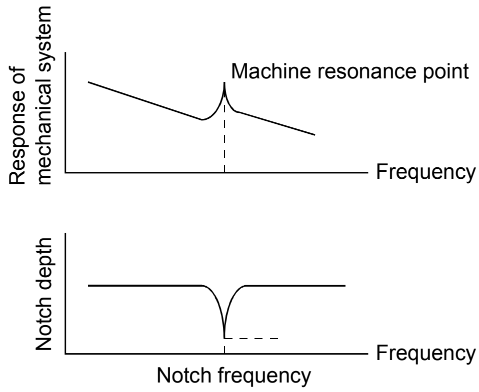


5.2 Gain/filter parameters (No.PB□□)

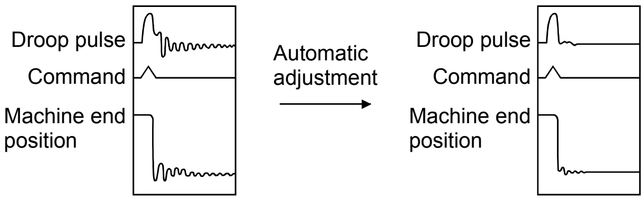
5.2.1 Parameter list

No.	Symbol	Name	Initial value	Unit
PB01	FILT	Adaptive tuning mode (Adaptive filter Ⅱ)	0000h	
PB02	VRFT	Vibration suppression control filter tuning mode (Advanced vibration suppression control)	0000h	
PB03		For manufacturer setting	0000h	
PB04	FFC	Feed forward gain	0	%
PB05		For manufacturer setting	500	
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	7.0	times
PB07	PG1	Model loop gain	24	rad/s
PB08	PG2	Position loop gain	37	rad/s
PB09	VG2	Speed loop gain	823	rad/s
PB10	VIC	Speed integral compensation	33.7	ms
PB11	VDC	Speed differential compensation	980	
PB12		For manufacturer setting	0	
PB13	NH1	Machine resonance suppression filter 1	4500	Hz
PB14	NHQ1	Notch form selection 1	0000h	
PB15	NH2	Machine resonance suppression filter 2	4500	Hz
PB16	NHQ2	Notch form selection 2	0000h	
PB17		Automatic setting parameter		
PB18	LPF	Low-pass filter	3141	rad/s
PB19	VRF1	Vibration suppression control vibration frequency setting	100.0	Hz
PB20	VRF2	Vibration suppression control resonance frequency setting	100.0	Hz
PB21		For manufacturer setting	0.00	
PB22			0.00	
PB23	VFBF	Low-pass filter selection	0000h	
PB24	*MVS	Slight vibration suppression control selection	0000h	
PB25		For manufacturer setting	0000h	
PB26	*CDP	Gain changing selection	0000h	
PB27	CDL	Gain changing condition	10	
PB28	CDT	Gain changing time constant	1	ms
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment	7.0	times
PB30	PG2B	Gain changing position loop gain	37	rad/s
PB31	VG2B	Gain changing speed loop gain	823	rad/s
PB32	VICB	Gain changing speed integral compensation	33.7	ms
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	100.0	Hz
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	100.0	Hz
PB35		For manufacturer setting	0.00	
PB36			0.00	
PB37			100	
PB38			0	
PB39			0	
PB40			0	
PB41			1125	
PB42			1125	
PB43			0004h	
PB44			0000h	
PB45			0000h	

5.2.2 Detail list

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PB01</td><td>FILT</td><td>Adaptive tuning mode (adaptive filter Ⅱ)
Select the setting method for filter tuning. Setting this parameter to " □□□ 1" (filter tuning mode 1) automatically changes the machine resonance suppression filter 1 (parameter No. PB13) and notch shape selection (parameter No. PB14).

0 0 0 □
Filter tuning mode selection
<table><tr><th>Setting</th><th>Filter adjustment mode</th><th>Automatically set parameter</th></tr><tr><td>0</td><td>Filter OFF</td><td>(Note)</td></tr><tr><td>1</td><td>Filter tuning mode</td><td>Parameter No. PB13
Parameter No. PB14</td></tr><tr><td>2</td><td>Manual mode</td><td></td></tr></table>Note. Parameter No. PB13 and PB14 are fixed to the initial values.

When this parameter is set to " □□□ 1", the tuning is completed after positioning is done the predetermined number or times for the predetermined period of time, and the setting changes to " □□□ 2". When the filter tuning is not necessary, the setting changes to " □□□ 0". When this parameter is set to " □□□ 0", the initial values are set to the machine resonance suppression filter 1 and notch shape selection. However, this does not occur when the servo off.</td><td>0000h</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PB02</td><td>VRFT</td><td>Vibration suppression control tuning mode (advanced vibration suppression control)
The vibration suppression is valid when the parameter No. PA08 (auto tuning) setting is " □□□2" or " □□□3". When PA08 is " □□□1", vibration suppression is always invalid.
Select the setting method for vibration suppression control tuning. Setting this parameter to " □□□1" (vibration suppression control tuning mode) automatically changes the vibration suppression control - vibration frequency (parameter No. PB19) and vibration suppression control - resonance frequency (parameter No. PB20) after positioning is done the predetermined number of times.


0 0 0 □
Vibration suppression control tuning mode
<table>
<tr><th>Setting</th><th>Vibration suppression control tuning mode</th><th>Automatically set parameter</th></tr>
<tr><td>0</td><td>Vibration suppression control OFF</td><td>(Note)</td></tr>
<tr><td>1</td><td>Vibration suppression control tuning mode (Advanced vibration suppression control)</td><td>Parameter No. PB19
Parameter No. PB20</td></tr>
<tr><td>2</td><td>Manual mode</td><td></td></tr>
</table>
Note. Parameter No. PB19 and PB20 are fixed to the initial values.

When this parameter is set to " □□□1", the tuning is completed after positioning is done the predetermined number or times for the predetermined period of time, and the setting changes to " □□□2". When the vibration suppression control tuning is not necessary, the setting changes to " □□□0". When this parameter is set to " □□□0", the initial values are set to the vibration suppression control - vibration frequency and vibration suppression control - resonance frequency. However, this does not occur when the servo off.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PB03</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PB04</td><td>FFC</td><td>Feed forward gain
Set the feed forward gain. When the setting is 100%, the droop pulses during operation at constant speed are nearly zero. However, sudden acceleration/deceleration will increase the overshoot. As a guideline, when the feed forward gain setting is 100%, set 1s or more as the acceleration/deceleration time constant up to the rated speed.</td><td>0</td><td>%</td><td>0
to
100</td></tr>
</table>

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB05		For manufacturer setting Do not change this value by any means.	500		
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment Used to set the ratio of the load inertia moment to the servo motor shaft inertia moment. When auto tuning mode 1 and interpolation mode is selected, the result of auto tuning is automatically used. (Refer to section 8.1.1) In this case, it varies between 0 and 100.0.	7.0	times	0 to 300.0
PB07	PG1	Model loop gain Set the response gain up to the target position. Increase the gain to improve track ability in response to the command. When auto turning mode 1,2 is selected, the result of auto turning is automatically used.	24	rad/s	1 to 2000
PB08	PG2	Position loop gain Used to set the gain of the position loop. Set this parameter to increase the position response to level load disturbance. Higher setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1,2 and interpolation mode is selected, the result of auto tuning is automatically used.	37	rad/s	1 to 1000
PB09	VG2	Speed loop gain Set this parameter when vibration occurs on machines of low rigidity or large backlash. Higher setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1・2, manual mode and interpolation mode is selected, the result of auto tuning is automatically used.	823	rad/s	20 to 50000
PB10	VIC	Speed integral compensation Used to set the integral time constant of the speed loop. Lower setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1・2 and interpolation mode is selected, the result of auto tuning is automatically used.	33.7	ms	0.1 to 1000.0
PB11	VDC	Speed differential compensation Used to set the differential compensation. Made valid when the proportion control (PC) is switched on.	980		0 to 1000
PB12		For manufacturer setting Do not change this value by any means.	0		
PB13	NH1	Machine resonance suppression filter 1 Set the notch frequency of the machine resonance suppression filter 1. Setting parameter No. PB01 (filter tuning mode 1) to "□□□1" automatically changes this parameter. When the parameter No. PB01 setting is "□□□0", the setting of this parameter is ignored.	4500	Hz	100 to 4500

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PB14</td><td>NHQ1</td><td>Notch shape selection 1
Used to selection the machine resonance suppression filter 1.

0 □ □ 0

Notch depth selection
<table>
<tr><th>Setting value</th><th>Depth</th><th>Gain</th></tr>
<tr><td>0</td><td>Deep</td><td>-40dB</td></tr>
<tr><td>1</td><td>to</td><td>-14dB</td></tr>
<tr><td>2</td><td></td><td>-8dB</td></tr>
<tr><td>3</td><td>Shallow</td><td>-4dB</td></tr>
</table>
Notch width
<table>
<tr><th>Setting value</th><th>Width</th><th>α</th></tr>
<tr><td>0</td><td>Standard</td><td>2</td></tr>
<tr><td>1</td><td>to</td><td>3</td></tr>
<tr><td>2</td><td></td><td>4</td></tr>
<tr><td>3</td><td>Wide</td><td>5</td></tr>
</table>
Setting parameter No. PB01 (filter tuning mode 1) to " □□□ 1" automatically changes this parameter.
When the parameter No. PB01 setting is " □□□ 0", the setting of this parameter is ignored.</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PB15</td><td>NH2</td><td>Machine resonance suppression filter 2
Set the notch frequency of the machine resonance suppression filter 2.
Set parameter No. PB16 (notch shape selection 2) to " □□□ 1" to make this parameter valid.</td><td>4500</td><td>Hz</td><td>100
to
4500</td></tr>
<tr><td>PB16</td><td>NHQ2</td><td>Notch shape selection 2
Select the shape of the machine resonance suppression filter 2.

0 □ □ □

Machine resonance suppression filter 2 selection
0: Invalid
1: Valid

Notch depth selection
<table>
<tr><th>Setting value</th><th>Depth</th><th>Gain</th></tr>
<tr><td>0</td><td>Deep</td><td>-40dB</td></tr>
<tr><td>1</td><td>to</td><td>-14dB</td></tr>
<tr><td>2</td><td></td><td>-8dB</td></tr>
<tr><td>3</td><td>Shallow</td><td>-4dB</td></tr>
</table>
Notch width
<table>
<tr><th>Setting value</th><th>Width</th><th>α</th></tr>
<tr><td>0</td><td>Standard</td><td>2</td></tr>
<tr><td>1</td><td>to</td><td>3</td></tr>
<tr><td>2</td><td></td><td>4</td></tr>
<tr><td>3</td><td>Wide</td><td>5</td></tr>
</table></td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PB17</td><td></td><td>Automatic setting parameter
The value of this parameter is set according to a set value of parameter No.PB06 (Ratio of load inertia moment to servo motor inertia moment).</td><td></td><td></td><td></td></tr>
</table>

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB18	LPF	Low-pass filter setting Set the low-pass filter. Setting parameter No. PB23 (low-pass filter selection) to " □ □ 0 □ " automatically changes this parameter. When parameter No. PB23 is set to " □ □ 1 □ ", this parameter can be set manually.	3141	rad/s	100 to 18000
PB19	VRF1	Vibration suppression control - vibration frequency setting Set the vibration frequency for vibration suppression control to suppress low-frequency machine vibration, such as enclosure vibration. Setting parameter No. PB02 (vibration suppression control tuning mode) to " □ □ □ 1" automatically changes this parameter. When parameter No. PB02 is set to " □ □ □ 2", this parameter can be set manually.	100.0	Hz	0.1 to 100.0
PB20	VRF2	Vibration suppression control - resonance frequency setting Set the resonance frequency for vibration suppression control to suppress low-frequency machine vibration, such as enclosure vibration. Setting parameter No. PB02 (vibration suppression control tuning mode) to " □ □ □ 1" automatically changes this parameter. When parameter No. PB02 is set to " □ □ □ 2", this parameter can be set manually.	100.0	Hz	0.1 to 100.0
PB21		For manufacturer setting	0.00		
PB22		Do not change this value by any means.	0.00		
PB23	VFBF	Low-pass filter selection Select the low-pass filter. 0 0 □ 0 Low-pass filter selection 0: Automatic setting 1: Manual setting (parameter No. PB18 setting) When automatic setting has been selected, select the filter that has the band width close to the one calculated with $\frac{VG2 \cdot 10}{1 + GD2}$ [rad/s]	0000h		Refer to name and function column.
PB24	*MVS	Slight vibration suppression control selection Select the slight vibration suppression control. When parameter No. PA08 (auto tuning mode) is set to " □ □ □ 3", this parameter is made valid. 0 0 0 □ Slight vibration suppression control selection 0: Invalid 1: Valid	0000h		Refer to name and function column.

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB25		For manufacturer setting Do not change this value by any means.	0000h		
PB26	*CDP	Gain changing selection Select the gain changing condition. (Refer to section 9.6.) 0 0 □ □ Gain changing selection Under any of the following conditions, the gains change on the basis of the parameter No. PB29 to PB32 settings. 0: Invalid 1: Gain changing (CDP) is ON 2: Command frequency (Parameter No.PB27 setting) 3: Droop pulse value (Parameter No.PB27 setting) 4: Servo motor speed (Parameter No.PB27 setting) Gain changing condition 0: Valid at more than condition (Valid when gain changing (CDP) is ON) 1: Valid at less than condition (Valid when gain changing (CDP) is OFF)	0000h		Refer to name and function column.
PB27	CDL	Gain changing condition Used to set the value of gain changing condition (command frequency, droop pulses, servo motor speed) selected in parameter No. PB26. The set value unit changes with the changing condition item. (Refer to section 9.6.)	10	kpps pulse r/min	0 to 9999
PB28	CDT	Gain changing time constant Used to set the time constant at which the gains will change in response to the conditions set in parameters No. PB26 and PB27. (Refer to section 9.6.)	1	ms	0 to 100
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment Used to set the ratio of load inertia moment to servo motor inertia moment when gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3).	7.0	times	0 to 300.0
PB30	PG2B	Gain changing position loop gain Set the position loop gain when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3).	37	rad/s	1 to 2000
PB31	VG2B	Gain changing speed loop gain Set the speed loop gain when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3). Note. The setting range of 50000 applies to the servo amplifier whose software version is A3 or later. The setting range of the servo amplifier whose software version is older than A3 is 20 to 20000. When the software version of MR Configurator is A3 or earlier, 20001 or more cannot be set. Use the display/operation section of the servo amplifier to set 20001 or more.	823	rad/s	20 to 20000
PB32	VICB	Gain changing speed integral compensation Set the speed integral compensation when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3).	33.7	ms	0.1 to 5000.0

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting Set the vibration frequency for vibration suppression control when the gain changing is valid. This parameter is made valid when the parameter No. PB02 setting is " □□□ 2" and the parameter No. PB26 setting is " □□□ 1". When using the vibration suppression control gain changing, always execute the changing after the servo motor has stopped.	100.0	Hz	0.1 to 100.0
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting Set the resonance frequency for vibration suppression control when the gain changing is valid. This parameter is made valid when the parameter No. PB02 setting is " □□□ 2" and the parameter No. PB26 setting is " □□□ 1". When using the vibration suppression control gain changing, always execute the changing after the servo motor has stopped.	100.0	Hz	0.1 to 100.0
PB35		For manufacturer setting Do not change this value by any means.	0.00		
PB36			0.00		
PB37			100		
PB38			0		
PB39			0		
PB40			0		
PB41			1125		
PB42			1125		
PB43			0004h		
PB44			0000h		
PB45			0000h		

5.3 Extension setting parameters (No.PC□□)

5.3.1 Parameter list

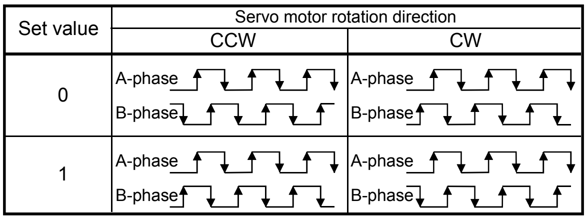
No.	Symbol	Name	Initial value	Unit
PC01		For manufacturer setting	0000h	
PC02	*ZTY	Home position return type	0000h	
PC03	*ZDIR	Home position return direction	0001h	
PC04	ZRF	Home position return speed	500	r/min
PC05	CRF	Creep speed	10	r/min
PC06	ZST	Home position shift distance	0	μm
PC07	*ZPS	Home position return position data	0	$\times 10^{STM}\mu m$
PC08	DCT	Moving distance after proximity dog	1000	$\times 10^{STM}\mu m$
PC09	ZTM	Stopper type home position return stopper time	100	ms
PC10	ZTT	Stopper type home position return torque limit value	15.0	%
PC11	CRP	Rough match output range	0	$\times 10^{STM}\mu m$
PC12	JOG	Jog speed	100	r/min
PC13	*STC	S-pattern acceleration/deceleration time constant	0	ms
PC14	*BKC	Backlash compensation	0	pulse
PC15		For manufacturer setting	0000h	
PC16	MBR	Electromagnetic brake sequence output	100	ms
PC17	ZSP	Zero speed	50	r/min
PC18	*BPS	Alarm history clear	0000h	
PC19	*ENRS	Encoder output pulse selection	0000h	
PC20	*SNO	Station number setting	0	station
PC21	*SOP	RS-422 communication function selection	0000h	
PC22	*COP1	Function selection C-1	0000h	
PC23		For manufacturer setting	0000h	
PC24	*COP3	Function selection C-3	0000h	
PC25		For manufacturer setting	0000h	
PC26	*COP5	Function selection C-5	0000h	
PC27		For manufacturer setting	0000h	
PC28	*COP7	Function selection C-7	0000h	
PC29		For manufacturer setting	0000h	
PC30			0000h	
PC31	LMPL	Software limit +	0	$\times 10^{STM}\mu m$
PC32	LMPH			
PC33	LMNL	Software limit −	0	$\times 10^{STM}\mu m$
PC34	LMNH			
PC35	TL2	Internal torque limit 2	100.0	%
PC36	*DMD	Status display selection	0000h	
PC37	*LPPL	Position range output address +	0	$\times 10^{STM}\mu m$
PC38	*LPPH			
PC39	*LNPL	Position range output address −	0	$\times 10^{STM}\mu m$
PC40	*LNPH			
PC41		For manufacturer setting	0000h	
PC42			0000h	
PC43			0000h	
PC44			0000h	
PC45			0000h	
PC46			0000h	
PC47			0000h	
PC48			0000h	

No.	Symbol	Name and function	Initial value	Unit
PC49		For manufacturer setting	0000h	
PC50			0000h	

5.3.2 Detail list

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC01		For manufacturer setting Do not change this value by any means.	0000h		
PC02	*ZTY	Home position return type Used to set the home position return system. (Refer to section 4.7.) 0 0 0 □ Home position return system 0: Dog type 1: Count type 2: Data setting type 3: Stopper type 4: Home position ignorance (Servo-on position as home position) 5: Dog type rear end reference 6: Count type front end reference 7: Dog cradle type 8: Dog type right-before Z-phase reference 9: Dog type front end reference A: Dogless Z-phase reference	0000h		Refer to name and function column.
PC03	*ZDIR	Home position return direction Used to set the home position return direction. 0 0 0 □ Home position return direction 0: Address increment direction 1: Address decrement direction	0001h		Refer to name and function column.
PC04	ZRF	Home position return speed Used to set the servo motor speed for home position return. (Refer to section 4.7.)	500	r/min	0 to permissible speed
PC05	CRF	Creep speed Used to set the creep speed after proximity dog detection. (Refer to section 4.7.)	10	r/min	0 to permissible speed
PC06	ZST	Home position shift distance Used to set the shift distance starting at the Z-phase pulse detection position inside the encoder. (Refer to section 4.7.)	0	μm	0 to 65535
PC07	*ZPS	Home position return position data Used to set the current position on completion of home position return. (Refer to section 4.7.)	0	$\times 10^{STM}\mu m$	−32768 to 32767
PC08	DCT	Moving distance after proximity dog Used to set the moving distance after proximity dog in count type home position return. (Refer to section 4.7.)	1000	$\times 10^{STM}\mu m$	0 to 65535
PC09	ZTM	Stopper type home position return stopper time In stopper type home position return, used to set the time from when the machine part is pressed against the stopper and the torque limit set in parameter No.PC10 is reached to when the home position is set. (Refer to section 4.6.5.)	100	ms	5 to 1000

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC10	ZTT	Stopper type home position return torque limit Used to set the torque limit value relative to the max. torque in [%] in stopper type home position return. (Refer to section 5.6.5.)	15.0	%	1 to 100.0
PC11	CRP	Rough match output range Used to set the command remaining distance range where the rough match (CPO) is output.	0	$\times 10^{STM}$ μm	0 to 65535
PC12	JOG	Jog speed Used to set the jog speed command.	100	r/min	0 to permissible speed
PC13	*STC	S-pattern acceleration/deceleration time constant Set when inserting S-pattern time constant into the acceleration/deceleration time constant of the point table. (Refer to section 5.3.3.) This time constant is invalid for home position return.	0	ms	0 to 1000
PC14	*BKC	Backlash compensation Used to set the backlash compensation made when the command direction is reversed. This function compensates for the number of backlash pulses in the opposite direction to the home position return direction. For the home position ignorance (servo-on position as home position), this function compensates for the number of backlash pulses in the opposite direction to the first rotating direction after establishing the home position by switching ON the servo-on (SON). In the absolute position detection system, this function compensates for the backlash pulse count in the direction opposite to the operating direction at power-on.	0	pulse	0 to 32000
PC15		For manufacturer setting Do not change this value by any means.	0000h		
PC16	MBR	Electromagnetic brake sequence output Used to set the delay time (Tb) between when the electromagnetic brake interlock (MBR) switches off and when the base circuit is shut off.	100	ms	0 to 1000
PC17	ZSP	Zero speed Used to set the output range of the zero speed (ZSP). Zero speed signal detection has hysteresis width of 20r/min.	50	r/min	0 to 10000
PC18	*BPS	Alarm history clear Used to clear the alarm history. 0 0 0 □ Alarm history clear 0: Invalid 1: Valid When alarm history clear is made valid, the alarm history is cleared at next power-on. After the alarm history is cleared, the setting is automatically made invalid (reset to 0).	0000h		Refer to name and function column.

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC19	*ENRS	Encoder output pulse selection Use to select the, encoder output pulse direction and encoder output pulse setting. 0 0 _ _ Encoder output pulse phase changing Changes the phases of A, B-phase encoder pulses output .  Encoder output pulse setting selection (refer to parameter No. PA15.) 0: Output pulse designation 1: Division ratio setting 2: Ratio is automatically set to command pulse unit Setting "2" makes the parameter No. PA15 (encoder output pulse) setting invalid.	0000h		Refer to name and function column.
PC20	*SNO	Station number setting Used to specify the station number for RS-422 serial communication. Always set one station to one axis of servo amplifier. If one station number is set to two or more stations, normal communication cannot be made.	0	station	0 to 31
PC21	*SOP	RS-422 communication function selection Select the communication I/F and select the RS-422 communication conditions. 0 _ _ 0 RS-422 communication baud rate selection 0: 9600 [bps] 1: 19200 [bps] 2: 38400 [bps] 3: 57600 [bps] 4: 115200[bps] RS-422 communication response delay time 0: Invalid 1: Valid, reply sent after delay time of 800 μs or more	0000h		Refer to name and function column.
PC22	*COP1	Function selection C-1 Select the encoder cable communication system selection. _ 0 0 0 Encoder cable communication system selection 0: Two-wire type 1: Four-wire type The following encoder cables are of 4-wire type. MR-EKCBL30M-L MR-EKCBL30M-H MR-EKCBL40M-H MR-EKCBL50M-H The other encoder cables are all of 2-wire type. Incorrect setting will result in an encoder alarm 1 (A16) or encoder alarm 2 (A20).	0000h		Refer to name and function column.
PC23		For manufacturer setting Do not change this value by any means.	0000h		

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC24	*COP3	Function selection C-3 Select the unit of the in-position range. 0 0 0 □ In-position range unit selection 0: Command input unit 1: Servo motor encoder unit	0000h		Refer to name and function column.
PC25		For manufacturer setting Do not change this value by any means.	0000h		
PC26	*COP5	Function selection C-5 Select the stroke limit warning (A99). 0 0 0 □ Stroke limit warning (A99) selection 0: Valid 1: Invalid When this parameter is set to "1", A99 will not occur if the forward rotation stroke end (LSP) or reverse rotation stroke end (LSN) turns OFF.	0000h		Refer to name and function column.
PC27		For manufacturer setting Do not change this value by any means.	0000h		
PC28	*COP7	Function selection C-7 Select the display method of the current position and command position. 0 0 □ □ Electronic gear fraction clear selection 0: Invalid 1: Valid By setting it to “1”, the fraction of the last command by the electronic gear is cleared when starting automatic operation. Current position/command position selection	0000h		Refer to name and function column.

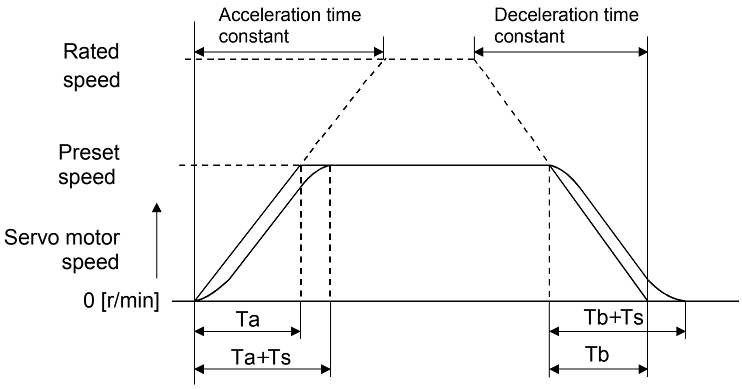
Set value	Display method	Operation mode	Status display description	
			Current position	Command position
0	Positioning display	Automatic	The actual current position where the machine home position is assumed as 0 is displayed.	The command current position where the machine home position is assumed as 0 is displayed.
		Manual		
1	Roll feed display	Automatic	The actual current position where the automatic operation start position is assumed as 0 is displayed.	The count starts from 0 when the start signal is turned ON, and the command current position to the target position is displayed. During a stop, the command position of the selected point table is displayed.
		Manual		The command position of the selected point table is displayed.

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC29		For manufacturer setting	0000h		
PC30		Do not change this value by any means.	0000h		
PC31	LMPL	Software limit +	0	$\times 10^{STM}$ μm	−999999 to 999999
PC32	LMPH	Used to set the address increment side software stroke limit. The software limit is made invalid if this value is the same as in "software limit −". (Refer to section 5.3.6.) Set the same sign to parameters PC31 and PC32. Setting of different signs will result in a parameter error. Set address:□□□□□□ Upper 3 digits — Parameter No. PC32 Lower 3 digits — Parameter No. PC31 The software limit+ is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.			
PC33	LMNL	Software limit −	0	$\times 10^{STM}$ μm	−999999 to 999999
PC34	LMNH	Used to set the address decrement side software stroke limit. The software limit is made invalid if this value is the same as in "software limit +". (Refer to section 5.3.6.) Set the same sign to parameters No. PC33 and PC34. Setting of different signs will result in a parameter error. Set address: □□□□□□ Upper 3 digits — Parameter No. PC34 Lower 3 digits — Parameter No. PC33 The software limit− is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.			
PC35	TL2	Internal torque limit 2 Set this parameter to limit servo motor torque on the assumption that the maximum torque is 100[%]. When 0 is set, torque is not produced.	100.0	%	0 to 100.0
PC36	*DMD	Status display selection Select the status display to be provided at power-on. □ □ 0 0 Selection of status display at power-on 00: Current position 01: Command position 02: Command remaining distance 03: Point table No. 04: Cumulative feedback pulses 05: Servo motor speed 06: Droop pulses 07: Override voltage 08: Override [%] 09: Analog speed command voltage 0A: Regenerative load ratio 0B: Effective load ratio 0C: Peak load ratio 0D: Instantaneous torque 0E: Within one-revolution position 0F: ABS counter 10: Load inertia moment ratio 11: Bus voltage	0000h		Refer to name and function column.

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC37 PC38	*LPPL *LPPH	Position range output address + Used to set the address increment side position range output address. Set the same sign to parameters No. PC37 and PC38. Setting of different signs will result in a parameter error. In parameters No. PC37 to PC40, set the range where position range (POT) turns on. Set address:□□□□□□ Upper 3 digits: Parameter No. PC38 Lower 3 digits: Parameter No. PC37 Position range output address + is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.	0	$\times 10^{STM}\mu m$	−999999 to 999999
PC39 PC40	*LNPL *LNPH	Position range output address − Used to set the address decrement side position range output address. Set the same sign to parameters No. PC39 and PC40. Setting of different signs will result in a parameter error. Set address:□□□□□□ Upper 3 digits: Parameter No. PC40 Lower 3 digits: Parameter No. PC39 Position range output address − is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.	0	$\times 10^{STM}\mu m$	−999999 to 999999
PC41		For manufacturer setting Do not change this value by any means.	0000h		
PC42			0000h		
PC43			0000h		
PC44			0000h		
PC45			0000h		
PC46			0000h		
PC47			0000h		
PC48			0000h		
PC49			0000h		
PC50			0000h		

5.3.3 S-pattern acceleration/deceleration

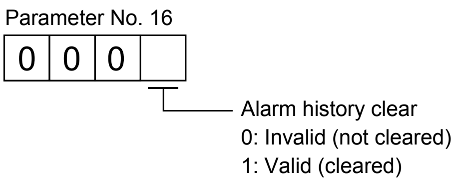
In servo operation, linear acceleration/deceleration is usually made. By setting the S-pattern acceleration/ deceleration time constant (parameter No. PC13), a smooth start/stop can be made. When the S-pattern time constant is set, smooth positioning is executed as shown below. Note that the time equivalent to the S-pattern time constant setting increases until positioning (MEND) complete.



Ta: Time until preset speed is reached
Tb: Time until stop
Ts: S-pattern acceleration/deceleration time constant (parameter No. PC13)
Setting range 0 to 1000ms

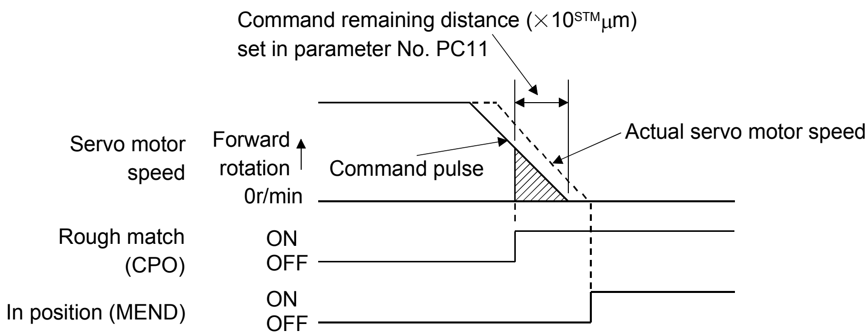
5.3.4 Alarm history clear

The alarm history can be confirmed by using the MR Configurator. The servo amplifier stores one current alarm and five past alarms from when its power is switched on first. To control alarms which will occur during operation, clear the alarm history using parameter No. PC18 (alarm history clear) before starting operation. Clearing the alarm history automatically returns to " □□□ 0".
This parameter is made valid by switching power off, then on after setting.



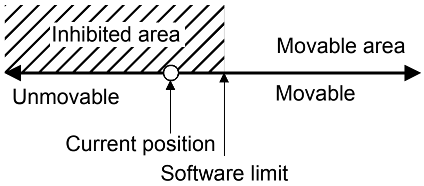
5.3.5 Rough match output

Rough match (CPO) is output when the command remaining distance reaches the value set in parameter No. PC11 (rough match output range). The set remaining distance is 0 to 65535 [$\times 10^{STM}\mu m$].



5.3.6 Software limit

A limit stop using a software limit (parameter No. PC31 to PC34) is made as in stroke end operation. When a motion goes beyond the setting range, the motor is stopped and servo-locked. This function is made valid at power-on but made invalid during home position return. This function is made invalid when the software limit + setting is the same as the software limit − setting. A parameter error (A37) will occur if the software limit + setting is less than the software limit − setting.



5.4 I/O setting parameters (No.PD□□)

5.4.1 Parameter list

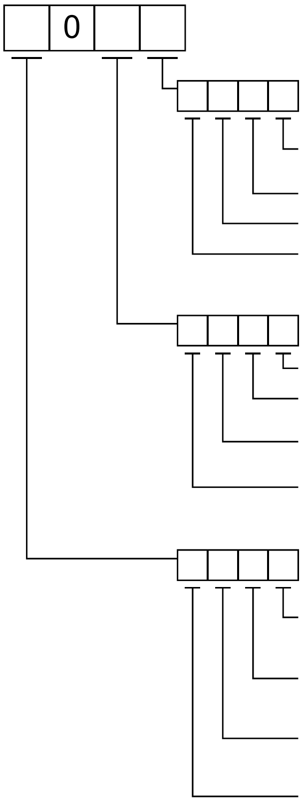
No.	Symbol	Name	Initial value	Unit
PD01	*DIA1	Input signal automatic ON selection 1	0000h	
PD02		For manufacturer setting	0000h	
PD03	*DIA3	Input signal automatic ON selection 3	0000h	
PD04	*DIA4	Input signal automatic ON selection 4	0000h	
PD05		For manufacturer setting	0000h	
PD06	*DI2	Input signal device selection 2 (CN6-2)	002Bh	
PD07	*DI3	Input signal device selection 3 (CN6-3)	000Ah	
PD08	*DI4	Input signal device selection 4 (CN6-4)	000Bh	
PD09	*DO1	Input signal device selection 1 (CN6-pin 14)	0002h	
PD10	*DO2	Input signal device selection 2 (CN6-pin 15)	0003h	
PD11	*DO3	Input signal device selection 3 (CN6-pin 16)	0024h	
PD12		For manufacturer setting	0C00h	
PD13			0000h	
PD14			0800h	
PD15			0000h	
PD16	*DIAB	Input polarity selection	0000h	
PD17		For manufacturer setting	0000h	
PD18			0000h	
PD19	*DIF	Response level setting	0002h	
PD20	*DOP1	Function selection D-1	0010h	
PD21		For manufacturer setting	0000h	
PD22	*DOP3	Function selection D-2	0000h	
PD23		For manufacturer setting	0000h	
PD24	*DOP5	Function selection D-5	0000h	
PD25		For manufacturer setting	0000h	
PD26			0000h	
PD27			0000h	
PD28			0000h	
PD29			0000h	
PD30			0000h	

5.4.2 Detail list

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD01</td><td>*DIA1</td><td>Input signal automatic ON selection 1
Select the input devices to be automatically turned ON.
part is for manufacturer setting. Do not set the value by any means.
<table>
<tr><th>Signal name</th><th>Initial value BIN</th><th>Initial value HEX</th></tr>
<tr><td></td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td>Servo-on (SON)</td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
<table>
<tr><th>Signal name</th><th>Initial value BIN</th><th>Initial value HEX</th></tr>
<tr><td>Proportion control (PC)</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td>External torque limit selection(TL)</td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
<table>
<tr><th>Signal name</th><th>Initial value BIN</th><th>Initial value HEX</th></tr>
<tr><td></td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td>Forward rotation stroke end (LSP)</td><td>0</td></tr>
<tr><td>Reverse rotation stroke end (LSN)</td><td>0</td></tr>
</table>
<table>
<tr><th>Signal name</th><th>Initial value BIN</th><th>Initial value HEX</th></tr>
<tr><td>Forced stop (EMG)</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
BIN 0: Used to external input signal.
BIN 1: Automatic ON

For example, to turn ON SON, the setting is "□□□4".</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD02</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
</table>

No.	Symbol	Name and function	Initial value	Unit	Setting range
PD03	*DIA3	Input signal automatic ON selection 3 Select the input devices to be automatically turned ON. part is for manufacturer setting. Do not set the value by any means.	0000h		Refer to name and function column.



Signal name	Initial value BIN	Initial value HEX
Automatic/manual selection(MD0)	0	0
	0	
	0	
	0	

Signal name	Initial value BIN	Initial value HEX
	0	0
	0	
Override selection (OVR)	0	
	0	

Signal name	Initial value BIN	Initial value HEX
Speed selection 1 (SP0)	0	0
Speed selection 2 (SP1)	0	
Speed selection 3 (SP2)	0	
Speed selection 4 (SP3)	0	

BIN 0: Used to external input signal.
BIN 1: Automatic ON

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD04</td><td>*DIA4</td><td>Input signal automatic ON selection 4
Select the input devices to be automatically turned ON.
<table>
<tr><td>Signal name</td><td>Initial value BIN</td><td>Initial value HEX</td></tr>
<tr><td>Point table No. selection 1 (DI0)</td><td>0</td><td>0</td></tr>
<tr><td>Point table No. selection 2 (DI1)</td><td>0</td><td></td></tr>
<tr><td>Point table No. selection 3 (DI2)</td><td>0</td><td></td></tr>
<tr><td>Point table No. selection 4 (DI3)</td><td>0</td><td></td></tr>
</table>
<table>
<tr><td>Signal name</td><td>Initial value BIN</td><td>Initial value HEX</td></tr>
<tr><td>Point table No. selection 5 (DI4)</td><td>0</td><td>0</td></tr>
<tr><td>Point table No. selection 6 (DI5)</td><td>0</td><td></td></tr>
<tr><td>Point table No. selection 7 (DI6)</td><td>0</td><td></td></tr>
<tr><td>Point table No. selection 8 (DI7)</td><td>0</td><td></td></tr>
</table>
BIN 0: Used to external input signal.
BIN 1: Automatic ON</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD05</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD06</td><td>*DI2</td><td>Input signal device selection 2 (CN6-2)
Any input device can be assigned to the CN6-2 pin.

0 0 □ □
Select the input device of the CN6-2 pin

The devices that can be assigned are indicated in the following table.
<table>
<tr><th rowspan="2">Setting (Note)</th><th colspan="2">Input device</th></tr>
<tr><th>Name</th><th>Abbreviation</th></tr>
<tr><td>00</td><td>No assignment function</td><td></td></tr>
<tr><td>02</td><td>Servo-on</td><td>SON</td></tr>
<tr><td>03</td><td>Reset</td><td>RES</td></tr>
<tr><td>04</td><td>Proportion control</td><td>PC</td></tr>
<tr><td>05</td><td>External torque limit selection</td><td>TL</td></tr>
<tr><td>06</td><td>Clear</td><td>CR</td></tr>
<tr><td>07</td><td>Forward rotation start</td><td>ST1</td></tr>
<tr><td>08</td><td>Reverse rotation start</td><td>ST2</td></tr>
<tr><td>09</td><td>Internal torque limit selection</td><td>TL1</td></tr>
<tr><td>0A</td><td>Forward rotation stroke end</td><td>LSP</td></tr>
<tr><td>0B</td><td>Reverse rotation stroke end</td><td>LSN</td></tr>
<tr><td>0D</td><td>Gain switch</td><td>CDP</td></tr>
<tr><td>20</td><td>Automatic/manual selection</td><td>MD0</td></tr>
<tr><td>24</td><td>Manual pulse generator multiplication 1</td><td>TP0</td></tr>
<tr><td>25</td><td>Manual pulse generator multiplication 2</td><td>TP1</td></tr>
<tr><td>26</td><td>Override selection</td><td>PC</td></tr>
<tr><td>27</td><td>Temporary stop/restart</td><td>TSTP</td></tr>
<tr><td>2B</td><td>Proximity dog</td><td>DOG</td></tr>
<tr><td>2F</td><td>Speed selection 4</td><td>SP3</td></tr>
</table>
Note. The other setting values than shown in this table are for manufacturer setting.</td><td>002Bh</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD07</td><td>*DI3</td><td>Input signal device selection 3 (CN6-3)
Any input device can be assigned to the CN6-3 pin.
The devices that can be assigned and the setting method are the same as in parameter No. PD06.

0 0 □ □
Select the input device of the CN6-3 pin</td><td>000Ah</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD08</td><td>*DI4</td><td>Input signal device selection 4 (CN6-4)
Any input device can be assigned to the CN6-4 pin.
The devices that can be assigned and the setting method are the same as in parameter No. PD06.

0 0 □ □
Select the input device of the CN6-4 pin</td><td>000Bh</td><td></td><td>Refer to name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD09</td><td>*DO1</td><td>Output signal device selection 1 (CN6-14)
Any output signal can be assigned to the CN6-14 pin.

0 0 □ □
Select the output device of the CN6-14 pin

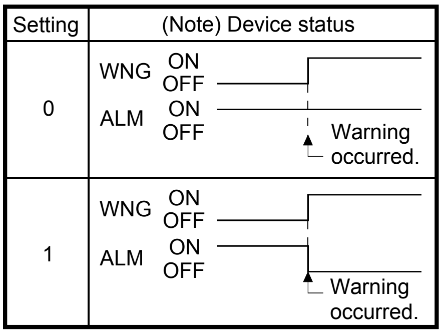
The devices that can be assigned are indicated in the following table.

<table>
<tr><th rowspan="2">Setting (Note)</th><th colspan="2">Output device</th></tr>
<tr><th>Name</th><th>Symbol</th></tr>
<tr><td>00</td><td>Always OFF</td><td></td></tr>
<tr><td>02</td><td>Ready</td><td>RD</td></tr>
<tr><td>03</td><td>Trouble</td><td>ALM</td></tr>
<tr><td>04</td><td>In position</td><td>INP</td></tr>
<tr><td>05</td><td>Electromagnetic brake interlock</td><td>MBR</td></tr>
<tr><td>06</td><td>Dynamic brake interlock</td><td>DB</td></tr>
<tr><td>07</td><td>Limiting torque</td><td>TLC</td></tr>
<tr><td>08</td><td>Warning</td><td>WNG</td></tr>
<tr><td>09</td><td>Battery warning</td><td>BWNG</td></tr>
<tr><td>0A</td><td>Speed command reached</td><td>SA</td></tr>
<tr><td>0C</td><td>Zero speed</td><td>ZSP</td></tr>
<tr><td>0F</td><td>Variable gain selection</td><td>CDPS</td></tr>
<tr><td>23</td><td>Rough match</td><td>CPO</td></tr>
<tr><td>24</td><td>Home position return completion</td><td>ZP</td></tr>
<tr><td>25</td><td>Position range</td><td>POT</td></tr>
<tr><td>26</td><td>Temporary stop</td><td>PUS</td></tr>
<tr><td>27</td><td>Movement finish</td><td>MEND</td></tr>
<tr><td>38</td><td>Point table No. output 1</td><td>PT0</td></tr>
<tr><td>39</td><td>Point table No. output 2</td><td>PT1</td></tr>
<tr><td>3A</td><td>Point table No. output 3</td><td>PT2</td></tr>
<tr><td>3B</td><td>Point table No. output 4</td><td>PT3</td></tr>
<tr><td>3C</td><td>Point table No. output 5</td><td>PT4</td></tr>
<tr><td>3D</td><td>Point table No. output 6</td><td>PT5</td></tr>
<tr><td>3E</td><td>Point table No. output 7</td><td>PT6</td></tr>
<tr><td>3F</td><td>Point table No. output 8</td><td>PT7</td></tr>
</table>
Note. The other setting values than shown in this table are for manufacturer setting.</td><td>0002h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD10</td><td>*DO2</td><td>Output signal device selection 2 (CN6-15)
Any output signal can be assigned to the CN6-15 pin.
The devices that can be assigned and the setting method are the same as in parameter No. PD09.

0 0 □ □
Select the output device of the CN6-15 pin</td><td>0003h</td><td></td><td>Refer to name and function column.</td></tr>
</table>

No.	Symbol	Name and function	Initial value	Unit	Setting range
PD11	*DO3	Output signal device selection 3 (CN6-16) Any output signal can be assigned to the CN6-16 pin. The devices that can be assigned and the setting method are the same as in parameter No. PD09. 0 0 □ □ Select the output device of the CN6-16 pin	0024h		Refer to name and function column.
PD12		For manufacturer setting Do not change this value by any means.	0C00h		
PD13			0000h		
PD14			0800h		
PD15			0000h		
PD16	*DIAB	Input polarity selection Used to set the proximity dog input polarity. (Refer to section 4.7.) 0 0 0 □ Proximity dog input polarity 0: OFF indicates detection of the dog. 1: ON indicates detection of the dog.	0000h		Refer to name and function column.
PD17		For manufacturer setting Do not change this value by any means.	0000h		
PD18			0000h		
PD19	*DIF	Response level setting Used to select the input. 0 0 0 □ Input filter If external input signal causes chattering due to noise, etc., input filter is used to suppress it. 0: None 1: 0.88[ms] 2: 1.77[ms] 3: 2.66[ms] 4: 3.55[ms] 5: 4.44[ms]	0002h		Refer to name and function column.

No.	Symbol	Name and function	Initial value	Unit	Setting range
PD20	*DOP1	Function selection D-1 Select the stop processing at forward rotation stroke end (LSN)/reverse rotation stroke end (LSN) OFF and the base circuit status at reset (RES) ON. 0 □ □ □ Stopping method used when forward rotation stroke end (LSP), reverse rotation stroke end (LSN) device or software limit is valid 0: Sudden stop (home position erased) 1: Slow stop (home position erased) 2: Slow stop (Deceleration to a stop by deceleration time constan 3: Sudden stop (Stop by remaining move distance clear) Selection of base circuit status at reset (RES)ON 0: Base circuit not switched off 1: Base circuit switched off Stopping method used when software limit is valid 0: Sudden stop (home position erased) 1: Slow stop (home position erased) 2: Slow stop (Deceleration to a stop by deceleration time constan 3: Sudden stop (Stop by remaining move distance clear) As in the following parameter settings, when the home position is lost by the forward rotation stroke end, reverse rotation stroke end, or the software limit detection, the home position return completion (ZP) turns on by turning OFF/ON the servo-on (SON). In this case, there is no need to perform the home position return again. 1. In absolute position detection system Parameter No. PA03: □ □ □ 1 (Select the absolute position detection system) Parameter No. PA01: □ □ □ 0 (Select the absolute value command system) 2. In incremental system Parameter No. PA03: □ □ □ 0 (Select the incremental system) Parameter No. PA01: □ □ □ 0 (Select the absolute value command system) Parameter No. PA04: □ □ □ 1 (Follow-up valid)	0010h		Refer to name and function column.
PD21		For manufacturer setting Do not change this value by any means.	0000h		
PD22	*DOP3	Function selection D-3 Set the clear (CR). 0 0 0 □ Clear (CR) selection 0: Droop pulses are cleared on the leading edge. 1: While on, droop pulses are always cleared.	0000h		Refer to name and function column.
PD23		For manufacturer setting Do not change this value by any means.	0000h		

No.	Symbol	Name and function	Initial value	Unit	Setting range
PD24	*DOP5	Function selection D-5 Select the output status of the warning (WNG). 0 0 ☐ 0 Selection of output device at warning occurrence Select the warning (WNG) and trouble (ALM) output status at warning occurrence.  Note. 0: OFF 1: ON	0000h		
PD25		For manufacturer setting Do not change this value by any means.	0000h		
PD26			0000h		
PD27			0000h		
PD28			0000h		
PD29			0000h		
PD30			0000h		

5.5 Option unit parameters (No.Po□□)

5.5.1 Parameter list

No.	Symbol	Name	Initial value	Unit
Po01		For manufacturer setting	1234h	
Po02	*ODI1	MR-J3-D01 input signal device selection 1 (CN10-21, 26)	0302h	
Po03	*ODI2	MR-J3-D01 input signal device selection 2 (CN10-27, 28)	0905h	
Po04	*ODI3	MR-J3-D01 input signal device selection 3 (CN10-29, 30)	2524h	
Po05	*ODI4	MR-J3-D01 input signal device selection 4 (CN10-31, 32)	2026h	
Po06	*ODI5	MR-J3-D01 input signal device selection 5 (CN10-33, 34)	0427h	
Po07	*ODI6	MR-J3-D01 input signal device selection 6 (CN10-35, 36)	0807h	
Po08	*ODO1	MR-J3-D01 output signal device selection 1 (CN10-46, 47)	2726h	
Po09	*ODO2	MR-J3-D01 output signal device selection 2 (CN10-48, 49)	0423h	
Po10	*OOP1	Function selection O-1	2101h	
Po11		For manufacturer setting	0000h	
Po12	*OOP3	Function selection O-3	0000h	
Po13	MOD1	MR-J3-D01 analog monitor output 1	0000h	
Po14	MOD2	MR-J3-D01 analog monitor output 2	0001h	
Po15	MO1	MR-J3-D01 analog monitor 1 offset	0	mV
Po16	MO2	MR-J3-D01 analog monitor 2 offset	0	mV
Po17		For manufacturer setting	0	
Po18			0	
Po19			0	
Po20			0	
Po21	VCO	MR-J3-D01 override offset	0	mV
Po22	TLO	MR-J3-D01 analog torque limit offset	0	mV
Po23		For manufacturer setting	0000h	
Po24			0050h	
Po25			0200h	
Po26			0	
Po27			0	
Po28			0	
Po29			0000h	
Po30			0000h	
Po31			0000h	
Po32			0000h	
Po33			0000h	
Po34			0000h	
Po35			0000h	

5.5.2 Detail list

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>Po01</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>1234h</td><td></td><td></td></tr>
<tr><td>Po02</td><td>*ODI1</td><td>MR-J3-D01 input signal device selection 2 (CN10-21, 26)
Any input signal can be assigned to the CN10-21, 26 pin.

Select the input device of the CN10-21 pin
Select the input device of the CN10-26 pin

The devices that can be assigned are indicated in the following table.
<table>
<tr><th rowspan="2">Setting (Note)</th><th colspan="2">Input device</th></tr>
<tr><th>Name</th><th>Abbreviation</th></tr>
<tr><td>00</td><td>No assignment function</td><td></td></tr>
<tr><td>02</td><td>Servo-on</td><td>SON</td></tr>
<tr><td>03</td><td>Reset</td><td>RES</td></tr>
<tr><td>04</td><td>Proportion control</td><td>PC</td></tr>
<tr><td>05</td><td>External torque limit selection</td><td>TL</td></tr>
<tr><td>06</td><td>Clear</td><td>CR</td></tr>
<tr><td>07</td><td>Forward rotation start</td><td>ST1</td></tr>
<tr><td>08</td><td>Reverse rotation start</td><td>ST2</td></tr>
<tr><td>09</td><td>Internal torque limit selection</td><td>TL1</td></tr>
<tr><td>0A</td><td>Forward rotation stroke end</td><td>LSP</td></tr>
<tr><td>0B</td><td>Reverse rotation stroke end</td><td>LSN</td></tr>
<tr><td>0D</td><td>Gain changing</td><td>CDP</td></tr>
<tr><td>20</td><td>Automatic/manual selection</td><td>MD0</td></tr>
<tr><td>24</td><td>Manual pulse generator multiplication 1</td><td>TP0</td></tr>
<tr><td>25</td><td>Manual pulse generator multiplication 2</td><td>TP1</td></tr>
<tr><td>26</td><td>Override selection</td><td>OVR</td></tr>
<tr><td>27</td><td>Temporary stop/restart</td><td>TSTP</td></tr>
<tr><td>2B</td><td>Proximity dog</td><td>DOG</td></tr>
<tr><td>2F</td><td>Speed selection 4</td><td>SP3</td></tr>
</table>
Note. The other setting values than shown in this table are for manufacturer setting.</td><td>0302h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>Po03</td><td>*ODI2</td><td>MR-J3-D01 input signal device selection 2 (CN10-27, 28)
Any input signal can be assigned to the CN10-27, 28 pin.
The devices that can be assigned and the setting method are the same as in parameter No. Po02.

Select the input device of the CN10-27 pin
Select the input device of the CN10-28 pin</td><td>0905h</td><td></td><td>Refer to name and function column.</td></tr>
</table>

No.	Symbol	Name and function	Initial value	Unit	Setting range
Po04	*ODI3	MR-J3-D01 input signal device selection 3 (CN10-29, 30) Any input signal can be assigned to the CN10-29, 30 pin. The devices that can be assigned and the setting method are the same as in parameter No. Po02. Select the input device of the CN10-29 pin Select the input device of the CN10-30 pin	2524h		Refer to name and function column.
Po05	*ODI4	MR-J3-D01 input signal device selection 4 (CN10-31, 32) Any input signal can be assigned to the CN10-31, 32 pin. The devices that can be assigned and the setting method are the same as in parameter No. Po02. Select the input device of the CN10-31 pin Select the input device of the CN10-32 pin	2026h		Refer to name and function column.
Po06	*ODI5	MR-J3-D01 input signal device selection 5 (CN10-33, 34) Any input signal can be assigned to the CN10-33, 34 pin. The devices that can be assigned and the setting method are the same as in parameter No. Po02. Select the input device of the CN10-33 pin Select the input device of the CN10-34 pin	0427h		Refer to name and function column.
Po07	*ODI6	MR-J3-D01 input signal device selection 6 (CN10-35, 36) Any input signal can be assigned to the CN10-35, 36 pin. The devices that can be assigned and the setting method are the same as in parameter No. Po02. Select the input device of the CN10-35 pin Select the input device of the CN10-36 pin	0807h		Refer to name and function column.

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>Po08</td><td>*ODO1</td><td>MR-J3-D01 output signal device selection 1 (CN10-46, 47)
Any output signal can be assigned to the CN10-46, 47 pin.

Select the output device of the CN10-46
Select the output device of the CN10-47

The devices that can be assigned are indicated in the following table.
<table>
<tr><th rowspan="2">Setting (Note)</th><th colspan="2">Output device</th></tr>
<tr><th>Name</th><th>Symbol</th></tr>
<tr><td>00</td><td>Always OFF</td><td></td></tr>
<tr><td>02</td><td>Ready</td><td>RD</td></tr>
<tr><td>03</td><td>Trouble</td><td>ALM</td></tr>
<tr><td>04</td><td>In position</td><td>INP</td></tr>
<tr><td>05</td><td>Electromagnetic brake interlock</td><td>MBR</td></tr>
<tr><td>06</td><td>Dynamic brake interlock</td><td>DB</td></tr>
<tr><td>07</td><td>Limiting torque</td><td>TLC</td></tr>
<tr><td>08</td><td>Warning</td><td>WNG</td></tr>
<tr><td>09</td><td>Battery warning</td><td>BWNG</td></tr>
<tr><td>0A</td><td>Speed command reached</td><td>SA</td></tr>
<tr><td>0C</td><td>Zero speed</td><td>ZSP</td></tr>
<tr><td>0F</td><td>Variable gain selection</td><td>CDPS</td></tr>
<tr><td>23</td><td>Rough match</td><td>CPO</td></tr>
<tr><td>24</td><td>Home position return completion</td><td>ZP</td></tr>
<tr><td>25</td><td>Position range</td><td>POT</td></tr>
<tr><td>26</td><td>Temporary stop</td><td>PUS</td></tr>
<tr><td>27</td><td>Movement finish</td><td>MEND</td></tr>
<tr><td>38</td><td>Point table No. output 1</td><td>PT0</td></tr>
<tr><td>39</td><td>Point table No. output 2</td><td>PT1</td></tr>
<tr><td>3A</td><td>Point table No. output 3</td><td>PT2</td></tr>
<tr><td>3B</td><td>Point table No. output 4</td><td>PT3</td></tr>
<tr><td>3C</td><td>Point table No. output 5</td><td>PT4</td></tr>
<tr><td>3D</td><td>Point table No. output 6</td><td>PT5</td></tr>
<tr><td>3E</td><td>Point table No. output 7</td><td>PT6</td></tr>
<tr><td>3F</td><td>Point table No. output 8</td><td>PT7</td></tr>
</table>
Note. The other setting values than shown in this table are for manufacturer setting.</td><td>2726h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>Po09</td><td>*ODO2</td><td>MR-J3-D01 output signal device selection 1 (CN10-48, 49)
Any output signal can be assigned to the CN10-48, 49 pin.
The devices that can be assigned and the setting method are the same as in parameter No. Po08.

Select the output device of the CN10-48
Select the output device of the CN10-49</td><td>0423h</td><td></td><td>Refer to name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>Po10</td><td>*OOP1</td><td>
Function selection O-1
Select the positioning operation by point table selection and BCD input.

□ □ 0 □

<table>
<tr><th></th><th></th><th>Setting value</th><th></th><th></th></tr>
<tr><td></td><td></td><td>0</td><td>1</td><td>2</td></tr>
<tr><td></td><td></td><td>Devices not assigned</td><td>Point table used</td><td>BCD input used</td></tr>
<tr><td>CN10 Pin No.</td><td>1</td><td></td><td>DI0</td><td>POS00</td></tr>
<tr><td></td><td>2</td><td></td><td>DI1</td><td>POS01</td></tr>
<tr><td></td><td>3</td><td></td><td>DI2</td><td>POS02</td></tr>
<tr><td></td><td>4</td><td></td><td>DI3</td><td>POS03</td></tr>
<tr><td></td><td>5</td><td></td><td>DI4</td><td>POS10</td></tr>
<tr><td></td><td>6</td><td></td><td>DI5</td><td>POS11</td></tr>
<tr><td></td><td>7</td><td></td><td>DI6</td><td>POS12</td></tr>
<tr><td></td><td>8</td><td></td><td>DI7</td><td>POS13</td></tr>
<tr><td></td><td>9</td><td></td><td></td><td>POS20</td></tr>
<tr><td></td><td>10</td><td></td><td></td><td>POS21</td></tr>
<tr><td></td><td>11</td><td></td><td></td><td>POS22</td></tr>
<tr><td></td><td>12</td><td></td><td></td><td>POS23</td></tr>
<tr><td></td><td>15</td><td></td><td></td><td>POSP</td></tr>
<tr><td></td><td>16</td><td></td><td></td><td>POSN</td></tr>
<tr><td></td><td>17</td><td></td><td></td><td>STRB(Note)</td></tr>
<tr><td></td><td>18</td><td></td><td></td><td>SP0</td></tr>
<tr><td></td><td>19</td><td></td><td></td><td>SP1</td></tr>
<tr><td></td><td>20</td><td></td><td></td><td>SP2</td></tr>
</table>
Note. When using the strobe input (STRB),
set the fourth digit of this parameter in "0□□□".

Symbol (+/−) of the positioning data in the BCD positioning
0: Invalid
+/− symbol is not used.
1: Valid
+/− symbol is used.

Strobe signal
0: Invalid
For the BCD input by the programmable controller
1: Valid
For the point table or MR-DS60 digital switch
</td><td>2101h</td><td></td><td>Refer to name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>Po11</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>Po12</td><td>*OOP3</td><td>Function selection O-3
Set the output of the alarm code and M code.

0 0

Alarm code output
0: Invalid
Alarm code is not output.
1: Valid
Alarm code is output at alarm occurrence.
M code output
0: Invalid
M code is not output.
1: Valid
M code is output after execution of point table.</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>Po13</td><td>MOD1</td><td>MR-J3-D01 analog monitor 1 output
Used to selection the signal provided to the analog monitor 1 (MO1) output. (Refer to section 6.5.3.)

0 0 0

Analog monitor 1 (MO1) output selection
<table>
<tr><th>Setting</th><th>Item</th></tr>
<tr><td>0</td><td>Servo motor speed (±8V/max. speed)</td></tr>
<tr><td>1</td><td>Torque (±8V/max. torque) (Note 2)</td></tr>
<tr><td>2</td><td>Servo motor speed (+8V/max. speed)</td></tr>
<tr><td>3</td><td>Torque (+8V/max. torque) (Note 2)</td></tr>
<tr><td>4</td><td>Current command (±8V/max. current command)</td></tr>
<tr><td>5</td><td>Speed command (±8V/max. speed)</td></tr>
<tr><td>6</td><td>Droop pulses (±10V/100 pulses) (Note 1)</td></tr>
<tr><td>7</td><td>Droop pulses (±10V/1000 pulses) (Note 1)</td></tr>
<tr><td>8</td><td>Droop pulses (±10V/10000 pulses) (Note 1)</td></tr>
<tr><td>9</td><td>Droop pulses (±10V/100000 pulses) (Note 1)</td></tr>
<tr><td>A</td><td>Feedback position (±10V/1 Mpulses) (Note 1)</td></tr>
<tr><td>B</td><td>Feedback position (±10V/10 Mpulses) (Note 1)</td></tr>
<tr><td>C</td><td>Feedback position (±10V/100 Mpulses) (Note 1)</td></tr>
<tr><td>D</td><td>Bus voltage (+8V/400V) (Note 3)</td></tr>
</table>
Note 1. Encoder pulse unit.
2. 8V is outputted at the maximum torque.
However, when parameter No. PA11・PA12 are set to limit torque, 8V is outputted at the torque highly limited.
3. For 400V class servo amplifier, the bus voltage becomes＋8V/800V.</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>Po14</td><td>MOD2</td><td>MR-J3-D01 analog monitor 2 output
Used to selection the signal provided to the analog monitor 2 (MO2) output. (Refer to section 5.5.3.)

0 0 0

Select the analog monitor 2 (MO2) output
The settings are the same as those of parameter No. Po13.</td><td>0001h</td><td></td><td>Refer to name and function column.</td></tr>
</table>

No.	Symbol	Name and function	Initial value	Unit	Setting range
Po15	MO1	MR-J3-D01 analog monitor 1 offset Used to set the offset voltage of the analog monitor (MO1).	0	mV	−9999 to 9999
Po16	MO2	MR-J3-D01 analog monitor 2 offset Used to set the offset voltage of the analog monitor (MO2).	0	mV	−9999 to 9999
Po17		For manufacturer setting Do not change this value by any means.	0		
Po18			0		
Po19			0		
Po20			0		
Po21	VCO	MR-J3-D01 override offset Used to set the offset voltage of the override (VC).	0	mV	−9999 to 9999
Po22	TLO	MR-J3-D01 analog torque limit offset Used to set the offset voltage of the analog torque limit (TLA).	0	mV	−9999 to 9999
Po23		For manufacturer setting Do not change this value by any means.	0000h		
Po24			0050h		
Po25			0200h		
Po26			0		
Po27			0		
Po28			0		
Po29			0000h		
Po30			0000h		
Po31			0000h		
Po32			0000h		
Po33			0000h		
Po34			0000h		
Po35			0000h		

5.5.3 Analog monitor

The servo status can be output to two channels in terms of voltage. The servo status can be monitored using un ammeter.

(1) Setting

Change the following digits of parameter No. Po13, Po14.

Parameter No. Po13

0	0	0	

Analog monitor (MO1) output selection
(Signal output to across MO1-LG)

Parameter No. Po14

0	0	0	

Analog monitor (MO2) output selection
(Signal output to across MO2-LG)

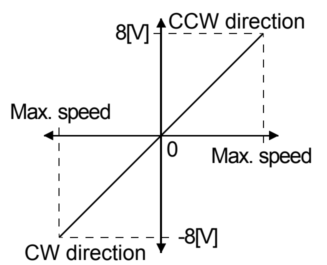
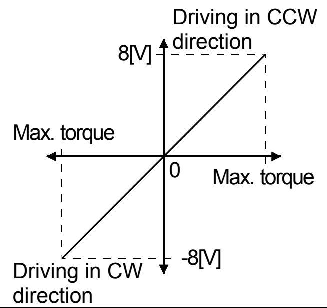
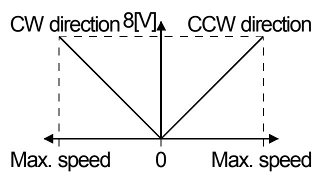
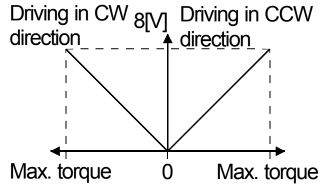
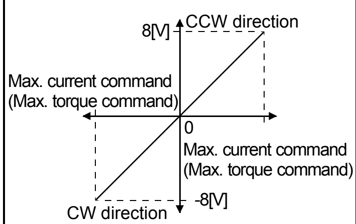
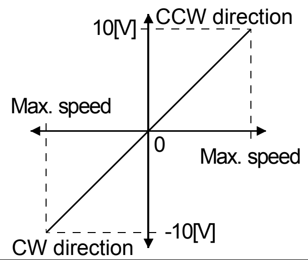
Parameters No. Po15 and Po16 can be used to set the offset voltages to the analog output voltages. The setting range is between −9999 and 9999mV.

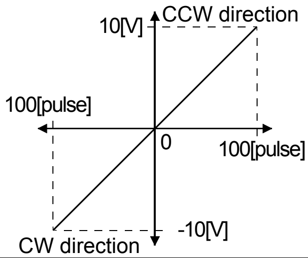
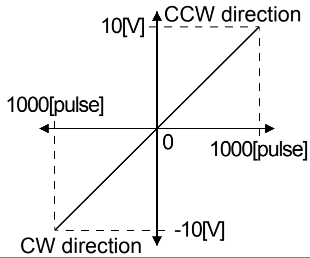
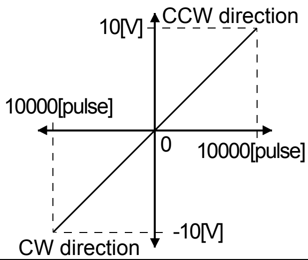
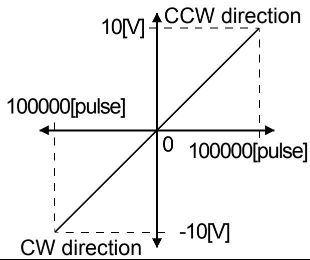
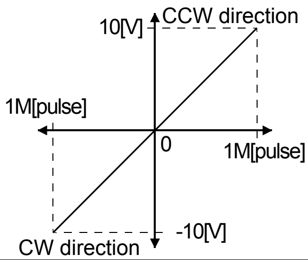
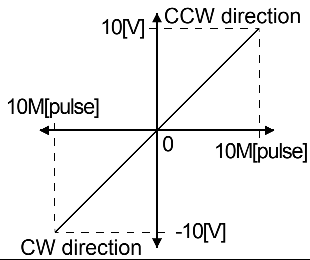
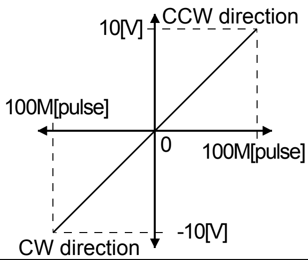
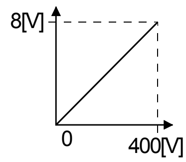
Parameter No.	Description	Setting range [mV]
Po15	Used to set the offset voltage for the analog monitor 1 (MO1).	−9999 to 9999
Po16	Used to set the offset voltage for the analog monitor 2 (MO2).	

(2) Set content

The servo amplifier is factory-set to output the servo motor speed to analog monitor 1 (MO1) and the torque to analog monitor (MO2). The setting can be changed as listed below by changing the parameter No. Po13 and Po14 value.

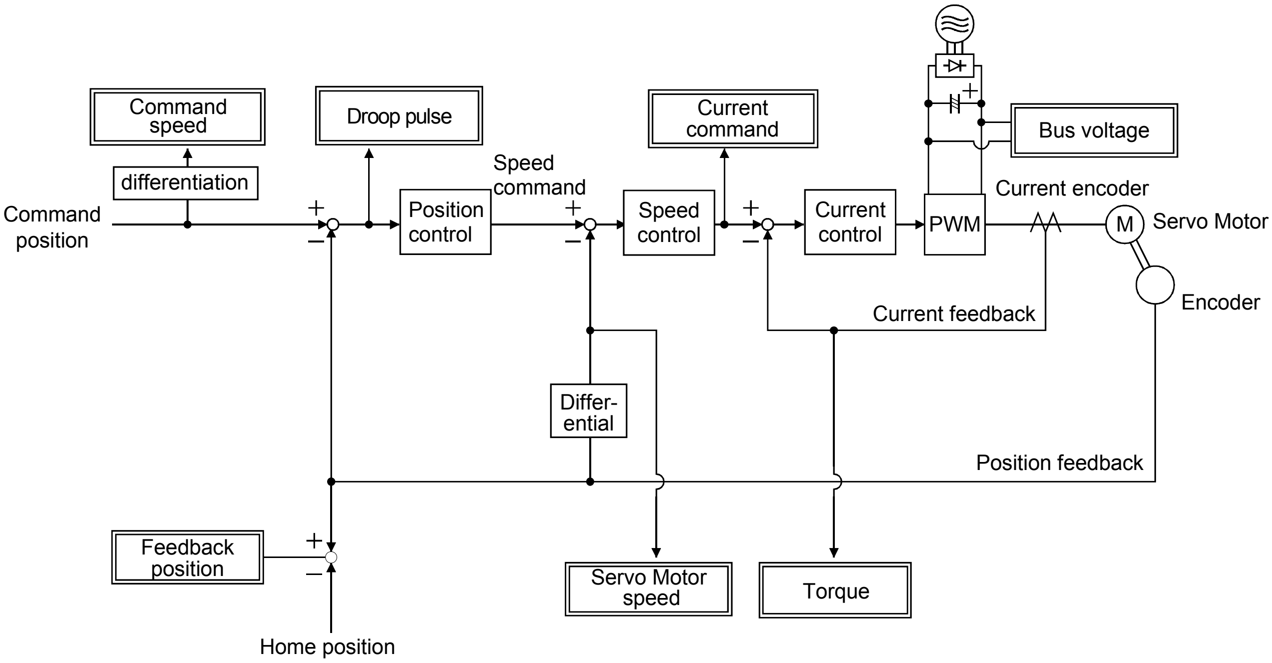
Refer to (3) for the measurement point.

Setting	Output item	Description	Setting	Output item	Description
0	Servo motor speed		1	Torque (Note 2)	
2	Servo motor speed		3	Torque (Note 2)	
4	Current command		5	Speed command	

Setting	Output item	Description	Setting	Output item	Description
6	Droop pulses (Note 1) (±10V/100 pulses)		7	Droop pulses (Note 1) (±10V/1000 pulses)	
8	Droop pulses (Note 1) (±10V/10000 pulses)		9	Droop pulses (Note 1) (±10V/100000 pulses)	
A	Feedback position (Note 1) (±10V/1 Mpulses)		B	Feedback position (Note 1) (±10V/10 Mpulses)	
C	Feedback position (Note 1) (±10V/100 Mpulses)		D	Bus voltage (Note 3)	

Note 1. Encoder pulse unit.
2. 8V is outputted at the maximum torque.
However, when parameter No. PA11・PA12 are set to limit torque, 8V is outputted at the torque highly limited.
3. For 400V class servo amplifier, the busvoltage becomes +8V/800V.

(3) Analog monitor block diagram



6. MR Configurator

The MR Configurator uses the communication function of the servo amplifier to perform parameter setting changes, graph display, test operation, etc. on a personal computer.

6.1 Specifications

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Compatibility with a servo amplifier</td><td>The following table shows MR Configurator software version for each servo amplifier.
<table>
<tr><th colspan="2">MR Configurator</th><th colspan="2">Compatible servo amplifier</th></tr>
<tr><th>Model</th><th>Software version</th><th>100V class
200V class</th><th>400V class</th></tr>
<tr><td rowspan="2">MRZJW3-SETUP221E</td><td>B0</td><td></td><td></td></tr>
<tr><td>C0 or later</td><td>○</td><td>○</td></tr>
</table></td></tr>
<tr><td>Baud rate [bps]</td><td>115200, 57600, 38400, 19200, 9600</td></tr>
<tr><td>Monitor</td><td>Display, I/O interface display, high speed monitor, trend graph</td></tr>
<tr><td>Alarm</td><td>Display, history, amplifier data</td></tr>
<tr><td>Diagnostic</td><td>No motor rotation, system information, tuning data, absolute encoder data, Axis name setting.</td></tr>
<tr><td>Parameters</td><td>Parameter list, device setting, turning, change list, detailed information</td></tr>
<tr><td>Test operation</td><td>Jog operation, positioning operation, motor-less operation, Do forced output, program operation, single-step feed, parameter copy.</td></tr>
<tr><td>Advanced function</td><td>Machine analyzer, gain search, machine simulation, Robust disturbance compensation.</td></tr>
<tr><td>Point data</td><td>Point table</td></tr>
<tr><td>File operation</td><td>Data read, save, delete, print</td></tr>
<tr><td>Others</td><td>Automatic demo, help display</td></tr>
</table>

6.2 System configuration

(a) Components

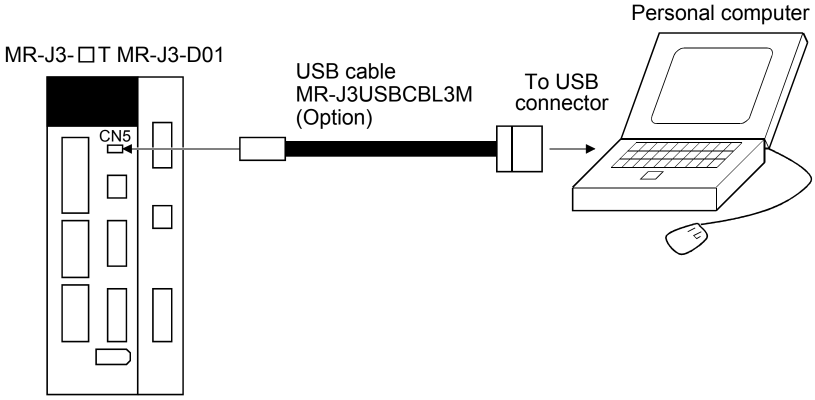
To use this software, the following components are required in addition to the servo amplifier and servo motor.

Equipment		(Note 1) Description
(Note 2, 3) Personal computer	OS	IBM PC/AT compatible where the English version of Windows® 98, Windows® Me, Windows® 2000 Professional, Windows® XP Professional, Windows® XP Home Edition, Windows Vista® Home Basic, Windows Vista® Home Premium, Windows Vista® Business, Windows Vista® Ultimate, Windows Vista® Enterprise operates
	Processor	Pentium® 133MHz or more (Windows® 98, Windows® 2000 Professional) Pentium® 150MHz or more (Windows® Me) Pentium® 300MHz or more (Windows® XP Professional, Windows® XP Home Edition) 32-bit (x86) processor of 1GHz or higher (Windows Vista® Home Basic, Windows Vista® Home Premium, Windows Vista® Business, Windows Vista® Ultimate, Windows Vista® Enterprise)
	Memory	24MB or more (Windows® 98) 32MB or more (Windows® Me, Windows® 2000 Professional) 128MB or more (Windows® XP Professional, Windows® XP Home Edition) 512MB or more (Windows Vista® Home Basic) 1GB or more (Windows Vista® Home Premium, Windows Vista® Business, Windows Vista® Ultimate, Windows Vista® Enterprise)
	Hard Disk	130MB or more of free space
Software		Internet Explorer 4.0 or more
Display		One whose resolution is 800×600 or more and that can provide a high color (16 bit) display. Connectable with the above personal computer.
Keyboard		Connectable with the above personal computer.
Mouse		Connectable with the above personal computer.
Printer		Connectable with the above personal computer.
USB cable		MR-J3USBCBL3M
RS-422/232C conversion cable		DSV-CABV (Diatrend) is recommended.

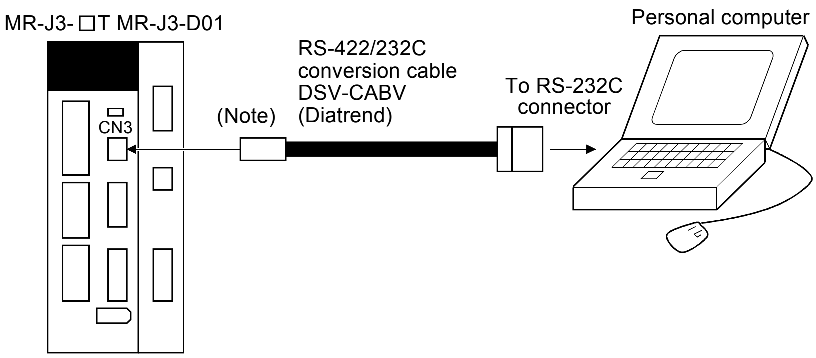
Note 1. Windows and Windows Vista are the registered trademarks of Microsoft Corporation in the United State and other countries.
Pentium is the registered trademarks of Intel Corporation.
2. On some personal computers, MR Configurator may not run properly.
3. 64-bit Windows XP and 64-bit Windows Vista are not supported.

(b) Connection with servo amplifier

1) For use of USB

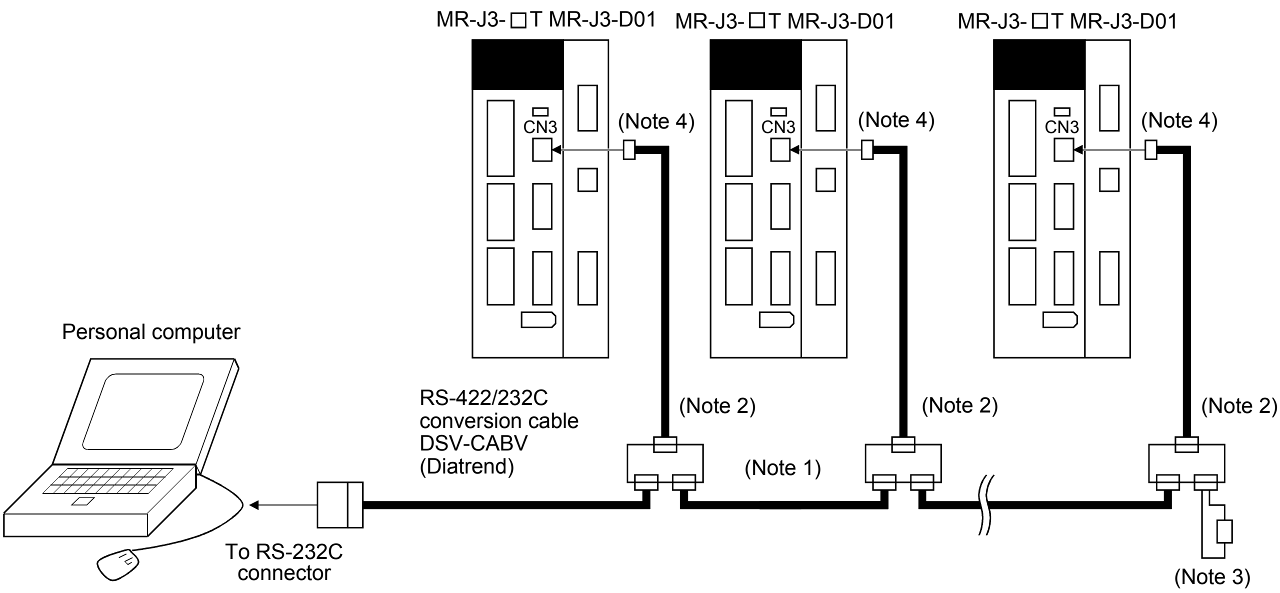


2) For use of RS-422



Note. Do not connect to the CN30 connector of MR-J3-D01. It cannot be used if connected.

3) For use of RS-422 to make multidrop connection



Note 1. Refer to section 13.1 for cable wiring.

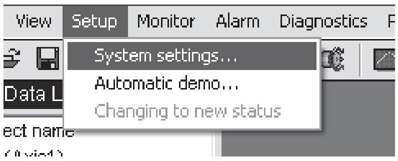
2. The BMJ-8 (Hakko Electric Machine Works) is recommended as the branch connector.

3. 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.

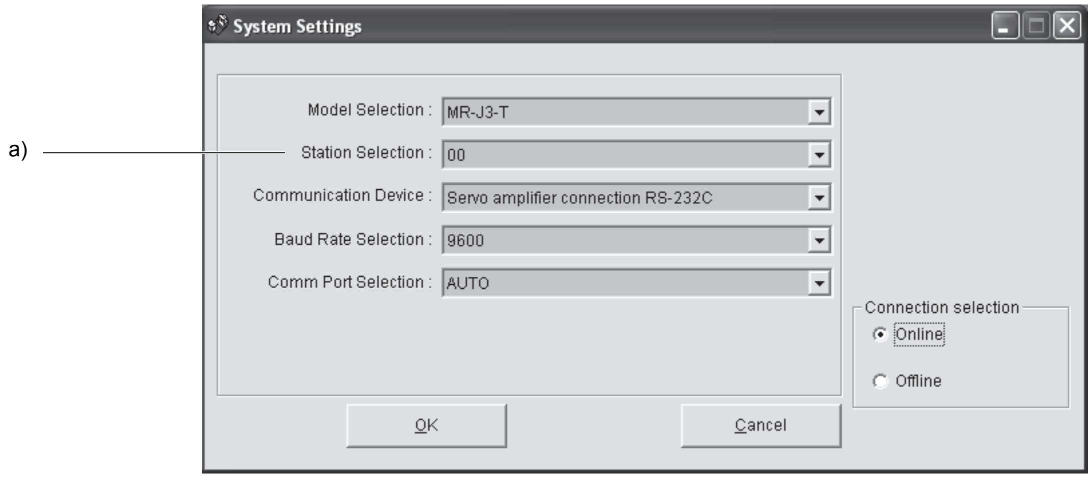
4. Do not connect to the CN30 connector of MR-J3-D01. It cannot be used if connected.

6.3 Station selection

Click "Setup" on the menu bar and click "System settings" on the menu.



When the above choices are made, the following window appears.



(1) Station number selection

Choose the station number in the combo box (a)).

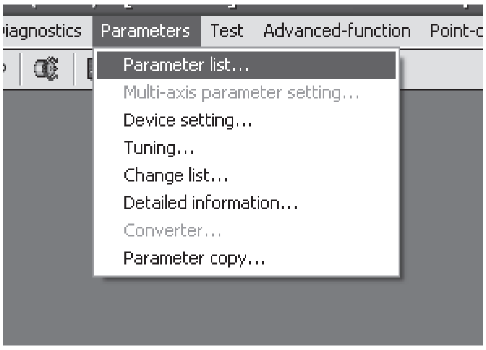
POINT
・This setting should be the same as the station number which has been set in the parameter in the servo amplifier used for communication.

(2) Closing of the station selection window

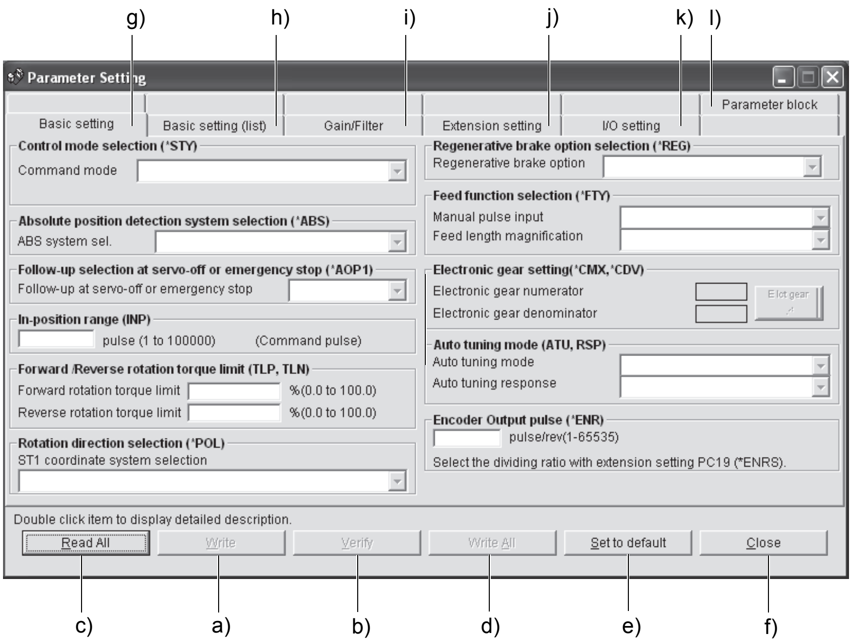
Click the "OK" button to close the window.

6.4 Parameters

Click "Parameters" on the menu bar and click "Parameter list" on the menu.



When the above choices are made, the following window appears.



(1) Parameter value write (a))

Click the parameter whose setting was changed and press the "Write" button to write the new parameter setting to the servo amplifier.

(2) Parameter value verify (b))

Click the "Verify" button to verify all parameter values being displayed and the parameter values of the servo amplifier.

(3) Parameter value batch-read (c))

Click the "Read All" button to read and display all parameter values from the servo amplifier.

(4) Parameter value batch-write (d))
Click the "Write All" button to write all parameter values to the servo amplifier.

(5) Parameter default value indication (e))
Click the "Set to default" button to show the initial value of each parameter.

(6) Basic settings for parameters (g))
Used to make the basic settings such as control mode selection and absolute position system selection.

(7) Basic setting parameters (h))
Used to make the basic settings for the servo amplifier. Select a parameter to be changed the setting, enter a new value to "Set value" and click "Enter".

(8) Gain/Filter parameters (i))
Used to adjust the gain manually. Select a parameter to be changed, enter a new value to "Set value" and click "Enter".

(9) Extension setting parameters (j))
Used to make the setting unique to MR-J3-□T servo amplifier. Select a parameter to be changed, enter a new value to "Set value" and click "Enter".

(10) I/O setting parameters (k))
Used to change the I/O device of the servo amplifier. Select a parameter to be changed, enter a new value to "Set value" and click "Enter".

(11) Parameter block (l))
Used to set the availability of parameter write.

(12) Parameter data file read
Used to read and display the parameter values stored in the file. Use the "Project" menu on the menu bar to read.

(13) Parameter value storage
Used to store all parameter values being displayed on the window into the specified file. Use the "Project" menu on the menu bar to store.

(14) Parameter data list print
Used to print all parameter values being displayed on the window. Use the "Project" menu on the menu bar to print.

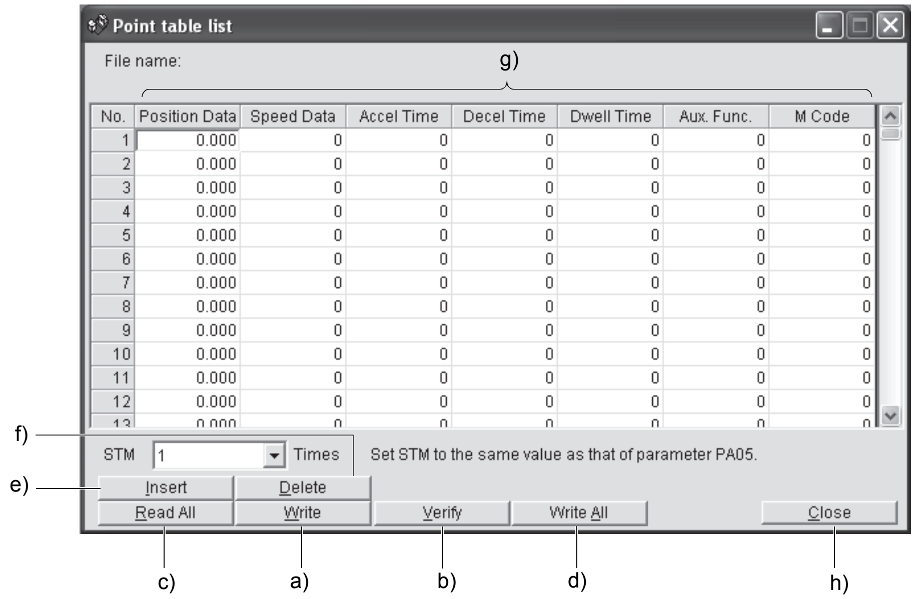
(15) Parameter list window closing (f))
Click the "Close" button to close the window. If the "Close" button is clicked without (1) parameter value write or (4) parameter value batch-write being performed, the parameter value changed is made invalid.

6.5 Point table

POINT
- The value of the parameter No. PA05 set on the parameter setting screen is not engaged with the STM (feed length multiplication) value on the point table list screen. Set the STM (feed length multiplication) value to the same as set in the parameter No. PA05 on the point table list screen.

Click "Point-data" on the menu bar and click "Point table" on the menu.

When the above choices are made, the following window appears.



(1) Point table data write (a))

Click the point table data changed and press the "Write" button to write the new point table data to the servo amplifier.

(2) Point table data verify (b))

Click the "Verify" button to verify all data being displayed and the data of the servo amplifier.

(3) Point table data batch-read (c))

Click the "Read All" button to read and display all point table data from the servo amplifier.

(4) Point table data batch-write (d))

Click the "Write All" button to write all point table data to the servo amplifier.

(5) Point table data insertion (e))

Click the "Insert" button to insert one block of data into the position before the point table No. chosen. The blocks after the chosen point table No. are shifted down one by one.

(6) Point table data deletion (f))

Click the "Delete" button to delete all data in the point table No. chosen. The blocks after the chosen point table No. are shifted up one by one.

(7) Point table data change (g))

Click the data to be changed, enter a new value into the "Enter" input field, and press the enter key or Enter Data button.

(8) Point table data file read

Used to read and display the point table data stored in the file. Use the "Project" menu on the menu bar to read.

(9) Point table data storage

Used to store all point table data being displayed on the window into the specified file. Use the "Project" menu on the menu bar to store.

(10) Point table data list print

Used to print all point table data being displayed on the window. Use the "Project" menu on the menu bar to print.

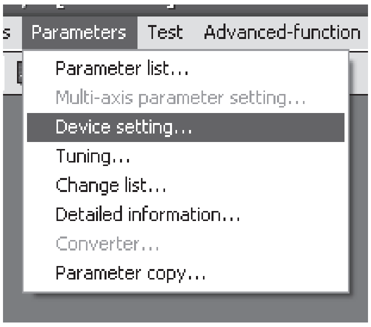
(11) Point table data list window closing (h))

Click the "Close" button to close the window.

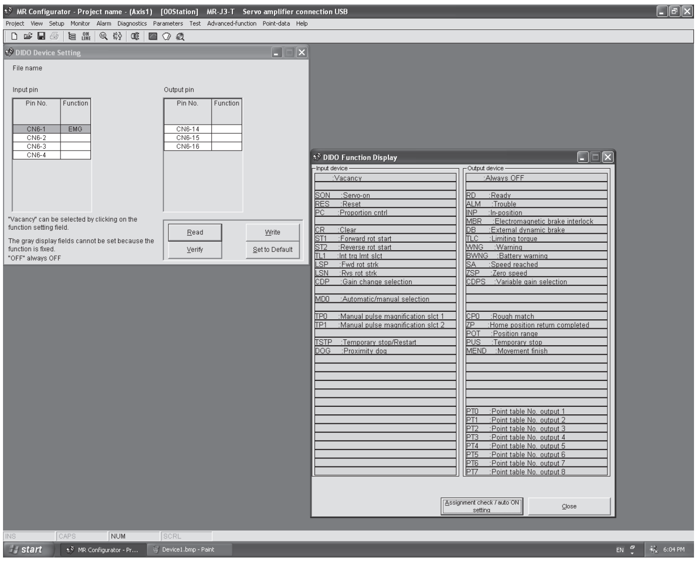
6.6 Device assignment method

(1) How to open the setting screen

Click "Parameters" on the menu bar and click "Device setting" in the menu.



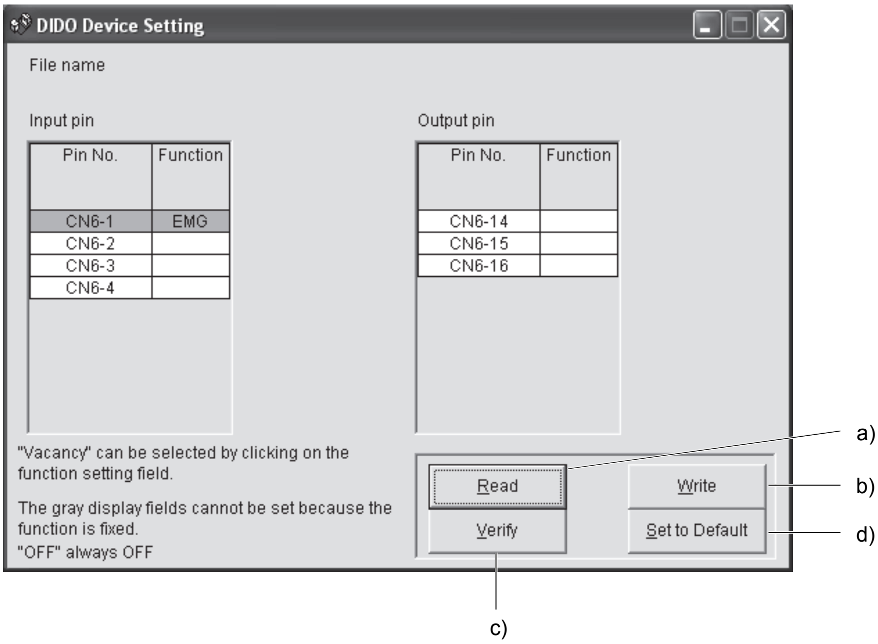
Making selection displays the following window.



(2) Screen explanation

(a) DIDO device setting window screen

This is the device assignment screen of the servo amplifier displays the pin assignment status of the servo amplifier.



1) Read of function assignment (a))

Click the "Read" button reads and displays all functions assigned to the pins from the servo amplifier.

2) Write of function assignment (b))

Click the "Write" button writes all pins that are assigned the functions to the servo amplifier.

3) Verify of function assignment (c))

Click the "Verify" button verifies the function assignment in the servo amplifier with the device information on the screen.

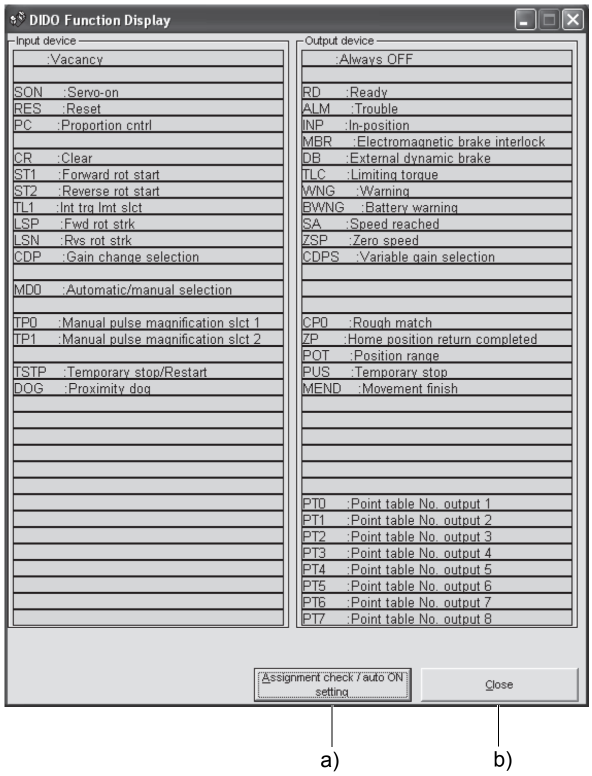
4) Initial setting of function assignment (d))

Click the "Set to Default" button initializes the function assignment.

(b) DIDO function display window screen

This screen is used to select the device assigned to the pins.

The functions displayed below * and * are assignable.



Move the pointer to the place of the function to be assigned. Drag and drop it as-is to the pin you want to assign in the DIDO device setting window.

1) Assignment checking, automatic ON setting (a))

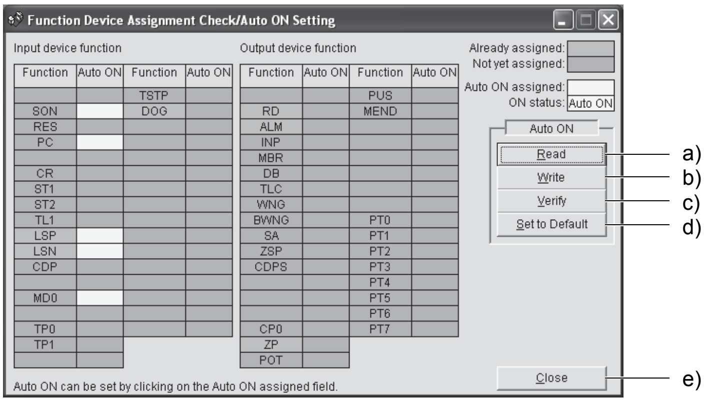
Press this button to display the screen that shows the assignment list and enables auto ON setting. Refer to (2)(c) in this section for more information.

2) Quitting

Click "Close" button to exit from the window. (b))

(c) Function device assignment checking auto ON setting display

Click the "Assignment check / auto ON setting" button in the DIDO function display window displays the following window.



The assigned functions are indicated by .

The functions assigned by auto ON are grayed. When you want to set auto ON to the function that is enabled for auto ON, click the corresponding cell. Clicking it again disables auto ON.

1) Auto ON read of function assignment (a))
   Click "Read" button reads the functions set for auto ON from the interface unit and extension IO unit.

2) Auto ON write of function assignment (b))
   Click "Write" button writes the functions currently set for auto ON to the interface unit and extension IO unit.

3) Auto ON verify of function assignment (c))
   Click "Verify" button verifies the current auto ON setting in the interface unit and extension IO unit with the auto ON setting on the screen.

4) Auto ON initial setting of function assignment (d))
   Click "Set to Default" button initializes the auto ON setting.

5) Quitting the function device assignment checking/auto ON setting window (e))
   Click "Close" button exits from the window.

6.7 Test operation

⚠ CAUTION

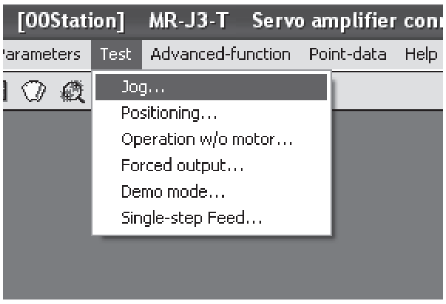
- When confirming the machine operation in the test operation mode, use the machine after checking that the safety mechanism such as the forced stop (EMG) operates.
- If any operational fault has occurred, stop operation using the forced stop (EMG).

6.7.1 Jog operation

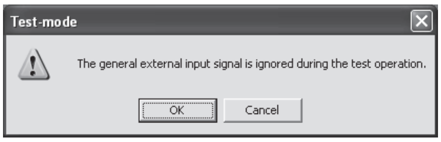
POINT

- For the program operation, refer to the manual of MR Configurator.
- The servo motor will not operate if the forced stop (EMG), forward rotation stroke end (LSP) and reverse rotation stroke end (LSN) are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn on across these signals and SG. (Refer to section 7.6.)
- When an alarm occurs, the JOG operation is automatically canceled.

Click "Test" on the menu bar and choose "Jog" on the menu.

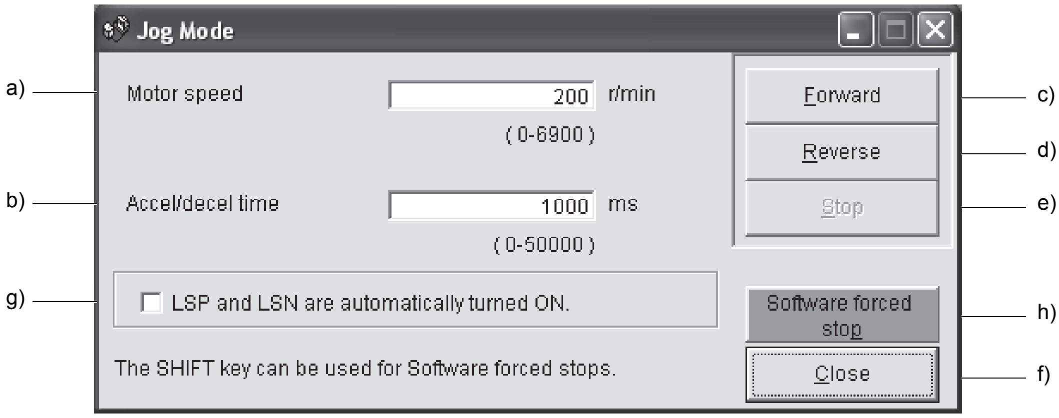


Clicking displays the confirmation window for switching to the test operation mode.



Click the "OK" button to display the setting screen of the Jog operation.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.

Turn the servo off, confirm that the operation is in the stop status, and click the "OK" button to display the setting screen for the Jog operation.



(1) Servo motor speed setting (a))
Enter a new value into the "Motor speed" input field and press the enter key.

(2) Acceleration/deceleration time constant setting (b))
Enter a new value into the "Accel/decel time" input field and press the enter key.

(3) Servo motor start (c), d))
Hold down the "Forward" button to rotate the servo motor in the CCW rotation direction.
Hold down the "Reverse" button to rotate the servo motor in the CW rotation direction.

(4) Servo motor stop (e))
Click the "Stop" button to stop the rotation of the servo motor.

(5) LSP/LSN (stroke end) automatic ON setting (g))
Put a check mark in the check box to automatically turn ON LSP/LSN. After selecting the check box, the LSP and the LSN of external signal are ignored.

(6) Servo motor software forced stop (h))
Click the "Software forced stop" button to stop the servo motor rotation immediately. When the "Software forced stop" button is enabled, the "Forward" and "Reverse" buttons cannot be used. Click the "Software forced stop" button again to make the "Forward" and "Reverse" buttons enabled.

(7) Jog operation window closing (f))
Click the "Close" button to cancel the jog operation mode and close the window.

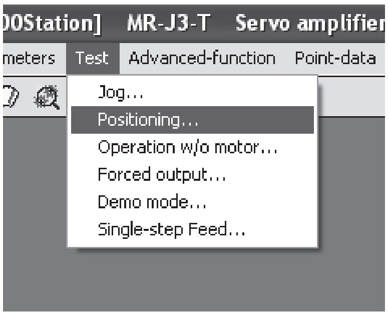
(8) Switching to usual operation mode
To switch from the test operation mode to the usual operation mode, turn OFF the power of the servo amplifier.

6.7.2 Positioning operation

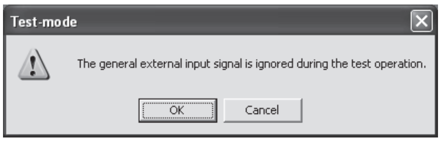
POINT

- The servo motor will not operate if the forced stop (EMG), forward rotation stroke end (LSP) and reverse rotation stroke end (LSN) are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn on across these signals and DOCOM. (Refer to section 7.6.)
- When an alarm occurs, the positioning operation is automatically canceled.

Click "Test" on the menu bar and click "Positioning" on the menu.

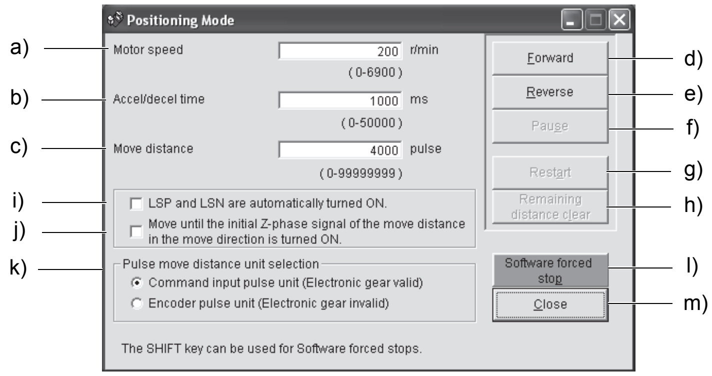


Clicking displays the confirmation window for switching to the test operation mode.



Click the "OK" button to display the setting screen of the Positioning operation.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.

After confirming that the operation is in the stop status, click the "OK" button to display the setting screen for the positioning operation.



(1) Servo motor speed setting (a))
Enter a new value into the "Motor speed" input field and press the enter key.

(2) Acceleration/deceleration time constant setting (b))
Enter a new value into the "Accel/decel time" input field and press the enter key.

(3) Moving distance setting (c))
Enter a new value into the "Move distance" input field and press the enter key.

(4) Servo motor start (d), e))
Click the "Forward" button to rotate the servo motor in the forward rotation direction.
Click the "Reverse" button to rotate the servo motor in the reverse rotation direction.

(5) Temporary stop of servo motor (f))
Click the "Pause" button to stop the servo motor temporarily.

(6) Servo motor restart (g))
Click the "Restart" button during the temporary stop to restart the rotations for the remaining move distance.
Enter a new value into the "Motor speed" input field and press the enter key.

(7) Move distance clear (h))
Click the "Remaining distance clear" during the temporary stop to clear the remaining move distance.

(8) LSP/LSN (stroke end) automatic ON setting (i))
Put a check mark in the check box to automatically turn ON LSP/LSN. After selecting the check box, the LSP and the LSN of external signal are ignored.

(9) Automatic ON setting for the movement to the Z-phase signal (j))
To move to the first Z-phase signal of the move distance + move direction, put a check mark in the check box.

(10) Pulse move distance unit selection (k)

Select with the option buttons whether the moving distance set is in the command input pulse unit or in the encoder pulse unit.

(11) Servo motor software forced stop (1))

Click the "Software forced stop" button to stop the servo motor rotation immediately. When the "Software forced stop" button is enabled, the "Forward" and "Reverse" buttons cannot be used. Click the "Software forced stop" button again to make the "Forward" and "Reverse" buttons enabled.

(12) Positioning operation window closing (m))

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

(13) Switching to usual operation mode

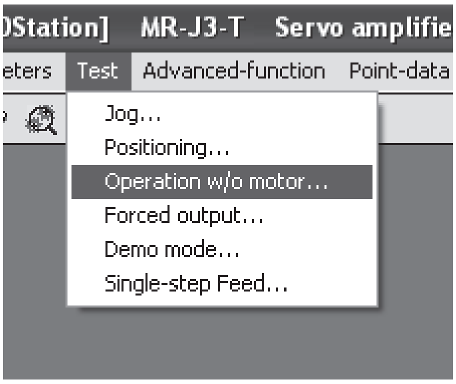
To switch from the test operation mode to the usual operation mode, turn OFF the power of the servo amplifier.

6.7.3 Motor-less operation

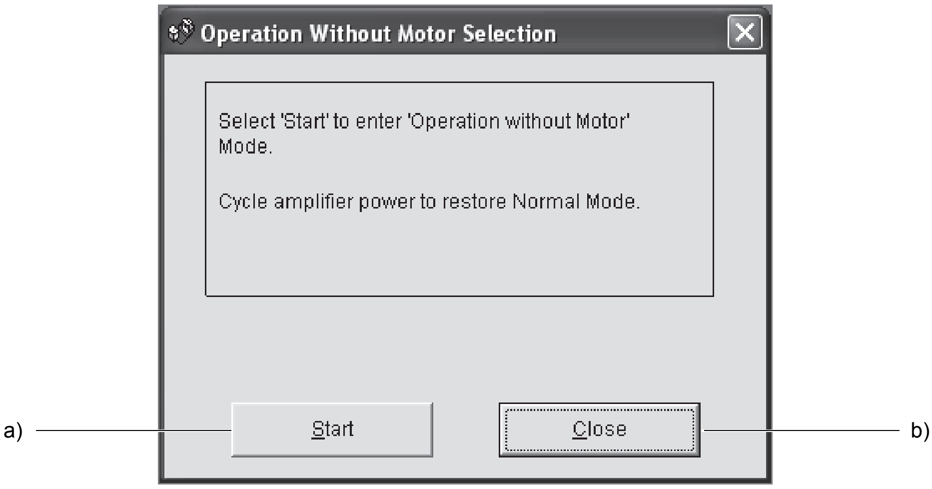
POINT
・When this operation is used in an absolute position detection system, the home position cannot be restored properly.

Without a servo motor being connected, the output signals are provided and the servo amplifier display shows the status as if a servo motor is actually running in response to the external I/O signals.
The sequence of the host programmable controller can be checked without connection of a servo motor.

Click "Test" on the menu bar and click "Operation w/o Motor" on the menu.



When the above choices are made, the following window appears.



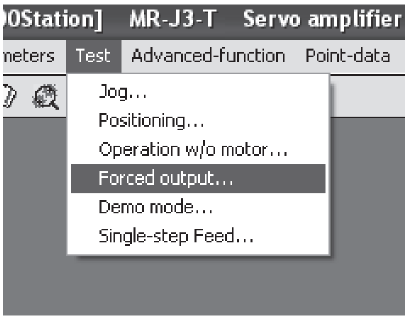
(1) Execution of motor-less operation (a))
Click "Start" to perform motor-less operation.

(2) Termination of motor-less operation (b))
Click "Close" to close the window.
Note that just clicking the "Close" button does not cancel motor-less operation. To cancel motor-less operation, turn ON the power of the servo amplifier and switch to the usual operation mode once.

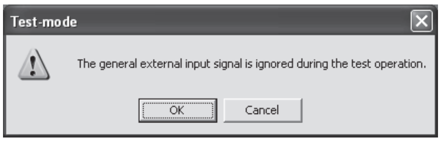
6.7.4 Output signal (DO) forced output

POINT
・When an alarm occurs, the DO forced output is automatically canceled.

Each servo amplifier output signal is forcibly switched on/off independently of the output condition of the output signal.
Click "Test" on the menu bar and click "Forced output" on the menu.



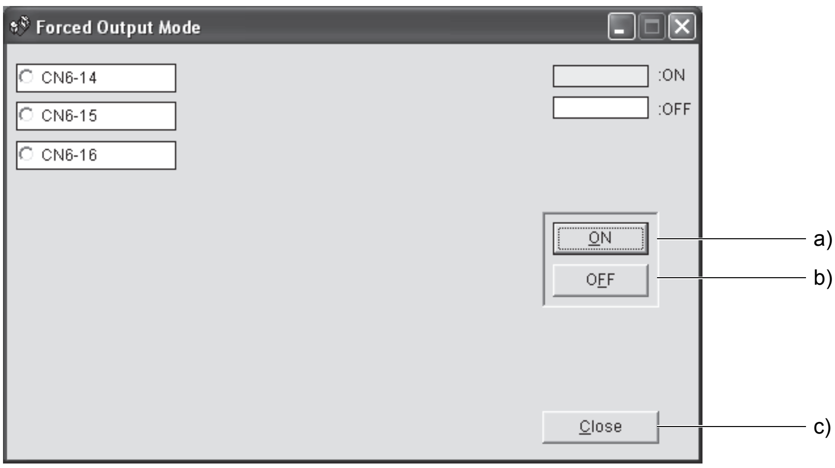
Clicking displays the confirmation window for switching to the test operation mode.



Click the "OK" button to display the setting screen of the DO forced output.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.

After confirming that the operation is in the stop status, click the "OK" button to display the setting screen for the DO forced output.

When the above choices are made, the following window appears.



(1) Signal ON/OFF setting (a), b))

Choose the signal name or pin number and click the "ON" or "OFF" button to write the corresponding signal status to the servo amplifier.

(2) DO forced output window closing (c))

Click the "Close" button to cancel the DO forced output mode and close the window.

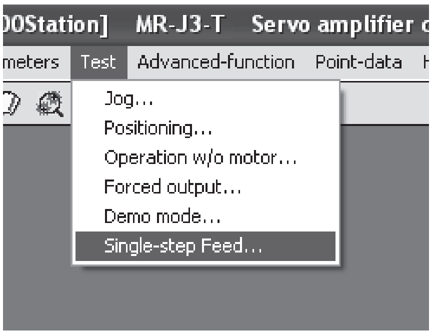
(3) Switching to usual operation mode

To switch from the test operation mode to the usual operation mode, turn OFF the power of the servo amplifier.

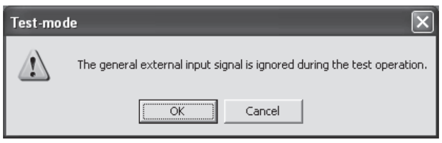
6.7.5 Single-step feed

POINT
・The servo motor will not operate if the forced stop (EMG), forward rotation stroke end (LSP) and reverse rotation stroke end (LSN) are off. Make automatic ON setting to turn on these devices or turn on across these signals and SG. (Refer to section 6.6.) ・When an alarm occurs, the 1-step feed is automatically canceled.

Operation is performed in accordance with the preset point table No.
Click "Test" on the menu bar and click "Single-step Feed" on the menu.

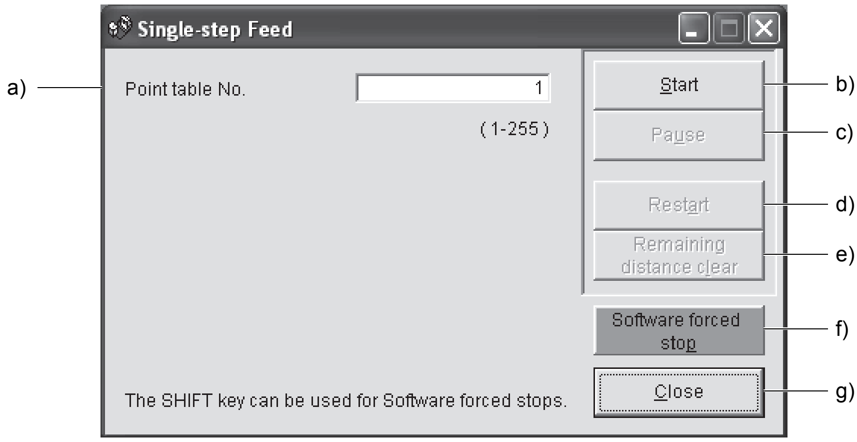


Clicking displays the confirmation window for switching to the test operation mode.



Click the "OK" button to display the setting screen of the Single-step feed.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.

After confirming that the operation is in the stop status, click the "OK" button.



(1) Point table No. setting (a))
Enter the point table No. into the "Point table No." input field and press the enter key.

(2) Servo motor start (b))
Click the "Start" button to rotate the servo motor.

(3) Temporary stop of servo motor (c))
Press the "Pause" button to stop the servo motor temporarily.

(4) Servo motor stop (c))
Click the "Pause" button again during a temporary stop of the servo motor to clear the remaining moving distance.

(5) Servo motor restart (d))
Click the "Restart" button during the temporary stop to restart the rotations for the remaining move distance.

(6) Move distance clear (e))
Click the "Remaining distance clear" during the temporary stop to clear the remaining move distance.

(7) Servo motor software forced stop (f))

Click the "Software forced stop" button to stop the servo motor rotation immediately. When the "Software forced stop" button is enabled, the "Start" button cannot be used. Click the "Software forced stop" button again to make the "Start" button enabled.

(8) Single-step feed window closing (g))

Click the "Close" button to cancel the single-step feed mode and close the window.

(9) Switching to usual operation mode

To switch from the test operation mode to the usual operation mode, turn OFF the power of the servo amplifier.

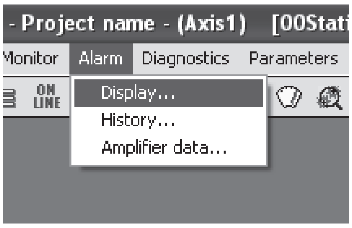
6.8 Alarm

6.8.1 Alarm display

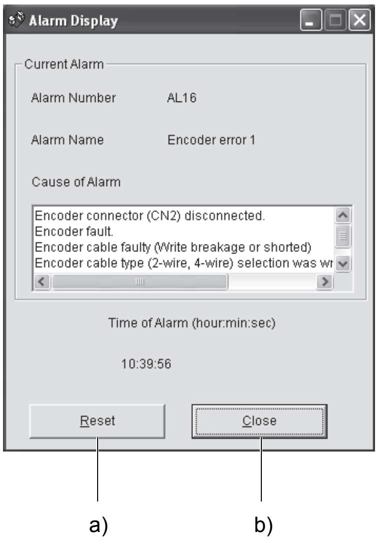
POINT

- If a menu is clicked or any other operation is performed during alarm occurrence, the following message window appears. The example given here is the window that indicates an occurrence of Encoder error 1 (16).

The current alarm can be displayed.
To display the current alarm, click "Alarm" on the menu bar and click "Display" on the menu.



When the above choices are made, the following window appears.



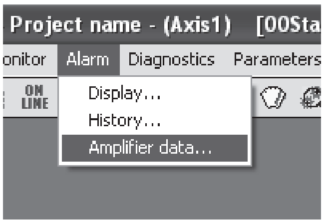
(1) Current alarm display
The window shows the alarm number, name, cause and occurrence time.
The following example is the window that indicates an occurrence of Encoder error 1 (16).

(2) Alarm reset (a))
Click the "Reset alarm" button to reset the current alarm and clear alarms on the window. The alarm at this time is stored as the latest alarm.

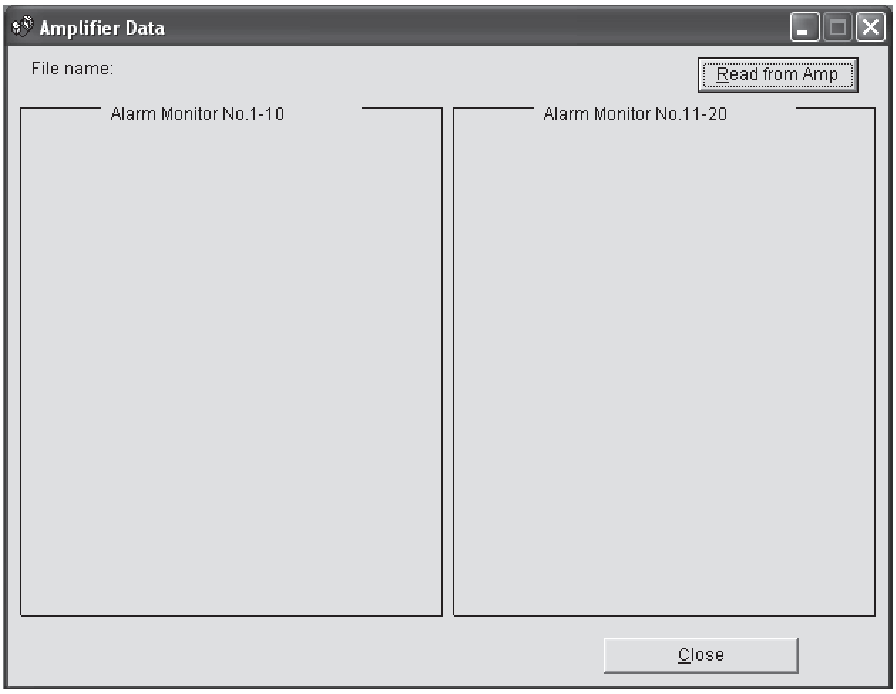
(3) Closing the current alarm window (b))
Click the "Close" button to close the window.

6.8.2 Batch display of data at alarm occurrence

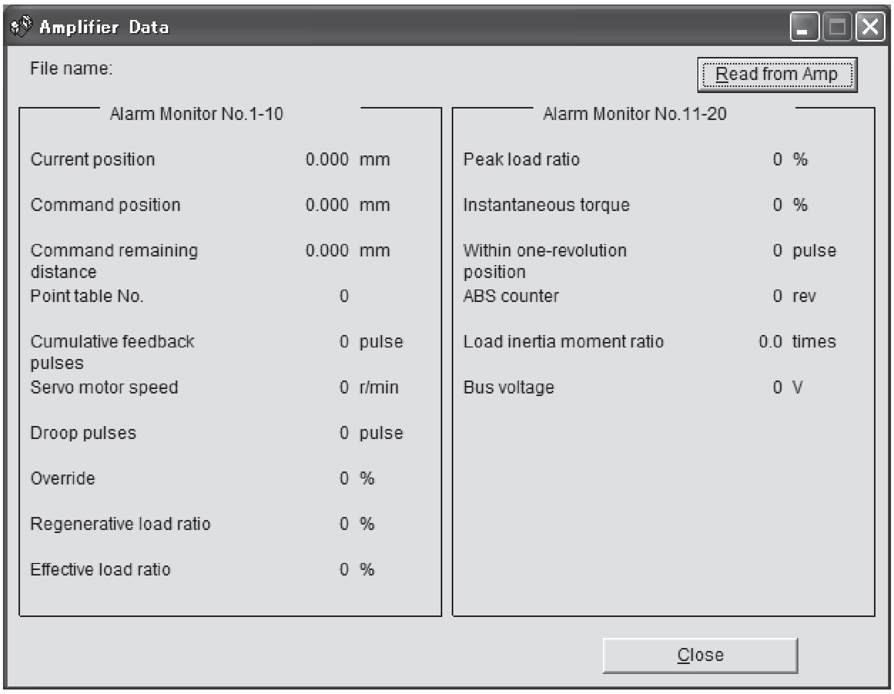
Monitor data during alarm occurrence is displayed.
To display monitor data, click "Alarm" on the menu bar and click "Amplifier data" on the menu.



When the above choices are made, the following window appears.

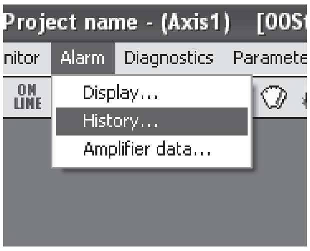


Click the "Read" button to read the monitor data at error occurrence from the servo amplifier. Read results are displayed as follows.

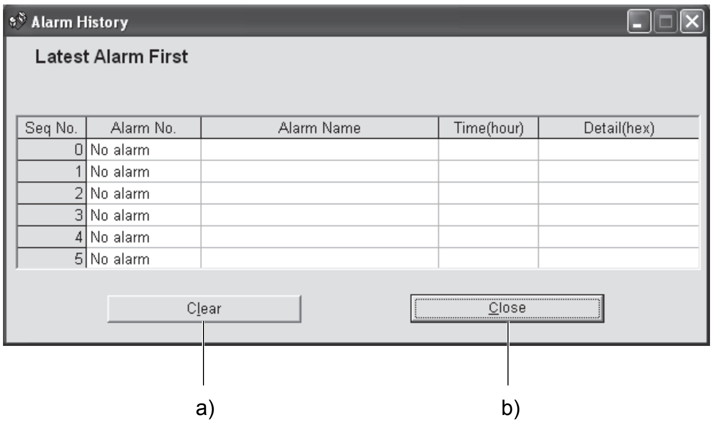


6.8.3 Alarm history

Click "Alarm" on the menu bar and click "History" on the menu.



When the above choices are made, the following window appears.



(1) Alarm history display

The most recent six alarms are displayed. The smaller numbers indicate newer alarms.

(2) Alarm history clear (a))

Click the "Clear" button to clear the alarm history stored in the servo amplifier.

(3) Closing of alarm history window (b))

Click the "Close" button to close the window.

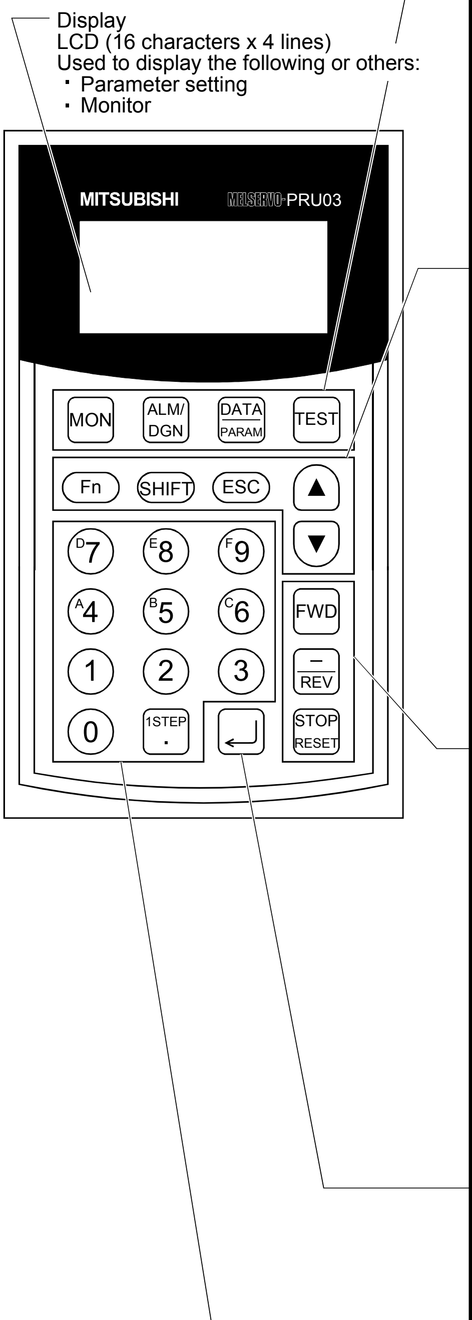
7. PARAMETER UNIT (MR-PRU03)

POINT
• Do not use MR-PRU03 parameter unit and MR Configurator together.

Perform simple data setting, test operation, parameter setting, etc. without MR Configurator by connecting the MR-PRU03 parameter unit to the servo amplifier.

7.1 External appearance and key explanations

This section gives the external appearance and explanations of the keys.



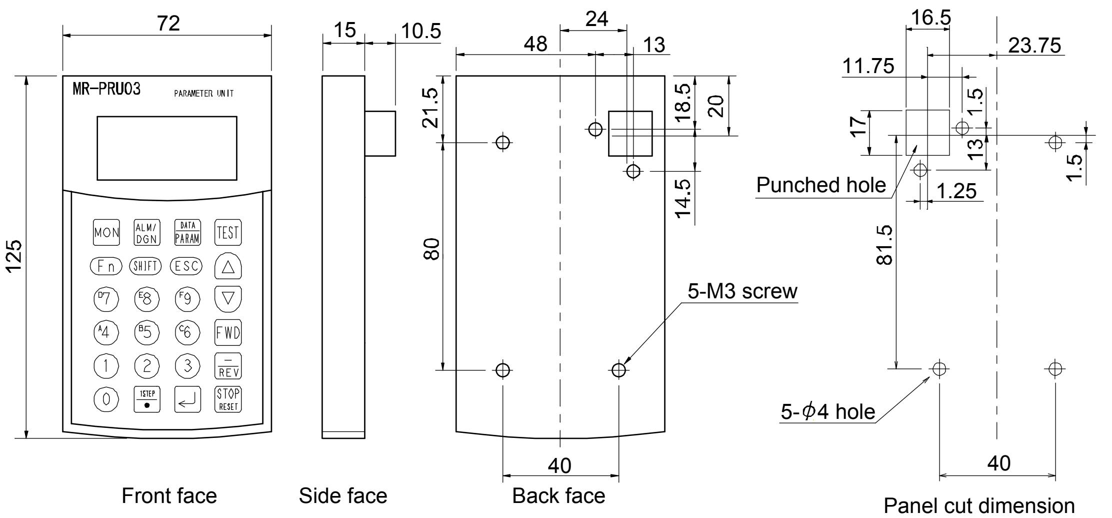
	Key	Key explanations
Mode key	MON	Monitor mode key ・Used to display the monitor screen.
	ALM/ DGN	Alarm/diagnosis mode ・Used to display the alarm/DO forced output/diagnosis selection screen.
	DATA PARAM	Parameter mode key ・Used to display parameter selection screen. ・Press this key while holding down the "SHIFT" key to display the point table setting screen.
	TEST	Test operation mode key ・Used to display the exit/JOG operation/positioning operation/motor-less operation/DO forced output/single-step feed selection screen.
Operation key	Fn	Function key ・Used to perform various operations in the test operation mode. ・Used to display the parameter range and point table setting range.
	SHIFT	SHIFT key ・Used to enter hexadecimal values. Press the "4" to "9" keys while holding down the "SHIFT" key to enter A to F. ・Press the "▲▼" keys while holding down the "SHIFT" key to move to the previous or next screen.
	ESC	ESC key ・Used to display the screen at one step upper hierarchical level. (not the pervious screen) Used to display the setting selection screen (the initial screen) of the monitor mode.
	▲ ▼	Scroll key ・Used to move the cursor across the screen or scroll the screen. Press this key while holding down the "SHIFT" key to move to the previous or next screen. ・Used to change parameter No. or point table No.
Test Operation key	FWD	Forward rotation key ・Used to start the forward rotation in the test operation mode (JOG operation/positioning operation).
	– REV	Symbol key/reverse rotation key ・Used to start the reverse rotation in the test operation mode (JOG operation/positioning operation). ・Used together with the "SHIFT" key to enter negative values. To exit the negative value entry mode, press the "SHIFT" key again and press the "-" key. ("-" disappears.)
	STOP RESET	Stop/reset key ・Used to stop temporarily in the JOG operation/positioning operation/single-step feed. ・The "RESET" key is valid when the "Fn" key is not pressed (i.e. at a stop). ・Used to reset alarms or alarm history, or clear cumulated monitor data or inputs. ・Normal operation cannot be stopped with this key.
Enter key	↵	Enter key ・Used to determine the selection, numerical values, etc. ・Used to determine to exit the test operation mode, or enter the motor-less operation. ・Used to switch ON/OFF in the DO output screen.
Numerical key	0 to F 9	Numerical keys ・Used to enter parameter No., setting values, etc. ・Press the "4" to "9" keys while holding down the "SHIFT" key to enter A to F.
	1STEP .	Decimal point key ・Used to enter a decimal point. ・Used to start the single-step feed.

7.2 Specifications

Item		Description
Model		MR-PRU03
Power supply		Supplied from the servo amplifier
Functions	Parameter mode	Basic setting parameters, Gain/filter parameters, Extension setting parameters, I/O setting parameters
	Monitor mode (Status display)	Current position, Command position, Command remaining distance, Override, Point table No., Feedback pulse value, Servo motor speed, Droop pulse value, Regenerative load factor, Effective load factor, Peak load factor, Instantaneous torque, Within one-revolution position, ABS counter, Load inertia moment ratio, Bus voltage
	Diagnosis mode	External I/O display, motor information
	Alarm mode	Current alarm, Alarm history
	Test operation mode	Jog operation, Positioning operation, DO forced output, Motor-less operation, Single-step feed
	Point table mode	Point data, Servo motor speed, Acceleration/deceleration time constant, Dwell, Auxiliary function, M code
Display section		LCD system (16 characters × 4 lines)
Environment	Ambient temperature	−10 to +55℃ (14 to 131°F) (non-freezing)
	Ambient humidity	90%RH or less (non-condensing)
	Storage temperature range	−20 to +65℃ (−4 to 149°F) (non-freezing)
	Storage humidity range	90%RH or less (non-condensing)
	Ambience	Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt
Mass [g] ([lb])		130 (0.287)

7.3 Outline dimension drawings

[Unit: mm]



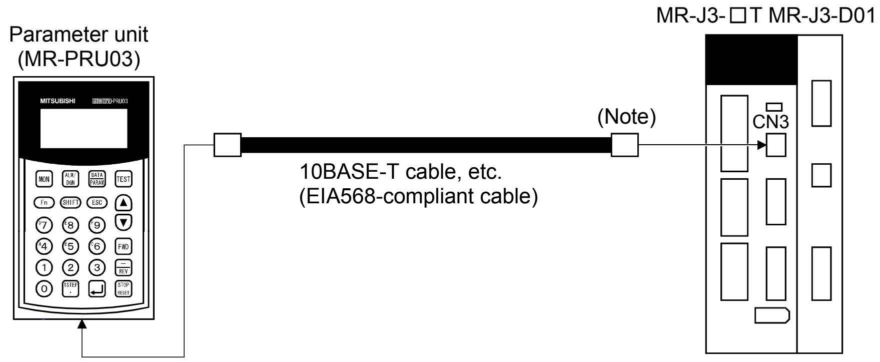
7.4 Connection with servo amplifier

POINT
・ A parameter unit cannot be connected to the CN30 connector of MR-J3-D01.

7.4.1 Single axis

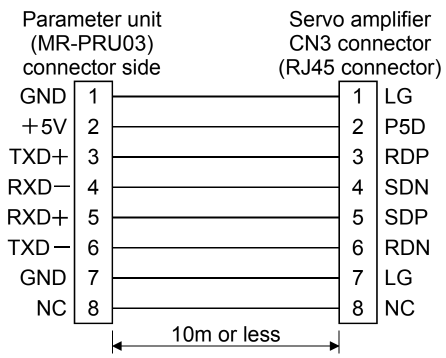
(1) Configuration diagram

Operate the single-axis servo amplifier. It is recommended to use the following cable.



Note. Do not connect to the CN30 connector of MR-J3-D01. It cannot be used if connected.

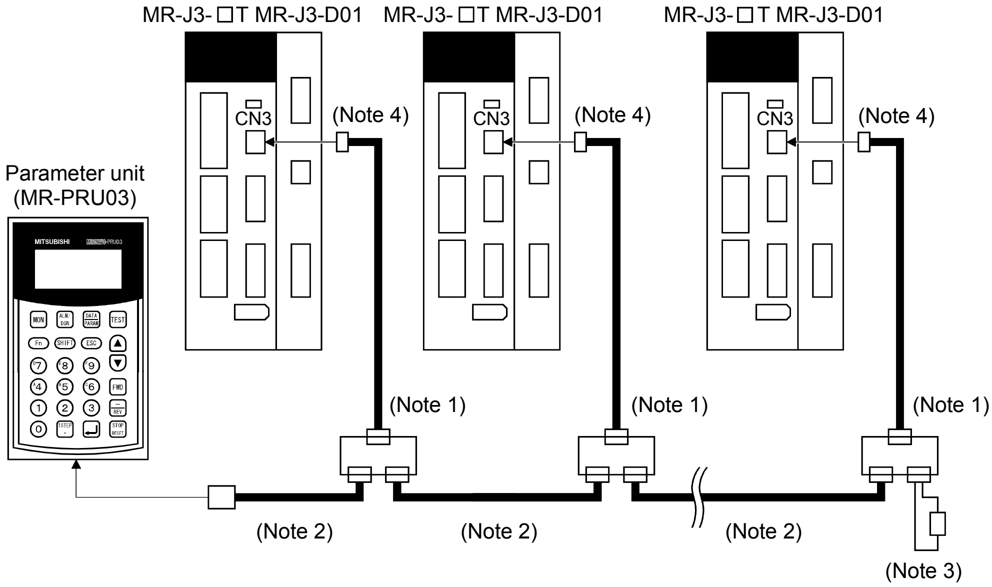
(2) Cable internal wiring diagram



7.4.2 Multidrop connection

(1) Configuration diagram

Up to 32 axes of servo amplifiers from stations 0 to 31 can be operated on the same bus.



Note 1. The BMJ-8 (Hakko Electric Machine Works) is recommended as the branch connector.

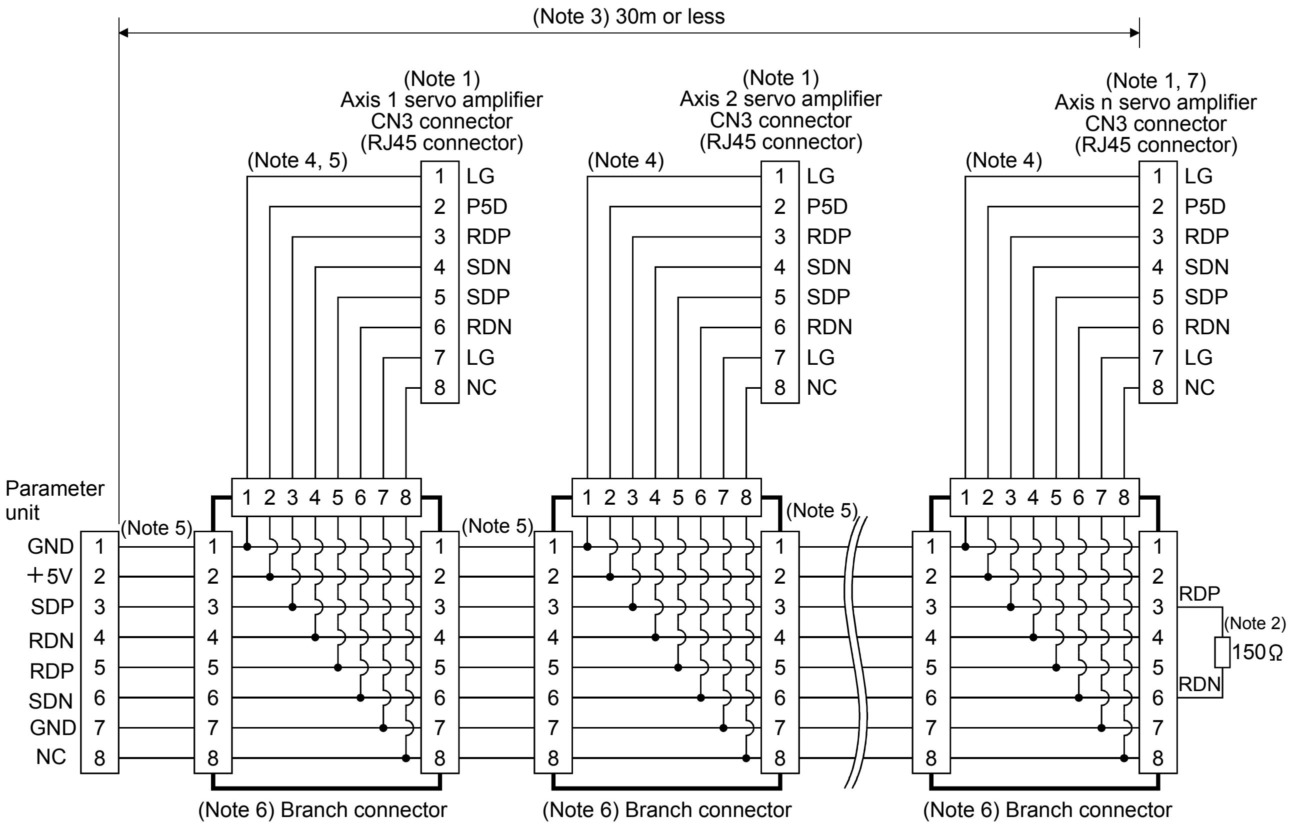
2. Use the 10BASE-T cable (EIA568-compliant), etc.

3. 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.

4. Do not connect to the CN30 connector of MR-J3-D01. It cannot be used if connected.

(2) Cable internal wiring diagram

Wire the cables as shown below.



Note 1. Recommended connector (Hirose Electric)

Plug: TM10P-88P

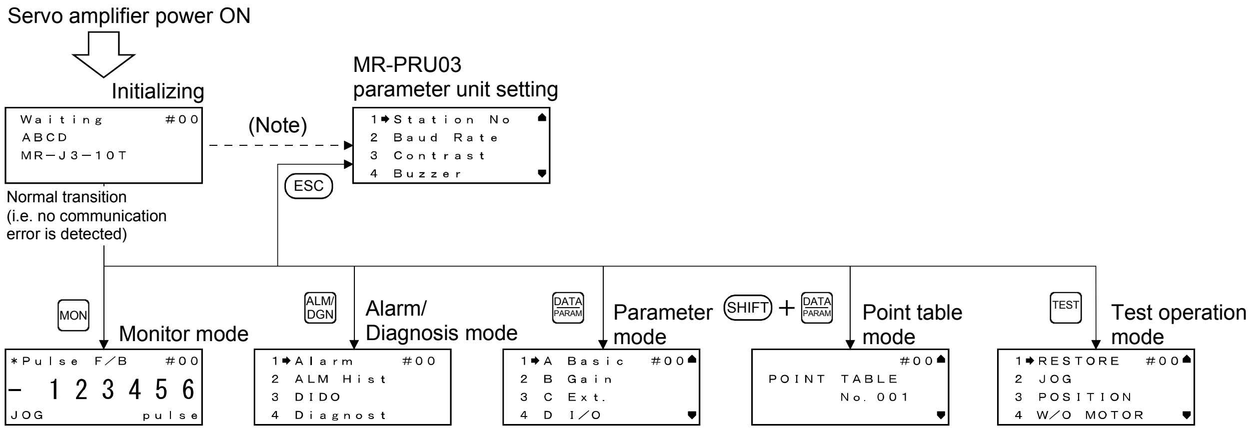
Connection tool: CL250-0228-1

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.
3. The overall length is 30m 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 (Hakko Electric Machine Works)
7. n ≤ 32 (Up to 32 axes can be connected.)

7.5 Display

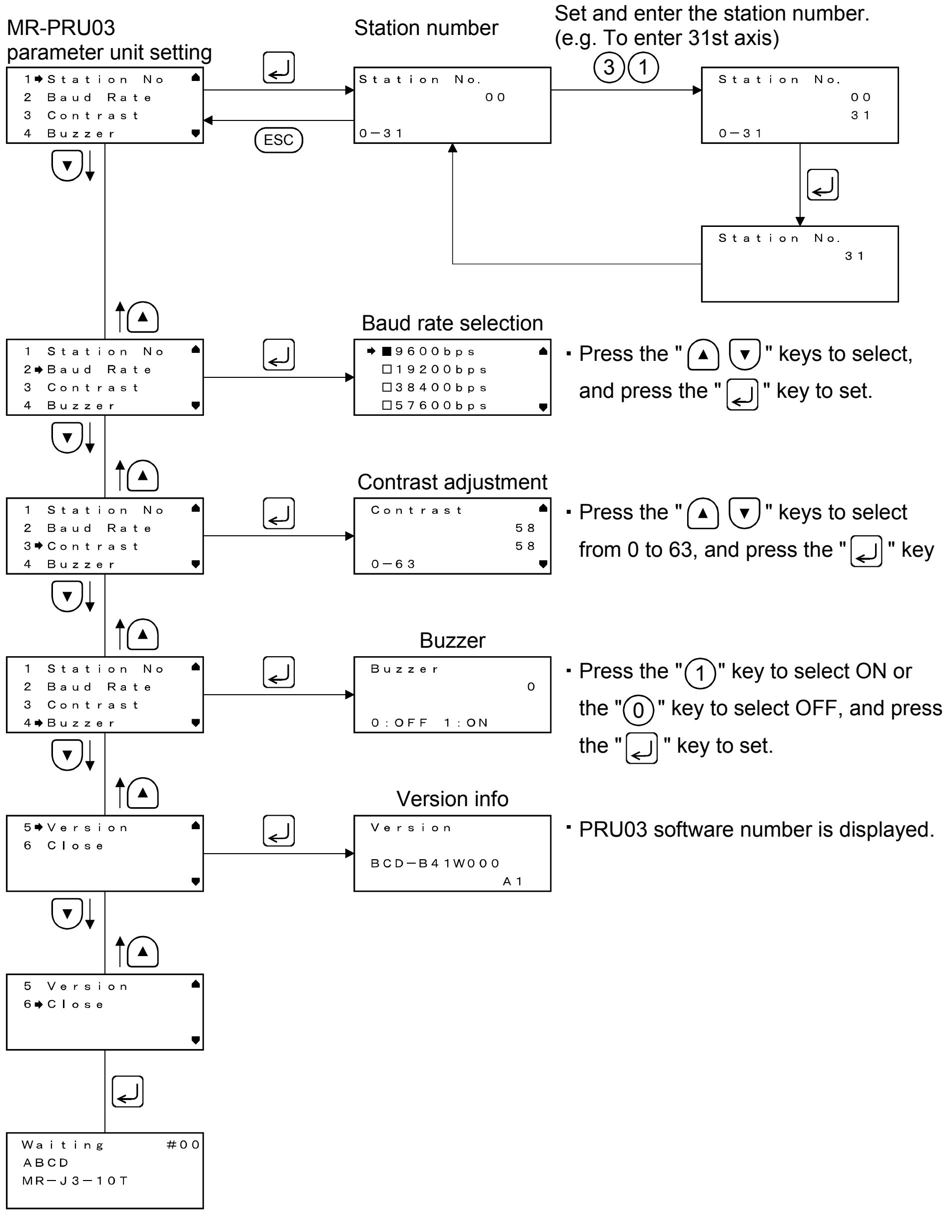
Connect the MR-PRU03 parameter unit to the servo amplifier, and turn ON the power of the servo amplifier. In this section, the screen transition of the MR-PRU03 parameter unit is explained, together with the operation procedure in each mode.

7.5.1 Outline of screen transition



Note. If initialization communication fails, a communication error is displayed. Press the "ESC" key to return to the PRU setting screen.

7.5.2 MR-PRU03 parameter unit setting



Note. Press the "SHIFT" key and "ESC" key together on any screen to return to the station number setting screen.

7.5.3 Monitor mode (status display)

(1) Monitor display

The servo status during operation is shown on the display. Refer to (2) in this section for details.

MON

Item	Display (line 1)	Display (line 2)	Unit
1. Current position	Cur posit #00	0.004	mm
2. Command position	Cmd posit #00	0.000	mm
3. Command remaining distance	Cmd remin #00	0.000	mm
4. Point table No.	Pnttbl No #00	0	
5. Cumulative feedback pulses	Pulse F/B #00	3	pulse
6. Servo motor speed	Speed F/B #00	0	r/min
7. Droop pulses	Droop Pls #00	0	pulse
8. Override voltage	Override #00	10.66	volt
9. Override	Override #00	100	%
10. Analog torque limit voltage	Trq Limit #00	1.26	volt
11. Regenerative load ratio	Regn Load #00	0	%
12. Effective load ratio	Effc Load #00	0	%
13. Peak load ratio	Peak Load #00	0	%
14. Instantaneous torque	Instn Trq #00	0	%
15. Within one-revolution position	Cyc posit #00	109549	pulse
16. ABS counter	Abs count #00	− 1	rev
17. Load inertia moment ratio	Moment Rt #00	0.8	
18. Bus voltage	P−N Volt #00	296	volt
19. For manufacturer setting	Moni Out1 #00	0.00	volt
20. For manufacturer setting	Moni Out2 #00	0.00	volt
21. For manufacturer setting	ABpls F/B #00	0	pulse

(2) Monitor display list

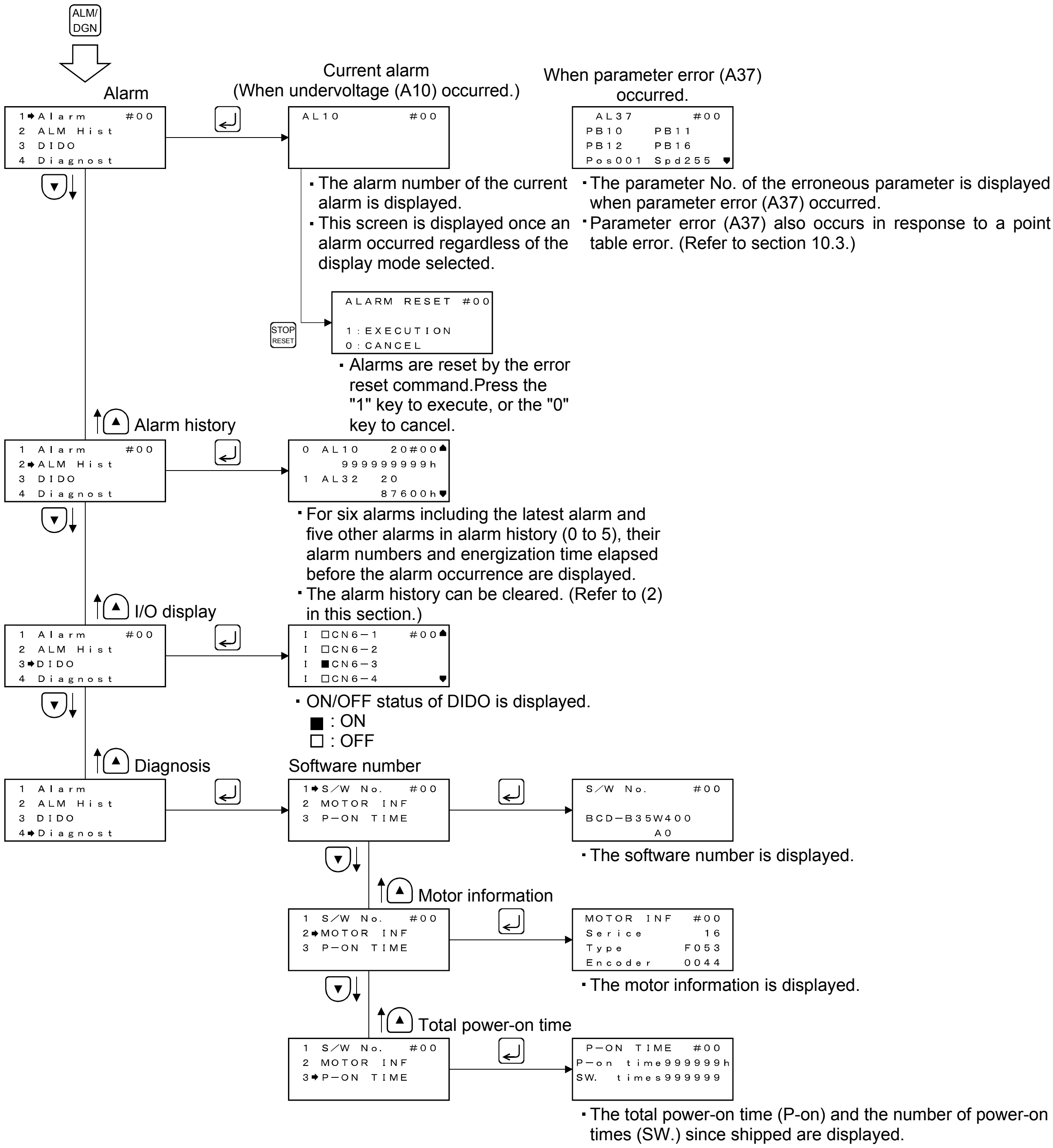
The following table lists the items and descriptions of monitor display.

Status display	Display on parameter unit	Unit	Description	Display range
Current position	Cur posit	$\times 10^{STM}$ mm	The current position from the machine home position of 0 is displayed.	−9999999 to 9999999
Command position	Cmd Posit	$\times 10^{STM}$ mm	The command position is displayed.	−9999999 to 9999999
Command remaining distance	Cmd remin	$\times 10^{STM}$ mm	The command remaining distance of the currently selected point table is displayed.	−999999999 to 999999999
Point table No.	Pnttbl No		The point table No. being executed is displayed.	0 to 255
Cumulative feedback pulses	Pulse F/B	pulse	Feedback pulses from the servo motor encoder are counted and displayed. When the value exceeds ±999999, characters are displayed smaller. Press the "RESET" key of the parameter unit to reset the display value to zero.	−999999999 to 999999999
Servo motor speed	Speed F/B	r/min	The servo motor speed is displayed. "-" is added to the speed of the servo motor rotating in the reverse rotation. The value rounded off is displayed in ×0.1r/min.	−7200 to 7200
Droop pulse	Droop Pls	pulse	The number of droop pulses in the deviation counter is displayed. "- " is added to the reverse pulses. When the value exceeds ±999999, characters are displayed smaller. The number of pulses displayed is in the encoder pulse unit.	−999999999 to 999999999
Override voltage	Override	V	The input voltage of the override is displayed.	−10.00 to 10.00
Override	Override	%	The override setting is displayed. 100% is displayed when override is invalid.	0 to 200
Analog torque limit voltage	u	V	The voltage of the Analog torque limit is displayed.	0.00 to 10.00
Regenerative load ratio	Regn Load	%	The ratio of regenerative power to permissible regenerative power is displayed in %. When regenerative option is used, the ratio to the permissible regenerative power is displayed.	0 to 100
Effective load ratio	Effc Load	%	The continuous effective load current is displayed The effective value is displayed relative to the rated current of 100%.	0 to 300
Peak load ratio	Peak Load	%	The maximum torque is displayed. The highest value in the past 15 seconds is displayed relative to the rated torque of 100%.	0 to 400
Instantaneous torque	Instn Trq	%	Torque that occurred instantaneously is displayed. The value of the torque that occurred is displayed in real time relative to the rate torque of 100%.	0 to 400
Within one-revolution position	Cyc posit	pulse	Position within one revolution is displayed in encoder pulses. The value returns to 0 when it exceeds the maximum number of pulses. The value is incremented in the CCW direction of rotation.	0 to 262143
ABS counter	Abs count	rev	Travel value from the home position in the absolute position detection systems is displayed in terms of the absolute position detectors counter value.	−32768 to 32767
Load inertia moment ratio	Moment Rt	times	The estimated ratio of the load inertia moment to the servo motor shaft inertia moment is displayed.	0.0 to 300.0
Bus voltage	P-N Volt	V	The voltage (across P-N or P+ - N−) of the main circuit converter is displayed.	0 to 900

7.5.4 Alarm/diagnostic mode

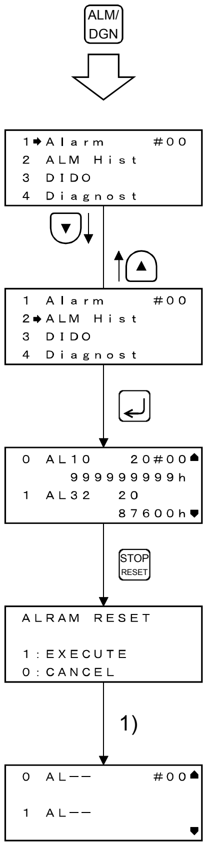
(1) Alarm display

The flowchart below shows the procedure of settings involving alarms, alarm history, external I/O signal (DIDO) display, device and diagnosis.



(2) Alarm history clear

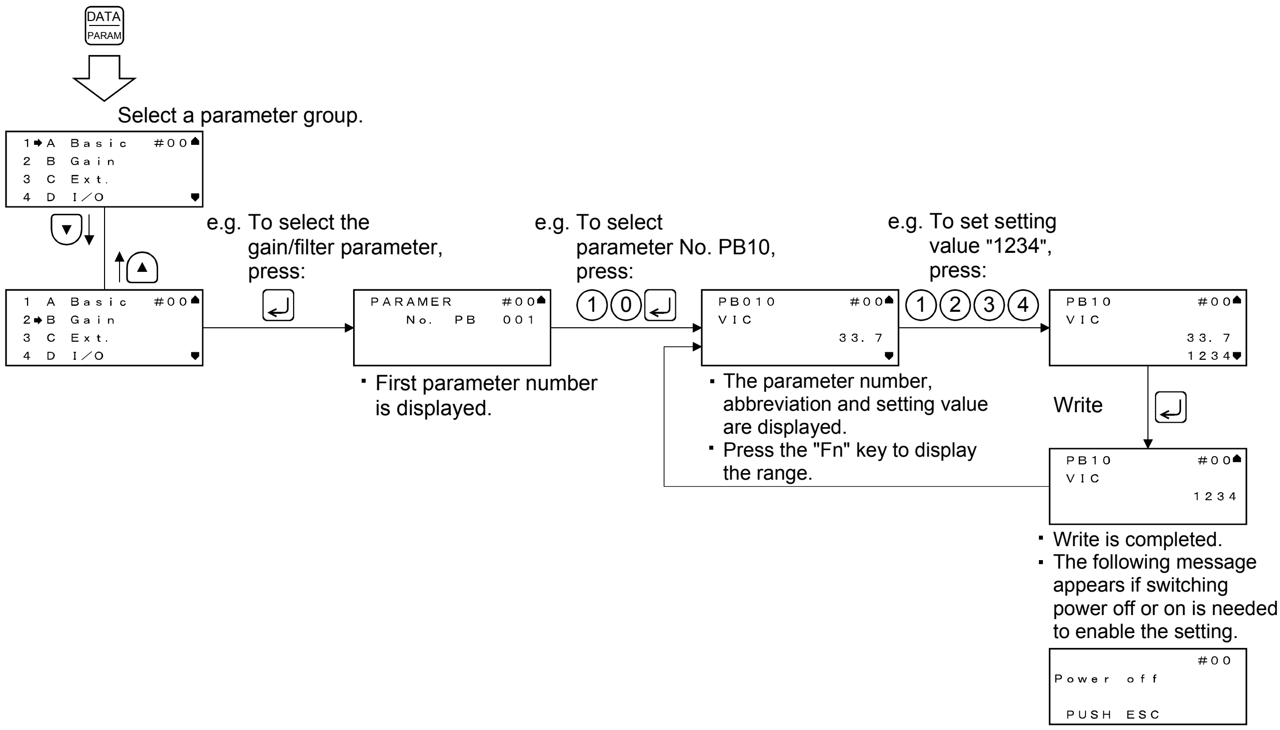
The servo amplifier stores one current alarm and five past alarms from when its power is switched on first. To control alarms which will occur during operation, clear the alarm history before starting operation.



- Select "ALM Hist".
- For six alarms including the latest alarm and five other alarms in alarm history (0 to 5), their alarm numbers and energization time elapsed before the alarm occurrence are displayed.
- The alarm history clear menu is displayed.
- Select "1" to clear the alarm history.

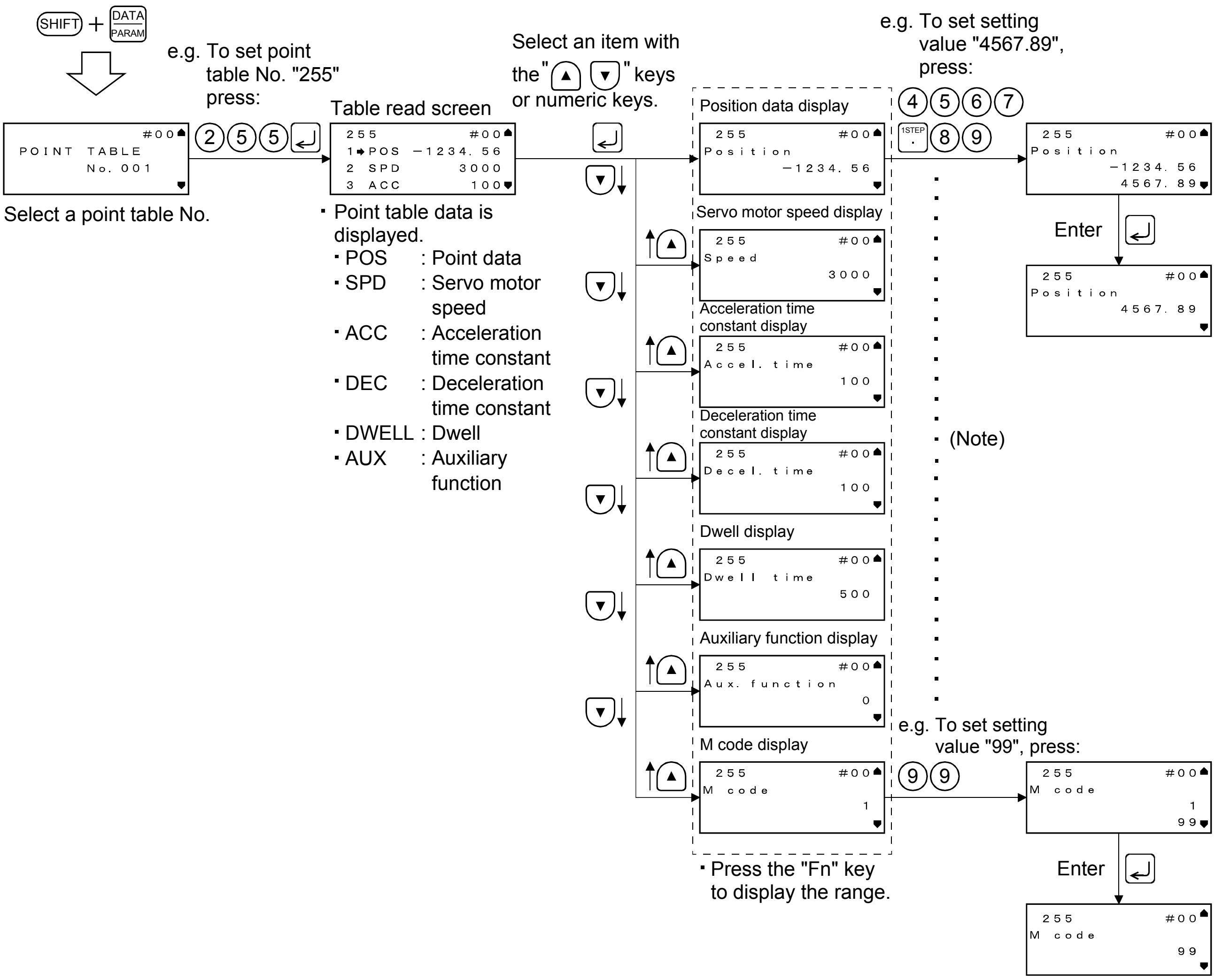
7.5.5 Parameter mode

The flowchart below shows the procedure for setting parameters.



7.5.6 Point table mode

The flowchart below shows the procedure for setting point table data.



Note. This applies to all types of data.

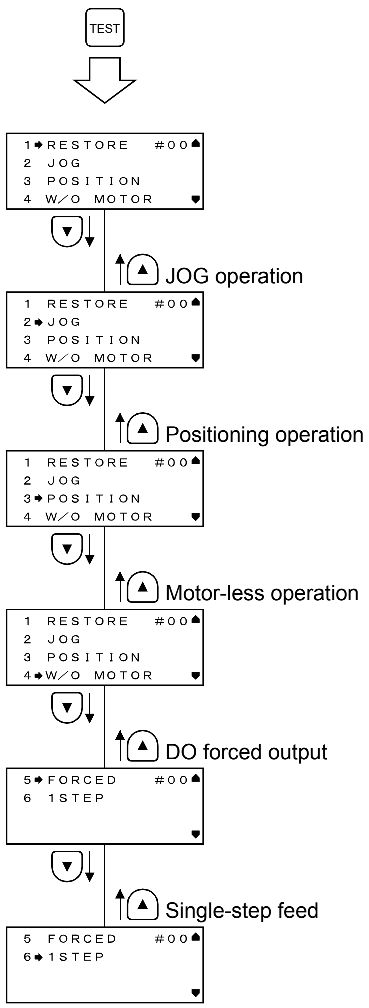
7.5.7 Test operation mode

CAUTION	
⚠ CAUTION	・When confirming the machine operation in the test operation mode, use the machine after checking that the safety mechanism such as the forced stop (EMG) operates. ・If any operational fault has occurred, stop operation using the forced stop (EMG).

POINT

- Test operation cannot be performed if the servo-on signal is not turned OFF.

Exiting test/JOG operation/positioning operation/motor-less operation/DO forced stop/single-step feed can be performed in this mode. The following shows how to set each operation.
When the servo motor equipped with electromagnetic brake is used, make sure to program a sequence circuit which will operate the electromagnetic brake by the servo amplifier electromagnetic brake interlock (MBR).



(1) Jog operation

Jog operation can be performed when there is no command from the external command device.
Connect EMG-DOCOM to start jog operation.

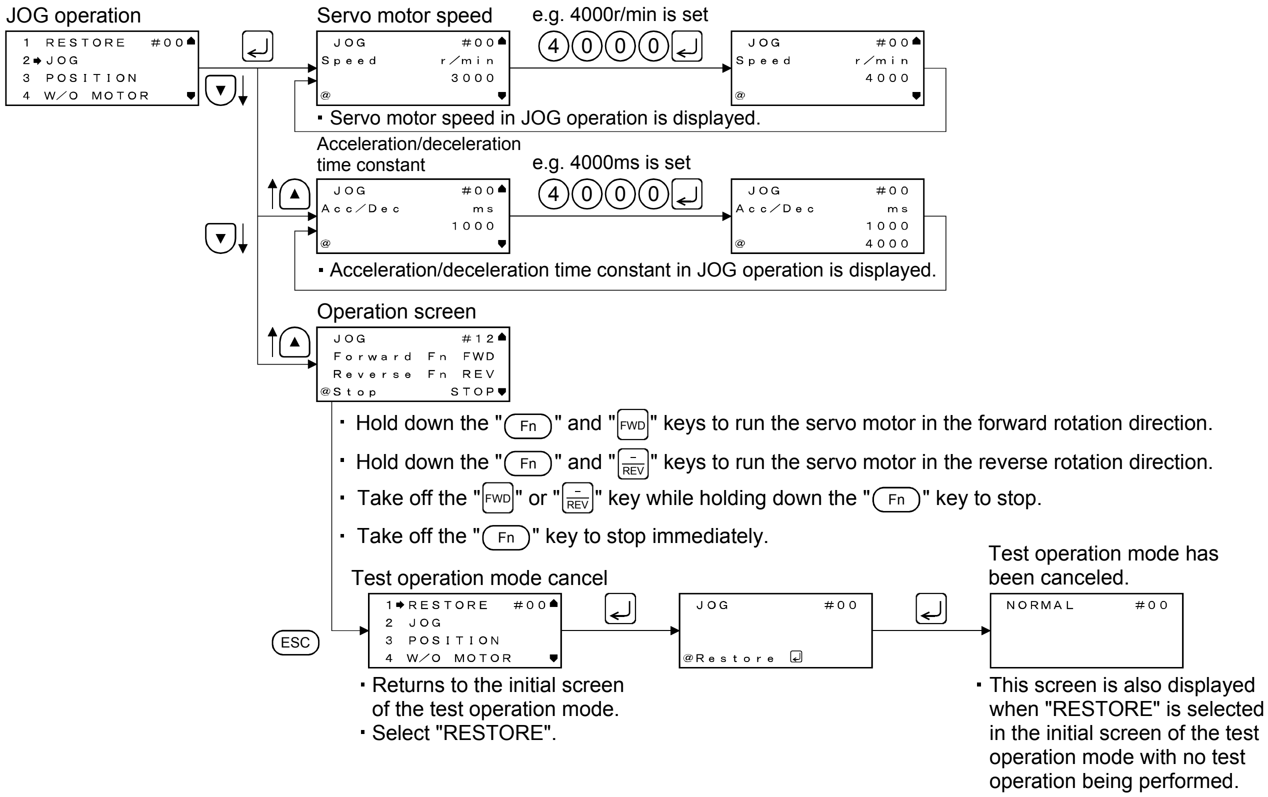
(a) Operation/cancel

You can change the operation conditions with the parameter unit. The initial conditions and setting ranges for operation are listed below.

Item	Initial setting	Setting range
Speed [r/min]	200	0 to instantaneous permissible speed
(Note) Acceleration/deceleration time constant [ms]	1000	0 to 20000

Note. Acceleration time constant refers to time required to reach the rated speed from stop status (0r/min), and deceleration time constant refers to time required to reach 0r/min from the rated speed.

The following shows the operation condition settings and the operation procedures.



If the parameter unit cable is disconnected during jog operation, the servo motor will be decelerated to a stop.

To switch from the test operation mode to the usual operation mode, turn OFF the power of the servo amplifier.

(b) Status display

You can monitor the status display even during JOG operation. At this time, the "FWD", "REV" and "STOP" keys can be used.

(2) Positioning operation

Positioning operation can be performed once when there is no command from the external command device.

Connect EMG-DOCOM to start positioning operation.

(a) Operation/cancel

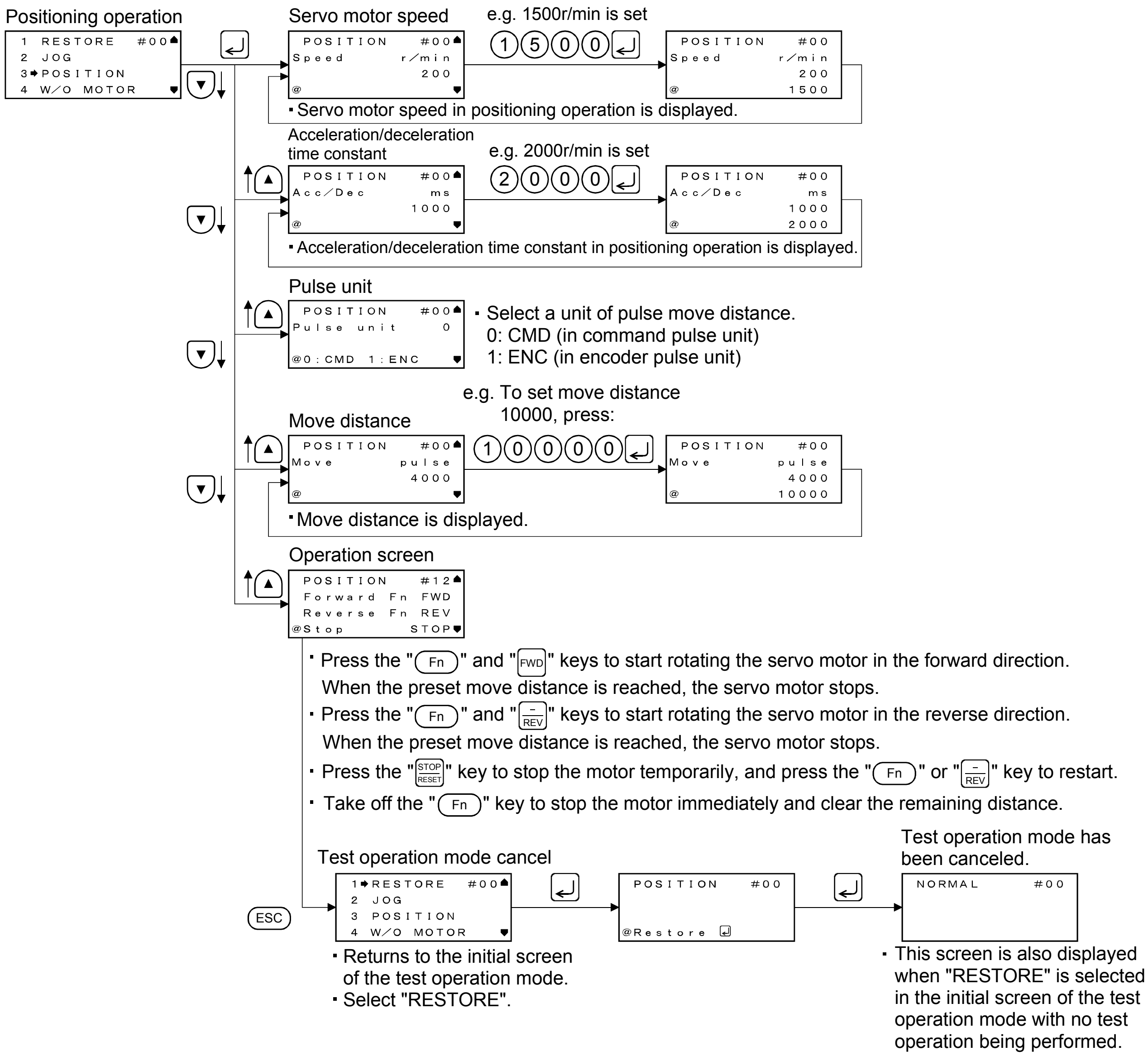
You can change the operation conditions with the parameter unit. The initial conditions and setting ranges for operation are listed below.

Item	Initial setting	Setting range
Speed [r/min]	200	0 to instantaneous permissible speed
(Note 2) Acceleration/deceleration time constant [ms]	1000	0 to 20000
(Note 1) Travel distance [pulse]	4000	0 to 99999999

Note 1. The unit of move distance can be changed using feed length multiplication factor selection of parameter No. PA05.

2. Acceleration time constant refers to time required to reach the rated speed from stop status (0r/min), and deceleration time constant refers to time required to reach 0r/min from the rated speed.

The following shows the operation condition settings and the operation procedures.

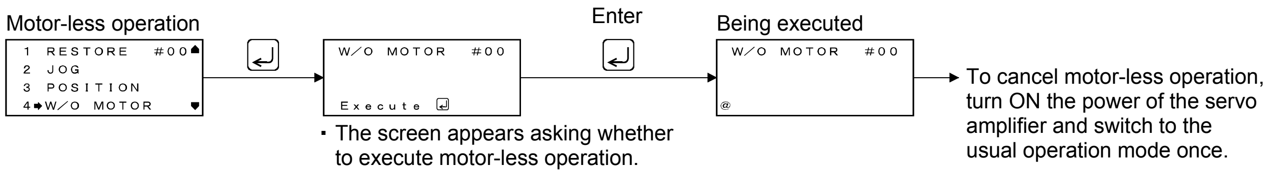


If the communication cable is disconnected during positioning operation, the servo motor will come to a sudden stop.
To switch from the test operation mode to the usual operation mode, turn OFF the power of the servo amplifier.

(b) Status display
You can monitor the status display even during positioning operation. At this time, the "FWD", "REV" and "STOP" keys can be used.

(3) Motor-less operation
Without connecting the servo motor, you can provide output signals or monitor the status display as if the servo motor is running in response to external input devices. This operation can be used to check the sequence of a programmable controller or the like.

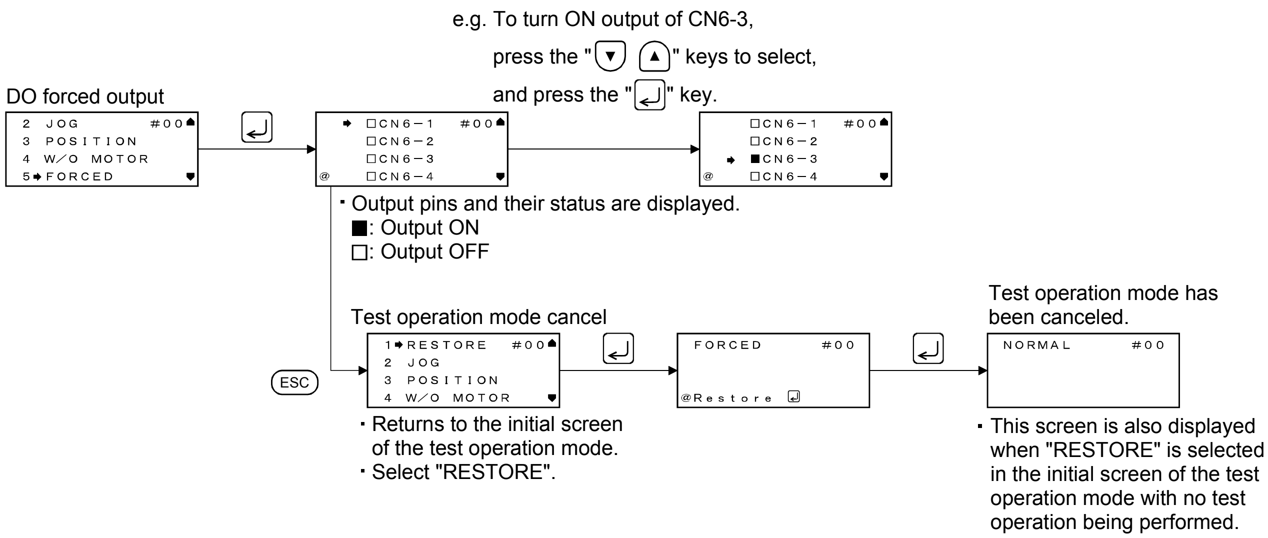
(a) Operation/cancel
After turning off the SON signal, choose motor-less operation. After that, perform external operation as in ordinary operation.
The following shows the operation procedures.



To switch from the test operation mode to the usual operation mode, turn OFF the power of the servo amplifier.

(b) Status display
You can monitor the status display even during motor-less operation.

(4) DO forced output
Each output signal can be forced on/off independently of the servo status. This function is used for the servo wiring check, etc.
Connect EMG-DOCOM to start DO forced output.
The following shows the operation procedures.



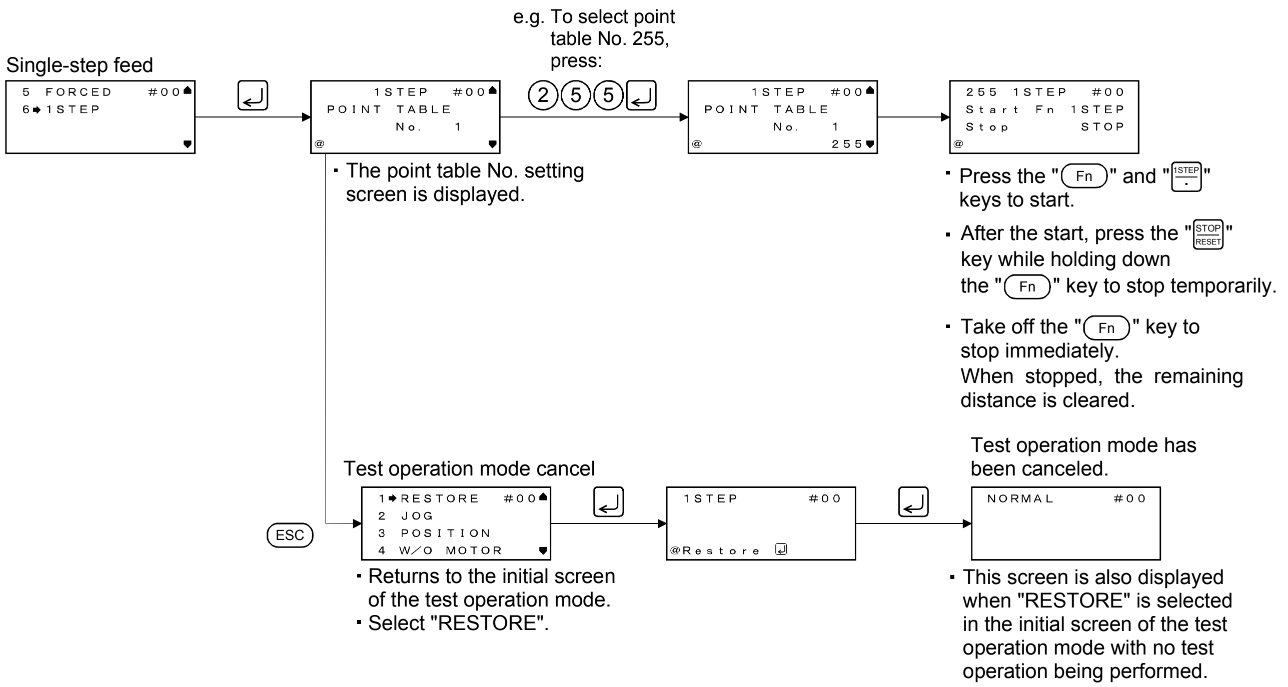
To switch from the test operation mode to the usual operation mode, turn OFF the power of the servo amplifier.

(5) Single-step feed

Operation is performed in accordance with the preset point table No.

Connect EMG-DOCOM to start single-step feed.

The following shows the operation condition settings and the operation procedures.



To switch from the test operation mode to the usual operation mode, turn OFF the power of the servo amplifier.

7.6 Error message list

When using the MR-PRU03 parameter unit, the following error messages may be displayed. When displayed, refer to this section to remove cause.

(1) Error messages

Operation	Message	Cause
Communication error	#00 COMMUNICATION ERROR PUSH ESC	1. Hardware reason 2. Mismatch in station number 3. Mismatch in baud rate
Setting error	PB10 #00 VIC 1234 INPUT ERR.	Incorrect input, etc.
Write error	PB10 #00 VIC 1234 WRITE ERR.	Value is written while write is disabled.
EEP-ROM write error	#00 EEPROM ERR. PUSH ESC	1. Parts in the MR-PRU03 parameter unit are faulty. 2. EEP-ROM built in the MR-PRU03 parameter unit has been overwritten more than 100000 times.

(2) Messages

Message	Description
#00 Power off PUSH ESC	Valid parameters were written when power is off.
#00 DO NOT CHANGE STATION NO PUSH ESC	The MR-PRU03 parameter unit was used to set a station number and perform transition during the test operation mode.
#00 SET TEST DRIVE DIFFER PUSH ESC	Operation mode is the test operation mode.
#00 TEST MODE CHANGED PUSH ESC	The test mode was changed due to external factor.
#00 DO NOT READ PARAMETER PUSH ESC	Reading settings specified for the parameter write disable (parameter No. PA19) was attempted.
TEST DRIVE ON PUSH ESC	In the test operation, the "ESC" key was pressed while the "Fn" key was held down to switch the screen to the MR-PRU03 parameter unit setting screen.
SERVO NOT READY PUSH ESC	The ready cannot be turned ON due to alarm, etc.
#12 SON ON PUSH ESC	Operation mode can be switched to the test operation mode at servo-on.
#12 DO NOT CHANGE STATION NO PUSH ESC	Station number change was attempted in the test operation mode.
#12 DO NOT WRITE BLOCK NUMBER PUSH ESC	Point table No. change was attempted in the single-step feed operation.

8. GENERAL GAIN ADJUSTMENT

8.1 Different adjustment methods

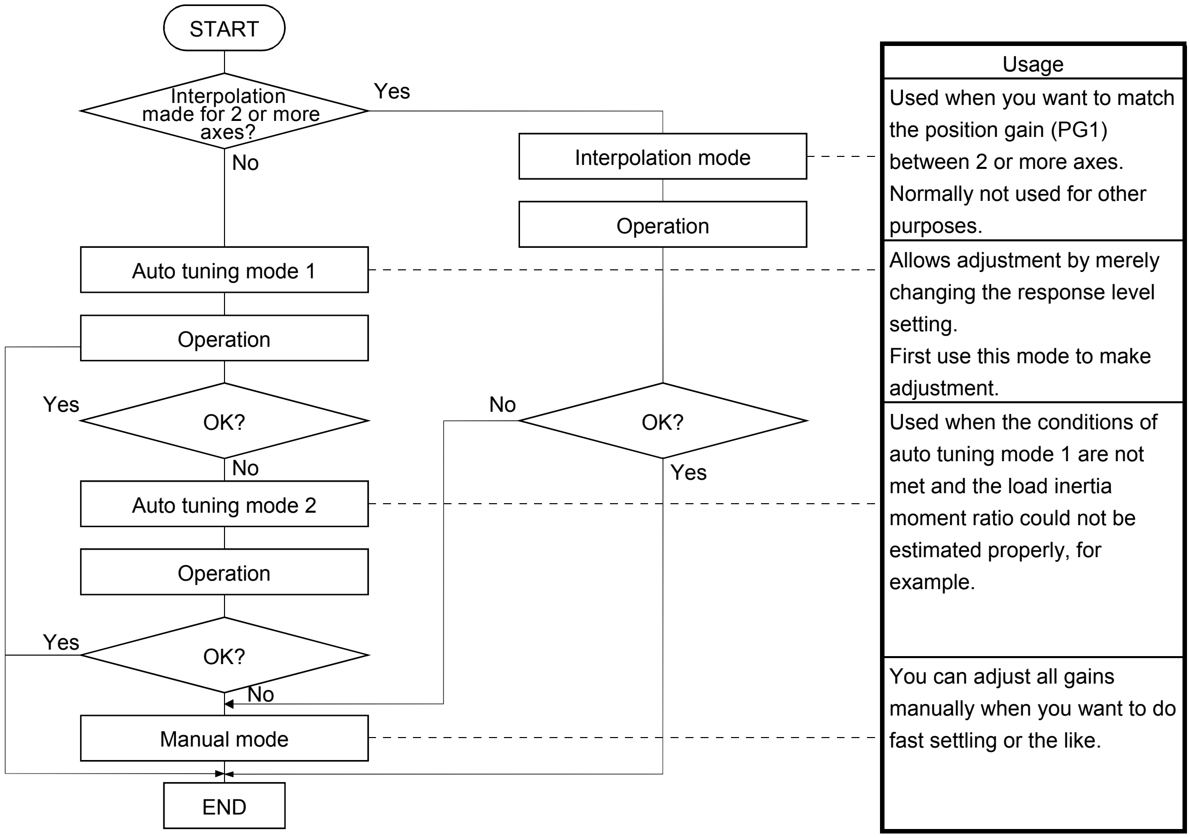
8.1.1 Adjustment on a single servo amplifier

The gain adjustment in this section can be made on a single servo amplifier. For gain adjustment, first execute auto tuning mode 1. If you are not satisfied with the results, execute auto tuning mode 2 and manual mode in this order.

(1) Gain adjustment mode explanation

Gain adjustment mode	Parameter No. PA08 setting	Estimation of load inertia moment ratio	Automatically set parameters	Manually set parameters
Auto tuning mode 1 (initial value)	0001	Always estimated	GD2 (parameter No. PB06) PG2 (parameter No. PB08) PG1 (parameter No. PB07) VG2 (parameter No. PB09) VIC (parameter No. PB10)	Response level setting of parameter No. 2
Auto tuning mode 2	0002	Fixed to parameter No. PB06 value	PG2 (parameter No. PB08) PG1 (parameter No. PB07) VG2 (parameter No. PB09) VIC (parameter No. PB10)	GD2 (parameter No. PB06) Response level setting of parameter No. PA09
Manual mode	0003			PG1 (parameter No. PB07) GD2 (parameter No. PB06) VG2 (parameter No. PB09) VIC (parameter No. PB10)
Interpolation mode	0000	Always estimated	GD2 (parameter No. PB06) PG2 (parameter No. PB08) VG2 (parameter No. PB09) VIC (parameter No. PB10)	PG1 (parameter No. PB07)

(2) Adjustment sequence and mode usage



8.1.2 Adjustment using MR Configurator

This section gives the functions and adjustment that may be performed by using the servo amplifier with the MR Configurator which operates on a personal computer.

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 the 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. ・You can automatically set the optimum gains in response to the machine characteristic. This simple adjustment is suitable for a machine which has large machine resonance and does not require much settling time.
Gain search	Executing gain search under to-and-fro positioning command measures settling characteristic while simultaneously changing gains, and automatically searches for gains which make settling time shortest.	・You can automatically set gains which make positioning settling time shortest.
Machine simulation	Response at positioning settling of a machine can be simulated from machine analyzer results on personal computer.	・You can optimize gain adjustment and command pattern on personal computer.

8.2 Auto tuning

8.2.1 Auto tuning mode

The servo amplifier has a real-time auto tuning function which estimates the machine characteristic (load inertia moment 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 inertia moment 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 No.	Abbreviation	Name
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
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 the following conditions are not satisfied.
- Time to reach 2000r/min is the acceleration/deceleration time constant of 5s or less.
- Speed is 150r/min or higher.
- The ratio of load inertia moment to servo motor inertia moment 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

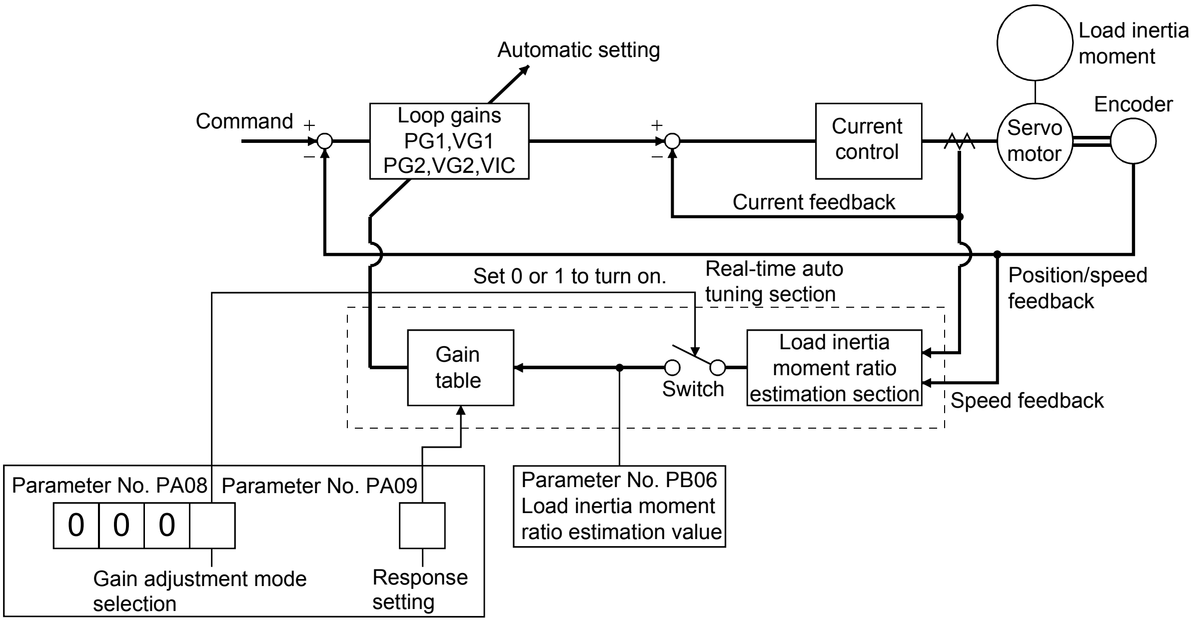
Use the auto tuning mode 2 when proper gain adjustment cannot be made by auto tuning mode 1. Since the load inertia moment ratio is not estimated in this mode, set the value of a correct load inertia moment ratio (parameter No. PB06).

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

Parameter No.	Abbreviation	Name
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

8.2.2 Auto tuning mode operation

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

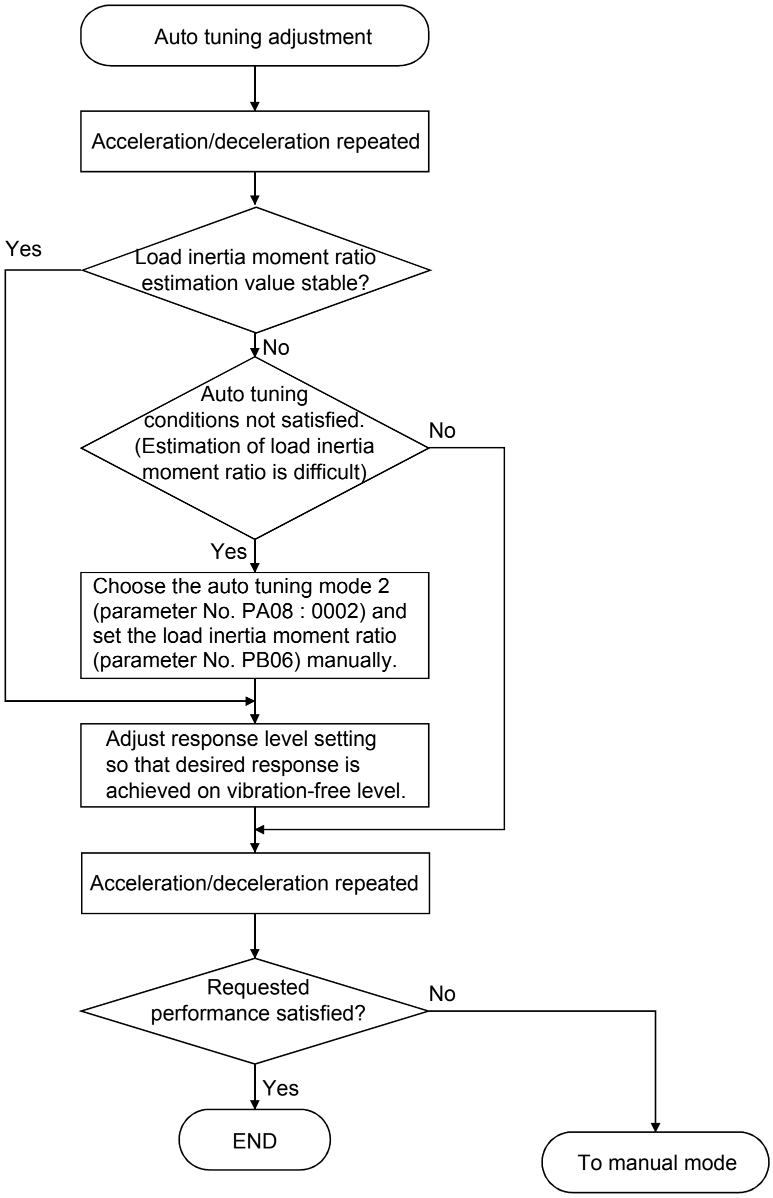


When a servo motor is accelerated/decelerated, the load inertia moment ratio estimation section always estimates the load inertia moment ratio from the current and speed of the servo motor. The results of estimation are written to parameter No. PB06 (the ratio of load inertia moment to servo motor). These results can be confirmed on the status display screen of the MR Configurator section.
If the value of the load inertia moment ratio is already known or if estimation cannot be made properly, chose the "auto tuning mode 2" (parameter No. PA08: 0002) to stop the estimation of the load inertia moment ratio (Switch in above diagram turned off), and set the load inertia moment ratio (parameter No. 34) manually.
From the preset load inertia moment ratio (parameter No. PB06) value and response level (parameter No. PA09), the optimum loop gains are automatically set on the basis of the internal gain tale.
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 estimation of the inertia moment ratio may malfunction temporarily. In such a case, choose the "auto tuning mode 2" (parameter No. PA08: 0002) and set the correct load inertia moment ratio in parameter No. 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 inertia moment ratio estimation value are saved in the EEP-ROM.

8.2.3 Adjustment procedure by auto tuning

Since auto tuning is made valid 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.

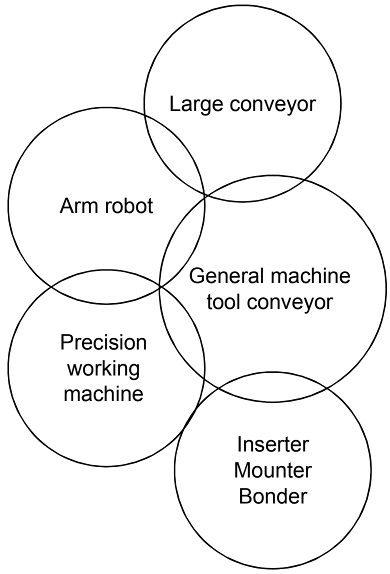


8.2.4 Response level setting in auto tuning mode

Set the response (The first digit of parameter No. PA09) of the whole servo system. 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 100Hz, filter tuning mode (parameter No. PB01) or machine resonance suppression filter (parameter No. PB13 to PB16) may be used to suppress machine resonance. Suppressing machine resonance may allow the response level setting to increase. Refer to section 9.3 for filter tuning mode and machine resonance suppression filter.

Setting of parameter No. PA09

Response level setting	Machine characteristic		
	Machine rigidity	Machine resonance frequency guideline	Guideline of corresponding machine
1	Low	10.0	
2		11.3	
3		12.7	
4		14.3	
5		16.1	
6		18.1	
7		20.4	
8		23.0	
9		25.9	
10		29.2	
11		32.9	
12		37.0	
13		41.7	
14		47.0	
15		52.9	
16	Middle	59.6	
17		67.1	
18		75.6	
19		85.2	
20		95.9	
21		108.0	
22		121.7	
23		137.1	
24		154.4	
25		173.9	
26		195.9	
27		220.6	
28		248.5	
29		279.9	
30		315.3	
31		355.1	
32	High	400.0	



8.3 Manual mode 1 (simple manual adjustment)

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 (parameter No. PB01) or machine resonance suppression filter (parameter No. PB13 to PB16) may be used to suppress machine resonance. (Refer to section 9.1.)

(1) For speed control

(a) Parameters

The following parameters are used for gain adjustment.

Parameter No.	Abbreviation	Name
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
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 8.2.3.	
2	Change the setting of auto tuning to the manual mode (Parameter No.PA08: 0003).	
3	Set an estimated value to the ratio of load inertia moment to servo motor inertia moment. (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 overshooting 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 filter tuning mode or machine resonance suppression filter and then executing steps 2 and 3.	Suppression of machine resonance. Refer to section 9.2, 9.3.
9	While checking the settling characteristic and rotational status, fine-adjust each gain.	Fine adjustment

(c) Adjustment description

1) Speed loop gain (parameter No. PB09)

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.

$$\text{Speed loop response frequency(Hz)} = \frac{\text{Speed loop gain setting}}{(1+\text{ratio of load inertia moment to servo motor inertia moment})\times 2\pi}$$

2) Speed integral compensation (VIC: parameter No. PB10)

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 inertia moment ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

$$\text{Speed integral compensation setting(ms)} \geq \frac{\text{2000 to 3000}}{\text{Speed loop gain setting/ }(1+\text{ratio of load inertia moment to servo motor inertia moment setting}\times 0.1)}$$

3) Model loop gain (PG1: Parameter No.PB07)

This parameter determines the response level to a position command. Increasing the model loop gain improves track ability to a position command, but a too high value will make overshooting liable to occur at the time of setting.

$$\text{Model loop gain guideline} \leq \frac{\text{Speed loop gain setting}}{(1+\text{ratio of load inertia moment to servo mortar inertia moment})} \times \left(\frac{1}{4} \text{ to } \frac{1}{8}\right)$$

(2) For position control

(a) Parameters

The following parameters are used for gain adjustment.

Parameter No.	Abbreviation	Name
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
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 8.2.3.	
2	Change the setting of auto tuning to the manual mode (Parameter No.PA08: 0003).	
3	Set an estimated value to the ratio of load inertia moment to servo motor inertia moment. (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 overshooting takes place.	Increase the position 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 filter tuning mode or machine resonance suppression filter and then executing steps 3 to 5.	Suppression of machine resonance. Refer to section 9.2, 9.3.
10	While checking the settling characteristic and rotational status, fine-adjust each gain.	Fine adjustment

(c) Adjustment description

1) Speed loop gain (VG2: parameter No. PB09)

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.

$$\text{Speed loop response frequency(Hz)} = \frac{\text{Speed loop gain 2 setting}}{(1+\text{ratio of load inertia moment to servo motor inertia moment}) \times 2\pi}$$

2) Speed integral compensation (VIC: parameter No. PB10)

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 inertia moment ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

$$\text{Speed integral compensation setting(ms)} \geq \frac{\text{2000 to 3000}}{\text{Speed loop gain 2 setting/ (1+ratio of load inertia moment to servo motor inertia moment 2 setting)}}$$

3) Model loop gain (PG1: Parameter No.PB07)

This parameter determines the response level to a position command. Increasing the model loop gain improves track ability to a position command, but a too high value will make overshooting liable to occur at the time of setting.

$$\text{Model loop gain guideline} \leq \frac{\text{Speed loop gain setting}}{(1+\text{ratio of load inertia moment to servo mortar inertia moment})} \times \left(\frac{1}{4} \text{ to } \frac{1}{8}\right)$$

4) Model loop gain (PG1: parameter No. PB07)

This parameter determines the response level to a position command. Increasing position loop gain 1 improves track ability to a position command but a too high value will make overshooting liable to occur at the time of settling.

$$\text{Model loop gain guideline} \leq \frac{\text{Speed loop gain 2 setting}}{(1+\text{ratio of load inertia moment to servo motor inertia moment})} \times \left(\frac{1}{4} \text{ to } \frac{1}{8}\right)$$

8.4 Interpolation mode

The interpolation 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) Parameter

(a) Automatically adjusted parameters

The following parameters are automatically adjusted by auto tuning.

Parameter No.	Abbreviation	Name
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Manually adjusted parameters

The following parameters are adjustable manually.

Parameter No.	Abbreviation	Name
PB07	PG1	Model loop gain

(2) Adjustment procedure

Step	Operation	Description
1	Set to the auto tuning mode.	Select the auto tuning mode 1.
2	During operation, increase the response level setting (parameter No. PA09), and return the setting if vibration occurs.	Adjustment in auto tuning mode 1.
3	Check the values of model loop gain.	Check the upper setting limits.
4	Set the interpolation mode (parameter No. PA08: 0000).	Select the interpolation mode.
5	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.
6	Looking at the interpolation characteristic and rotation status, fine-adjust the gains and response level setting.	Fine adjustment.

(3) Adjustment description

(a) Model loop gain (parameter No. PB07)

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

$$\text{Droop pulse value (pulse)} = \frac{\dfrac{\text{Rotation speed (r/min)}}{60} \times 262144\text{(pulse)}}{\text{Model loop gain setting}}$$

8.5 Differences between MELSERVO-J2-Super and MELSERVO-J3 in auto tuning

To meet higher response demands, the MELSERVO-J3 series has been changed in response level setting range from the MR-J2-Super. The following table lists comparison of the response level setting.

MELSERVO-J2-Super		MELSERVO-J3	
Parameter No. 3 Setting	Guideline for Machine Resonance Frequency [Hz]	Parameter No. PA09 Setting	Guideline for Machine Resonance Frequency [Hz]
		1	10.0
		2	11.3
		3	12.7
□□□1	15	4	14.3
		5	16.1
		6	18.1
□□□2	20	7	20.4
		8	23.0
□□□3	25	9	25.9
□□□4	30	10	29.2
		11	32.9
□□□5	35	12	37.0
		13	41.7
□□□6	45	14	47.0
□□□7	55	15	52.9
		16	59.6
□□□8	70	17	67.1
		18	75.6
□□□9	85	19	85.2
		20	95.9
□□□A	105	21	108.0
		22	121.7
□□□B	130	23	137.1
□□□C	160	24	154.4
		25	173.9
□□□D	200	26	195.9
		27	220.6
□□□E	240	28	248.5
		29	279.9
□□□F	300	30	315.3
		31	355.1
		32	400.0

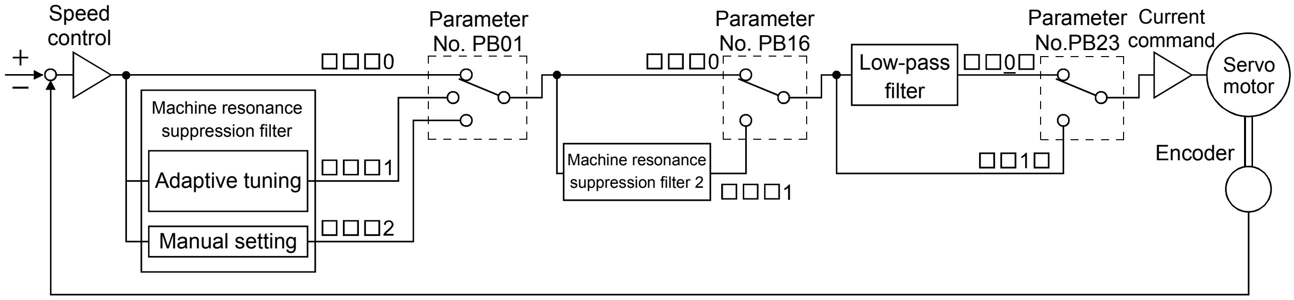
Note that because of a slight difference in gain adjustment pattern, response may not be the same if the resonance frequency is set to the same value.

9. SPECIAL ADJUSTMENT FUNCTIONS

POINT
・The functions given in this chapter need not be used generally. Use them if you are not satisfied with the machine status after making adjustment in the methods in chapter 9.

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.

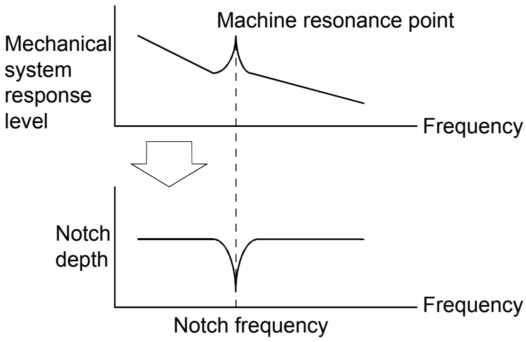
9.1 Function block diagram



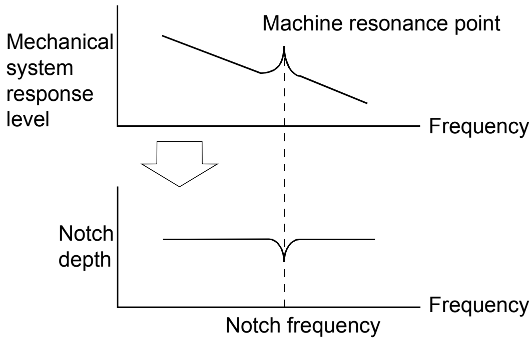
9.2 Adaptive filter Ⅱ

(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

POINT
・The machine resonance frequency which adaptive tuning mode can respond to is about 100 to 2.25kHz. Adaptive vibration suppression control has no effect on the resonance frequency outside this range. ・Adaptive vibration suppression control may provide no effect on a mechanical system which has complex resonance characteristics.

(2) Parameters

The operation of adaptive tuning mode (parameter No. PB01).

Parameter No.PB01

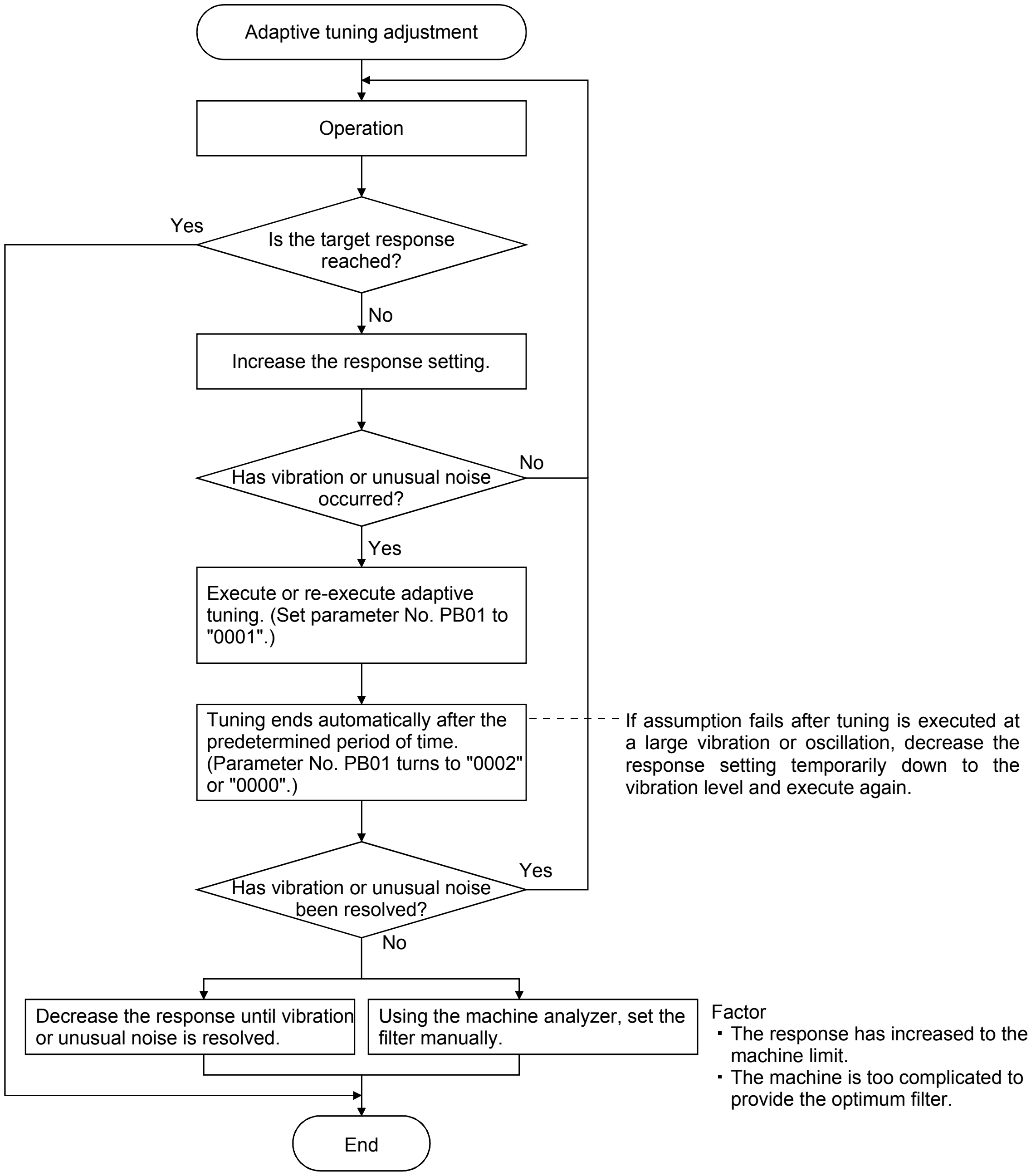
0	0	0	

Filter tuning mode selection

Setting	Filter adjustment mode	Automatically set parameter
0	Filter OFF	(Note)
1	Filter tuning mode	Parameter No. PB13 Parameter No. PB14
2	Manual mode	

Note. Parameter No. PB19 and PB20 are fixed to the initial values.

(3) Adaptive tuning mode procedure

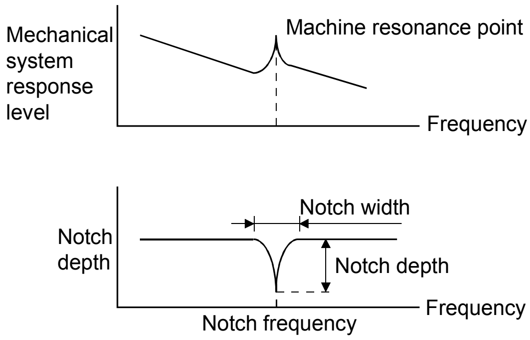


POINT
· "Filter OFF" enables a return to the factory-set initial value. · When adaptive tuning is executed, vibration sound increases as an excitation signal is forcibly applied for several seconds. · When adaptive tuning is executed, machine resonance is detected for a maximum of 10 seconds and a filter is generated. After filter generation, the adaptive tuning mode automatically shifts to the manual mode. · 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 mode.

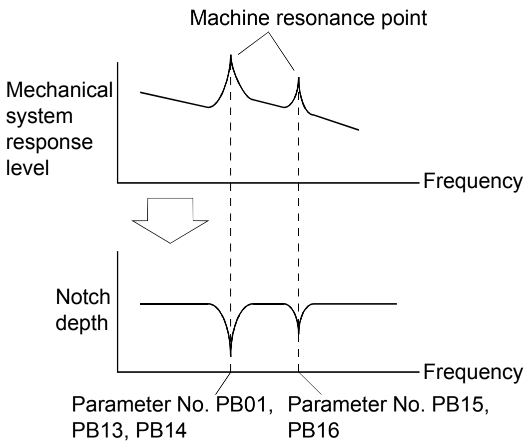
9.3 Machine resonance suppression filter

(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 use the machine resonance suppression filter 1 (parameter No. PB13, PB14) and machine resonance suppression filter 2 (parameter No. PB15, PB16) to suppress the vibration of two resonance frequencies. Execution of adaptive tuning in the filter tuning mode automatically adjusts the machine resonance suppression filter. When adaptive tuning is ON, the adaptive tuning mode shifts to the manual mode after the predetermined period of time. The manual mode enables manual setting using the machine resonance suppression filter 1.



(2) Parameters

(a) Machine resonance suppression filter 1 (parameter No. PB13, PB14)

Set the notch frequency, notch depth and notch width of the machine resonance suppression filter 1 (parameter No. PB13, PB14)

When you have made adaptive filter tuning mode (parameter No. PB01) "manual mode", set up the machine resonance suppression filter 1 becomes effective.

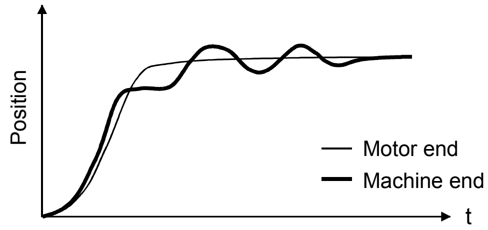
POINT

- The machine resonance suppression filter is a delay factor for the servo system. Hence, vibration may increase if you set a wrong resonance frequency or a too deep notch.
- 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 the MR Configurator. This allows the required notch frequency and depth to be determined.

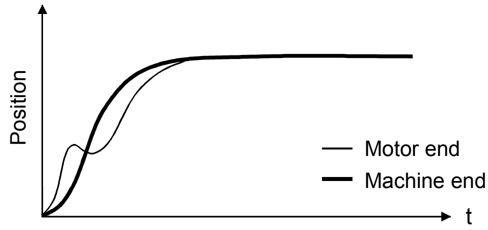
9.4 Advanced vibration suppression control

(1) Operation

Vibration suppression control is used to further suppress machine end vibration, such as workpiece end vibration and base shake. The motor side operation is adjusted for positioning so that the machine does not shake.



Vibration suppression control OFF
(Normal control)



Vibration suppression control ON

When the advanced vibration suppression control (vibration suppression control tuning mode parameter No. PB02) is executed, the vibration frequency at machine end can automatically be estimated to suppress machine end vibration.
In the vibration suppression control tuning mode, this mode shifts to the manual mode after operation is performed the predetermined number of times. The manual mode enables manual setting using the vibration suppression control vibration frequency setting (parameter No. PB19) and vibration suppression control resonance frequency setting (parameter No. PB20).

(2) Parameter

Select the operation of the vibration suppression control tuning mode (parameter No. PB02).

Parameter No. PB02

0	0	0	

Vibration suppression control tuning mode

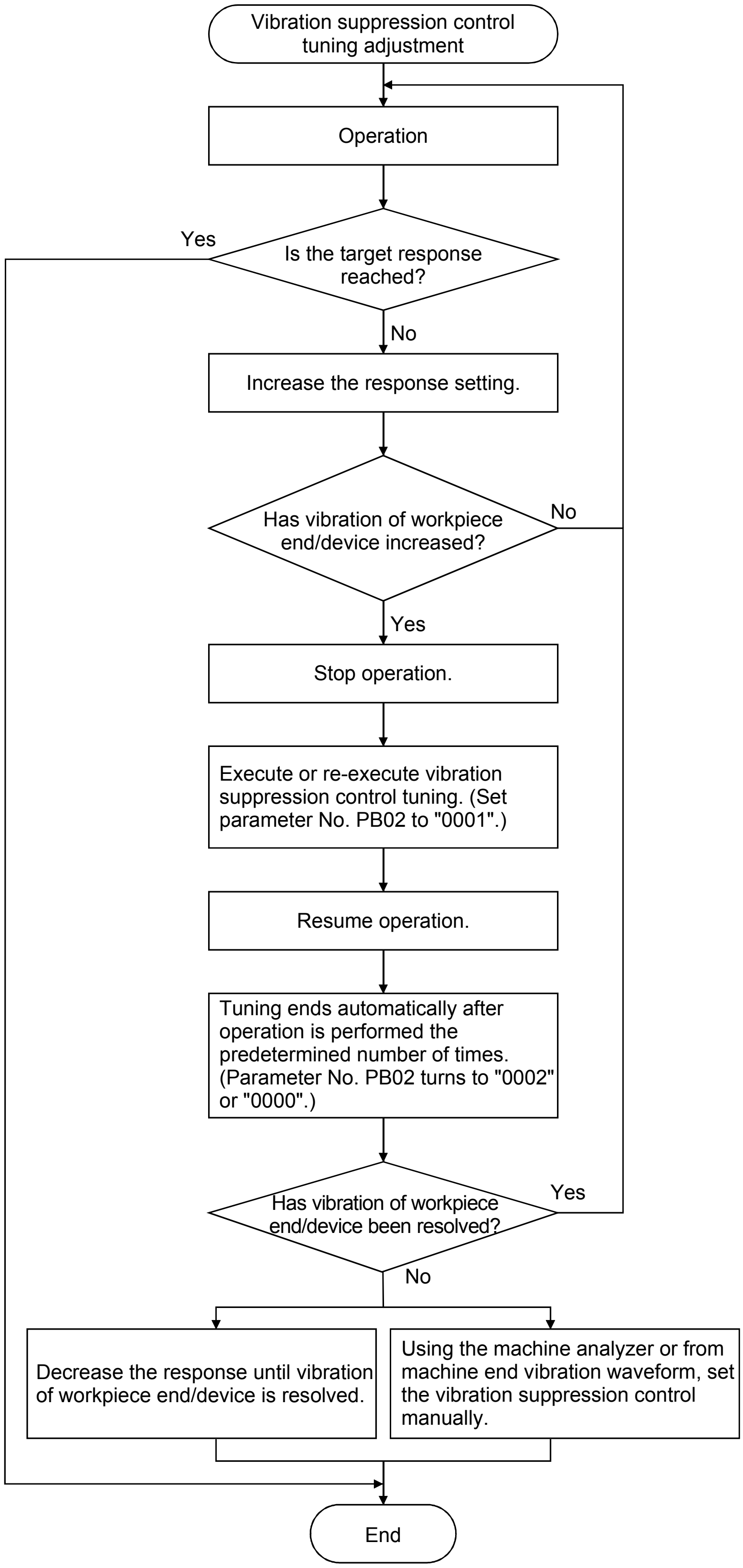
Setting	Vibration Suppression Control Tuning Mode	Automatically Set Parameter
0	Vibration suppression control OFF	(Note)
1	Vibration suppression control tuning mode (Advanced vibration suppression control)	Parameter No. PB19 Parameter No. PB20
2	Manual mode	

Note. Parameter No. PB19 and PB20 are fixed to the initial values.

POINT

- The function is made valid when the auto tuning mode (parameter No. PA08) is the auto tuning mode 2 ("0002") or manual mode ("0003").
- The machine resonance frequency supported in the vibration suppression control tuning mode is 1.0Hz to 100.0Hz. The function is not effective for vibration outside this range.
- Stop the motor before changing the vibration suppression control-related parameters (parameter No. PB02, PB19, PB20, PB33, PB34). A failure to do so will cause a shock.
- For positioning operation during execution of vibration suppression control tuning, provide a stop time to ensure a stop after full vibration damping.
- Vibration suppression control tuning may not make normal estimation if the residual vibration at the motor end 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.

(3) Vibration suppression control tuning mode procedure

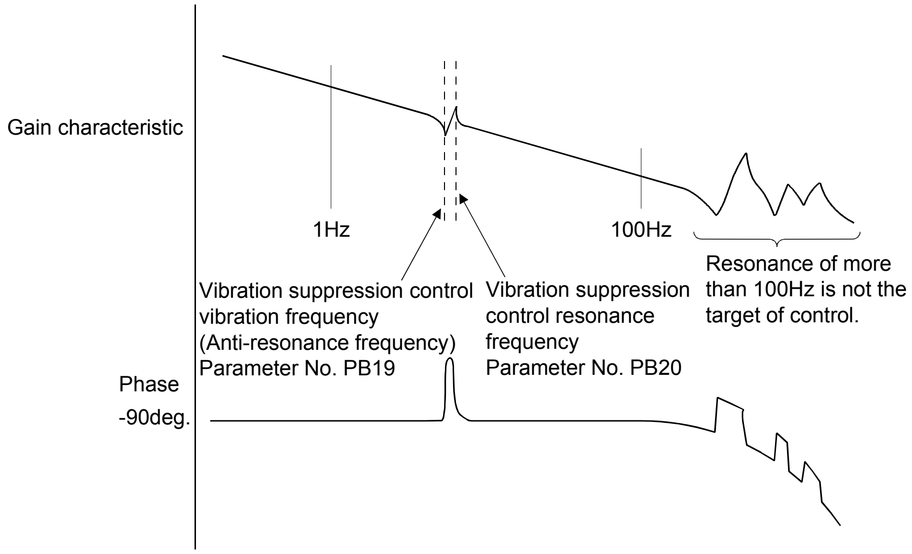


Factor
- Estimation cannot be made as machine end vibration has not been transmitted to the motor end.
- The response of the model loop gain has increased to the machine end vibration frequency (vibration suppression control limit).

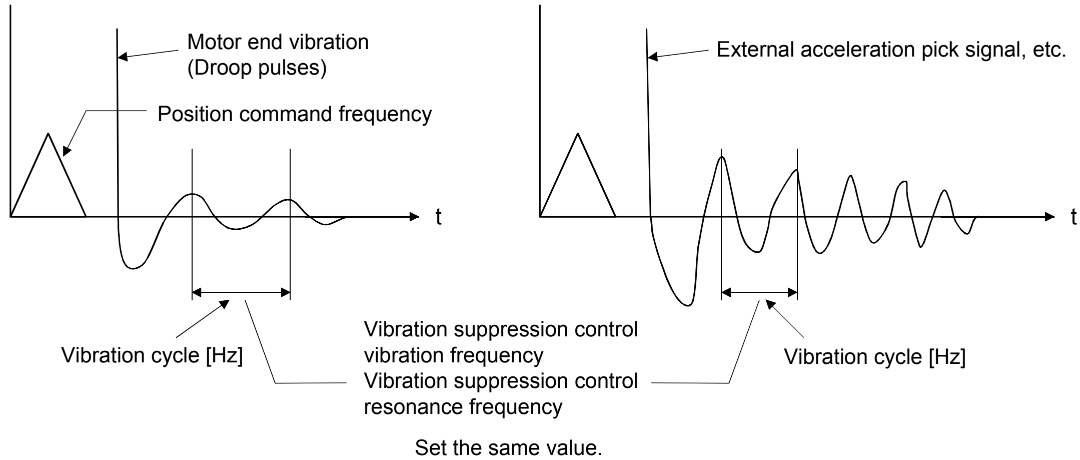
(4) Vibration suppression control manual mode

Measure work end vibration and device shake with the machine analyzer or external measuring instrument, and set the vibration suppression control vibration frequency (parameter No. PB19) and vibration suppression control resonance frequency (parameter No. PB20) to set vibration suppression control manually.

(a) When a vibration peak can be confirmed using MR Configurator, machine analyzer or external FFT equipment



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



POINT

- When machine end vibration does not show up in motor end vibration, the setting of the motor end vibration frequency does not produce an effect.
- When the anti-resonance frequency and resonance frequency can be confirmed using the machine analyzer or external FFT device, do not set the same value but set different values to improve the vibration suppression performance.
- A vibration suppression control effect is not produced if the relationship between the model loop gain (parameter No. PB07) value and vibration frequency is as indicated below. Make setting after decreasing PG1, e.g. reduce the response setting.

$$\frac{1}{2\pi}(1.5\times PG1) > \text{vibration frequency}$$

9.5 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 factory-set to be valid for a torque command. The filter frequency of this low-pass filter is automatically adjusted to the value in the following expression.

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

When parameter No. PB23 is set to " □□ 1 □ ", manual setting can be made with parameter No. PB18.

(2) Parameter

Set the operation of the low-pass filter selection (parameter No. PB23.)

Parameter No. PB23

Low-pass filter selection
0: Automatic setting (initial value)
1: Manual setting (parameter No. PB18 setting)

9.6 Gain changing function

This function can change the gains. You can change between gains during rotation and gains during stop or can use an input device to change gains during operation.

9.6.1 Applications

This function is used when:

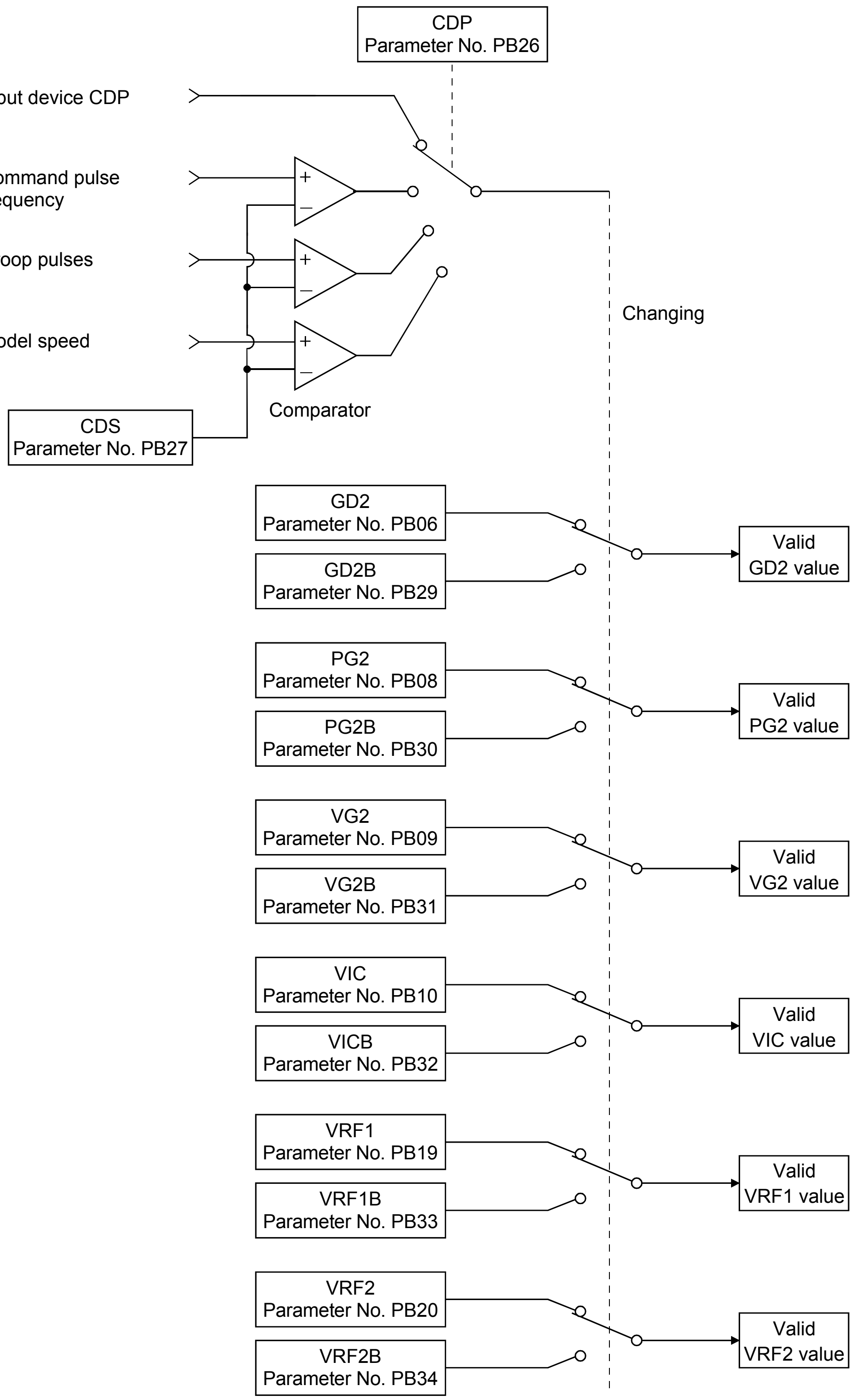
(1) You want to increase the gains during servo lock but decrease the gains to reduce noise during rotation.

(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 inertia moment ratio varies greatly during a stop (e.g. a large load is mounted on a carrier).

9.6.2 Function block diagram

The valid loop gains PG2, VG2, VIC and GD2 of the actual loop are changed according to the conditions selected by gain changing selection CDP (parameter No. PB26) and gain changing condition CDS (parameter No. PB27).



9.6.3 Parameters

When using the gain changing function, always set "□□□3" in parameter No. PA08 (auto tuning) to choose the manual mode of the gain adjustment modes. The gain changing function cannot be used in the auto tuning mode.

Parameter No.	Abbreviation	Name	Unit	Description
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	times	Control parameters before changing
PB07	PG1	Model loop gain	rad/s	Position and speed gains of a model used to set the response level to a command. Always valid.
PB08	PG2	Position loop gain	rad/s	
PB09	VG2	Speed loop gain	rad/s	
PB10	VIC	Speed integral compensation	ms	
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment	times	Used to set the ratio of load inertia moment to servo motor inertia moment after changing.
PB30	PG2B	Gain changing position loop gain	rad/s	Used to set the value of the after-changing position loop gain.
PB31	VG2B	Gain changing speed loop gain	rad/s	Used to set the value of the after-changing speed loop gain.
PB32	VICB	Gain changing speed integral compensation	ms	Used to set the value of the after-changing speed integral compensation.
PB26	CDP	Gain changing selection		Used to select the changing condition.
PB27	CDS	Gain changing condition	kpps pulse r/min	Used to set the changing condition values.
PB28	CDT	Gain changing time constant	ms	You can set the filter time constant for a gain change at changing.
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	Hz	Used to set the value of the after-changing vibration suppression control vibration frequency setting.
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	Hz	Used to set the value of the after-changing vibration suppression control resonance frequency setting.

(1) Parameters No. PB06 to PB10

These parameters are the same as in ordinary manual adjustment. Gain changing allows the values of ratio of load inertia moment to servo motor inertia moment, position loop gain, speed loop gain and speed integral compensation to be changed.

(2) Gain changing ratio of load inertia moment to servo motor inertia moment (GD2B: parameter No. PB29)

Set the ratio of load inertia moment to servo motor inertia moment after changing. If the load inertia moment ratio does not change, set it to the same value as ratio of load inertia moment to servo motor inertia moment (parameter No. PB06).

(3) Gain changing position loop gain (parameter No. PB30), Gain changing speed loop gain (parameter No. PB31), Gain changing speed integral compensation (parameter No. PB32)

Set the values of after-changing position loop gain, speed loop gain and speed integral compensation.

(4) Gain changing selection (parameter No. PB26)

Used to set the gain changing condition. Choose the changing condition in the first digit and second digit. If you set "1" in the first digit here, you can use the gain changing (CDP) input device for gain changing.

0	0		

Gain changing selection
Under any of the following conditions, the gains change on the basis of the parameter No. PB29 to PB32 settings.
0: Invalid
1: Gain changing (CDP) is ON
2: Command frequency (Parameter No.PB27 setting)
3: Droop pulse value (Parameter No.PB27 setting)
4: Servo motor speed (Parameter No.PB27 setting)

Gain changing condition
0: Valid at more than condition (Valid when gain changing (CDP) is ON)
1: Valid at less than condition (Valid when gain changing (CDP) is OFF)

(5) Gain changing condition (parameter No. PB27)

When you selected "command frequency", "droop pulses" or "servo motor speed" in gain changing selection (parameter No. PB26), set the gain changing level.

The setting unit is as follows.

Gain changing condition	Unit
Command frequency	kpps
Droop pulses	pulse
Servo motor speed	r/min

(6) Gain changing time constant (parameter No. PB28)

You can set the primary delay filter to each gain at gain changing. This parameter is used to suppress shock given to the machine if the gain difference is large at gain changing, for example.

9.6.4 Gain changing operation

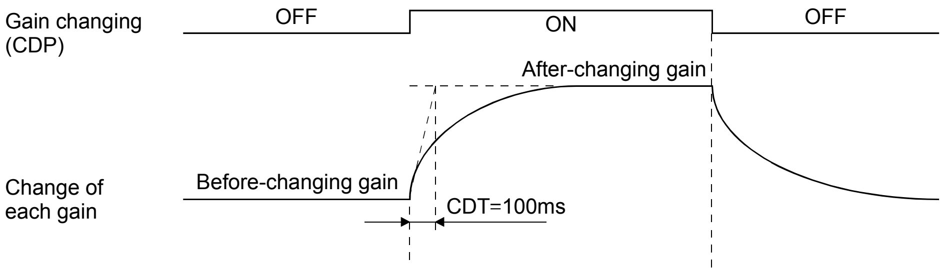
This operation will be described by way of setting examples.

(1) When you choose changing by input device

(a) Setting

Parameter No.	Abbreviation	Name	Setting	Unit
PB07	PG1	Model loop gain	100	rad/s
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	4.0	times
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	Gain changing ratio of load inertia moment to servo motor inertia moment	10.0	times
PB30	PG2B	Gain changing position loop gain	84	rad/s
PB31	VG2B	Gain changing speed loop gain	4000	rad/s
PB32	VICB	Gain changing speed integral compensation	50	ms
PB26	CDP	Gain changing selection	0001 (Changed by ON/OFF of input device)	
PB28	CDT	Gain changing time constant	100	ms
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	Used to set the value of the after-changing vibration suppression control vibration frequency setting.	Hz
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	Used to set the value of the after-changing vibration suppression control resonance frequency setting.	Hz

(b) Changing operation



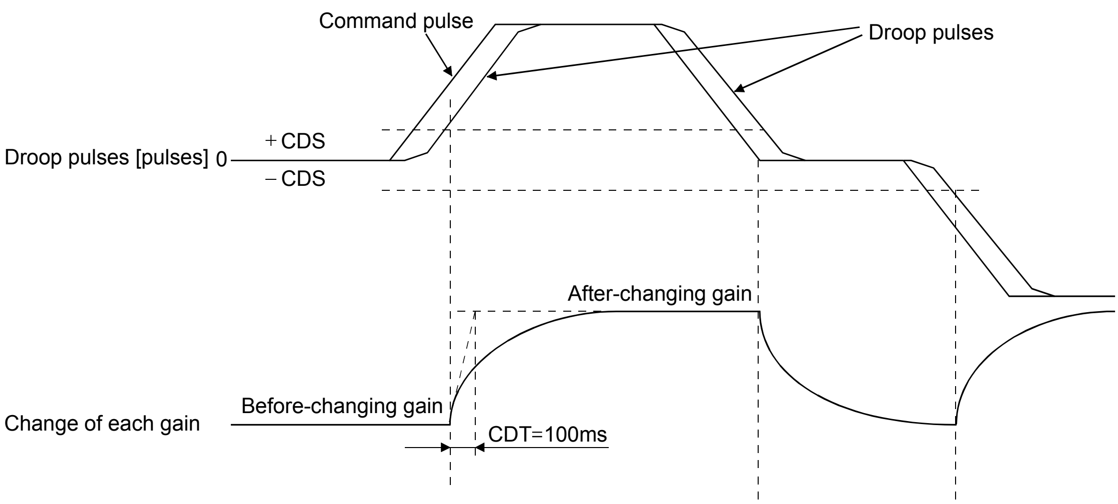
Model loop gain 1	100				
Ratio of load inertia moment to servo motor inertia moment	4.0	→	10.0	→	4.0
Position loop gain	120	→	84	→	120
Speed loop gain	3000	→	4000	→	3000
Speed integral compensation	20	→	50	→	20

(2) When you choose changing by droop pulses

(a) Setting

Parameter No.	Abbreviation	Name	Setting	Unit
PB07	PG1	Model loop gain	100	rad/s
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	4.0	times
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	Gain changing ratio of load inertia moment to servo motor inertia moment	10.0	times
PB30	PG2B	Gain changing position loop gain	84	rad/s
PB31	VG2B	Gain changing speed loop gain	4000	rad/s
PB32	VICB	Gain changing speed integral compensation	50	ms
PB26	CDP	Gain changing selection	0003 (Changed by droop pulses)	
PB27	CDS	Gain changing condition	50	pulse
PB28	CDT	Gain changing time constant	100	ms

(b) Changing operation



Model loop gain	100						
Ratio of load inertia moment to servo motor inertia moment	4.0	→	10.0	→	4.0	→	10.0
Position loop gain	120	→	84	→	120	→	84
Speed loop gain	3000	→	4000	→	3000	→	4000
Speed integral compensation	20	→	50	→	20	→	50

MEMO

10. TROUBLESHOOTING

10.1 Trouble at start-up

CAUTION	・Excessive adjustment or change of parameter setting must not be made as it will make operation instable.

POINT
・Using the MR Configurator, you can refer to unrotated servo motor reasons, 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	・LED is not lit. ・LED flickers.	Not improved if connectors CN2, CN3, CN6 and CN10 are disconnected.	1. Power supply voltage fault 2. Servo amplifier is faulty.	
			Improved when connectors CN6 and CN10 are disconnected.	Power supply of CN6 and CN10 cabling are shorted.	
			Improved when connector CN2 is disconnected.	1. Power supply of encoder cabling is shorted. 2. Encoder is faulty.	
			Improved when connector CN3 is disconnected.	Power supply of CN3 cabling is shorted.	
		Alarm occurs.	Refer to section 10.2 and remove cause.		Section 10.2
2	Switch on servo-on (SON) signal.	The I/O signal does not work to MR-J3-D01.	Confirm whether numbers are displayed in the last two digits of the display LED after the power-on.	If numbers are displayed in the last two digits of LED, MR-J3-D01 is disconnected from the servo amplifier. Install it correctly and confirm that "—" is displayed in the last two digits of the LED after the power-on.	
		Alarm occurs.	Refer to section 10.2 and remove cause.		Section 10.2
		Servo motor shaft is not servo-locked (is free).	1. Check the display to see if the servo amplifier is ready to operate. 2. Check the external I/O signal indication to see if the servo-on (SON) signal is ON.	1. Servo-on (SON) is not input. (Wiring mistake) 2. 24VDC power is not supplied to DICOM.	Section 7.5.4
3	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 several times to complete auto tuning.	Gain adjustment fault	Chapter 8
		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 several times to complete auto tuning.	Gain adjustment fault	Chapter 8

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
4	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.	

10.2 When alarm or warning has occurred

POINT

- Configure up a circuit which will detect the trouble (ALM) signal and turn off the servo-on (SON) at occurrence of an alarm.

10.2.1 Alarms and warning list

When a fault occurs during operation, the corresponding alarm or warning is displayed. If any alarm or warning has occurred, refer to section 10.2.2 or 10.2.3 and take the appropriate action. When an alarm occurs, ALM turns off.

After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column.

	Display	(Note 4) Alarm code				Name	Alarm deactivation		
		ACD3 (bit3)	ACD2 (bit2)	ACD1 (bit1)	ACD0 (bit0)		Power OFF→ON	(Note3) MR Configurator parameter unit	(Note2) Alarm reset (RES)
Alarms	A10	0	0	1	0	Undervoltage	○	○	○
	A12	0	0	0	0	Memory error 1	○		
	A13	0	0	0	0	Clock error	○		
	A15	0	0	0	0	Memory error 2 (EEP-ROM)	○		
	A16	0	1	1	0	Encoder error 1 (At power on)	○		
	A17	0	0	0	0	Board error	○		
	A19	0	0	0	0	Memory error 3 (Flash-ROM)	○		
	A1A	0	1	1	0	Motor combination error	○		
	A20	0	1	1	0	Encoder error 2	○		
	A24	1	1	0	0	Main circuit error	○	○	○
	A25	1	1	1	0	Absolute position erase	○		
	A30	0	0	0	1	Regenerative error	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A31	0	1	0	1	Overspeed	○	○	○
	A32	0	1	0	0	Overcurrent	○		
	A33	1	0	0	1	Overvoltage	○	○	○
	A35	1	1	0	1	Command pulse frequency alarm	○	○	○
	A37	1	0	0	0	Parameter error	○		
	A45	0	0	1	1	Main circuit device overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A46	0	0	1	1	Servo motor overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A47	0	0	1	1	Cooling fan alarm	○		
	A50	0	0	1	1	Overload 1	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A51	0	0	1	1	Overload 2	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A52	0	1	0	1	Error excessive	○	○	○
	A61	0	1	0	1	Operation alarm	○	○	○
	A8A	0	0	0	0	Serial communication time-out	○	○	○
	A8E	0	0	0	0	Serial communication error	○	○	○
	888	0				Watchdog	○		

Note 1. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.
2. Turns on RES.
3. Clicking the "Alarm reset" button on the "Alarm display" screen of MR Configurator allows an alarm to be deactivated. Pressing the "STOP RESET" key of the parameter unit allows an alarm to be deactivated.
4. 0: OFF
1: ON

	Display	Name
Warnings	A90	Home positioning incomplete warning
	A92	Open battery cable warning
	A96	Home position setting error
	A98	Software limit warning
	A99	Stoke limit warning
	A9A	Option unit input data error warning
	A9F	Battery warning
	AE0	Excessive regeneration warning
	AE1	Overload warning 1
	AE3	Absolute position counter warning
	AE6	Servo forced stop warning
	AE8	Cooling fan speed reduction warning
	AE9	Main circuit off warning
	AEC	Overload warning 2
	AED	Output watt excess warning

10.2.2 Remedies for alarms

⚠ CAUTION

- When any alarm has occurred, eliminate its cause, ensure safety, then reset the alarm, and restart operation. Otherwise, injury may occur.
- If an absolute position erase (A25) occurred, always make home position setting again. Not doing so may cause unexpected operation.
- As soon as an alarm occurs, turn off Servo-on (SON) and power off.

POINT

- When any of the following alarms has occurred, do not deactivate the alarm and resume operation repeatedly. To do so will cause the servo amplifier/servo motor to fail. Remove the cause of occurrence, and leave a cooling time of more than 30 minutes before resuming operation.
  - Regenerative error (A30)
  - Overload 1 (A50)
  - Overload 2 (A51)
- For the alarm deactivation method, refer to section 10.2.1.

When an alarm occurs, the trouble (ALM) switches off and the dynamic brake is operated to stop the servo motor. At this time, the display indicates the alarm No.
The servo motor comes to a stop. Remove the cause of the alarm in accordance with this section. Use the MR Configurator to refer to a factor of alarm occurrence.

Display	Name	Definition	Cause	Action
A10	Undervoltage	Power supply voltage dropped. MR-J3-□T: 160VAC or less MR-J3-□T1: 83VAC or less MR-J3-□T4: 280VAC or less	1. Power supply voltage is low.	Check the power supply.
			2. There was an instantaneous control power failure of 60ms or longer.	
			3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.	
			4. The bus voltage dropped to the following value or less. MR-J3-□T: 200VDC MR-J3-□T1: 158VDC MR-J3-□T: 380VDC	
			5. Faulty parts in the servo amplifier Checking method Alarm (A10) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the servo amplifier.
A12	Memory error 1 (RAM)	RAM, memory fault	Faulty parts in the servo amplifier Checking method Alarm (any of A12 and A13) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the servo amplifier.
A13	Clock error	Printed board fault		
A15	Memory error 2 (EEP-ROM)	EEP-ROM fault	1. Faulty parts in the servo amplifier Checking method Alarm (A15) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the servo amplifier.
			2. The number of write times to EEP-ROM exceeded 100,000.	
A16	Encoder error 1 (At power on)	Communication error occurred between encoder and servo amplifier.	1. Encoder connector (CN2) disconnected.	Connect correctly.
			2. Encoder fault	Change the servo motor.
			3. Encoder cable faulty (Wire breakage or shorted)	Repair or change the cable.
			4. Encoder cable type (2-wire, 4-wire) selection was wrong in parameter setting.	Correct the setting in the fourth digit of parameter No. PC22.
A17	Board error	CPU/parts fault	Faulty parts in the servo amplifier Checking method Alarm (A17 or A19) occurs if power is switched on after disconnection of all cables but the control circuit power supply cable.	Change the servo amplifier.
A19	Memory error 3 (Flash ROM)	ROM memory fault		
A1A	Motor combination error	Wrong combination of servo amplifier and servo motor.	Wrong combination of servo amplifier and servo motor connected.	Use correct combination.
A20	Encoder error 2	Communication error occurred between encoder and servo amplifier.	1. Encoder connector (CN2) disconnected.	Connect correctly.
			2. Encoder cable faulty (Wire breakage or shorted)	Repair or change the cable.
			3. Encoder fault	Change the servo motor.

Display	Name	Definition	Cause	Action
A24	Main circuit error	Ground fault occurred at the servo motor power (U,V and W phases) of the servo amplifier.	1. Power input wires and servo motor power wires are in contact.	Connect correctly.
			2. Sheathes of servo motor power cables deteriorated, resulting in ground fault.	Change the cable.
			3. Main circuit of servo amplifier failed. Checking method Alarm (A24) occurs if the servo is switched on after disconnecting the U, V, W power cables from the servo amplifier.	Change the servo amplifier.
A25	Absolute position erase	Absolute position data in error	1. Voltage drop in encoder. (Battery disconnected.)	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
			2. Battery voltage low.	Change the battery. Always make home position setting again.
			3. Battery cable or battery is faulty.	
		Power was switched on for the first time in the absolute position detection system.	4. Home position not set..	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
A30	Regenerative error	Permissible regenerative power of the built-in regenerative resistor or regenerative option is exceeded.	1. Wrong setting of parameter No. PA02.	Set correctly.
			2. Built-in regenerative resistor or regenerative option is not connected.	Connect correctly.
			3. High-duty operation or continuous regenerative operation caused the permissible regenerative power of the regenerative option to be exceeded. Checking method Call the status display and check the regenerative load ratio.	1. Reduce the frequency of positioning. 2. Use the regenerative option of larger capacity. 3. Reduce the load.
			4. Power supply voltage is abnormal. MR-J3-□T:260VAC or more MR-J3-□T1:More than 135VAC MR-J3-□T4: 535VAC or more	Check the power supply.
			5. Built-in regenerative resistor or regenerative option faulty.	Change the servo amplifier or regenerative option.
		Regenerative transistor fault	6. Regenerative transistor faulty. Checking method 1) The regenerative option has overheated abnormally. 2) The alarm occurs even after removal of the built-in regenerative resistor or regenerative option.	Change the servo amplifier.

Display	Name	Definition	Cause	Action
A31	Overspeed	Speed has exceeded the instantaneous permissible speed.	1. Input command pulse frequency exceeded the permissible instantaneous speed frequency.	Set command pulses correctly.
			2. Small acceleration/deceleration time constant caused overshoot to be large.	Increase acceleration/deceleration time constant.
			3. Servo system is instable to cause overshoot.	1. Re-set servo gain to proper value. 2. If servo gain cannot be set to proper value. 1) Reduce load inertia moment ratio; or 2) Reexamine acceleration/ deceleration time constant.
			4. Electronic gear ratio is large (parameters No. PA06, PA07)	Set correctly.
			5. Encoder faulty.	Change the servo motor.
A32	Overcurrent	Current that flew is higher than the permissible current of the servo amplifier. (When the alarm (A32) occurs, switch the power OFF and then ON to reset the alarm. Then, turn on the servo-on. When the alarm (A32) still occurs at the time, the transistor (IPM・IGBT) of the servo amplifier may be at fault. Do not switch the power OFF/ON repeatedly; check the transistor according to the cause 2 checking method.)	1. Short occurred in servo motor power (U, V, W).	Correct the wiring.
			2. Transistor (IPM) of the servo amplifier faulty. Checking method Alarm (A32) occurs if power is switched on after U,V and W are disconnected.	Change the servo amplifier.
			3. Ground fault occurred in servo motor power (U, V, W).	Correct the wiring.
			4. External noise caused the overcurrent detection circuit to misoperate.	Take noise suppression measures.

Display	Name	Definition	Cause	Action
A33	Overvoltage	The following shows the input value of converter bus voltage. MR-J3-□T(1): 400VDC or more MR-J3-□T4: 800VDC or more	1. Regenerative option is not used.	Use the regenerative option.
			2. Though the regenerative option is used, the parameter No.PA02 setting is "□□00 (not used)".	Set correctly.
			3. Lead of built-in regenerative resistor or regenerative option is open or disconnected.	1. Change the lead. 2. Connect correctly.
			4. Regenerative transistor faulty.	Change the servo amplifier
			5. Wire breakage of built-in regenerative resistor or regenerative option	1. For wire breakage of built-in regenerative resistor, change the servo amplifier. 2. For wire breakage of regenerative option, change the regenerative option.
			6. Capacity of built-in regenerative resistor or regenerative option is insufficient.	Add regenerative option or increase capacity.
			7. Power supply voltage high.	Check the power supply.
			8. Ground fault occurred in servo motor power (U, V, W).	Correct the wiring.
			9. The jumper across BUE-SD of the FR-BU2 brake unit is removed.	Fit the jumper across BUE-SD.
A35	Command pulse frequency error	Input pulse frequency of the command pulse is too high.	1. Pulse frequency of the manual pulse generator is too high.	Change the pulse frequency to a proper value.
			2. Noise entered the pulses of the manual pulse generator.	Take action against noise.
			3. Manual pulse generator failure	Change the manual pulse generator.
A37	Parameter error	Parameter setting is wrong.	1. Servo amplifier fault caused the parameter setting to be rewritten.	Change the servo amplifier.
			2. Regenerative option not used with servo amplifier was selected in parameter No.PA02.	Set parameter No.PA02 correctly.
			3. Value outside setting range has been set in electronic gear.	Set parameters No. PA06, PA07 correctly.
			4. Opposite sign has been set in software limit increasing side (parameters No. PC31, PC32). Similarly, opposite sign has been set in software limit decreasing side (parameters No. PC33, PC34).	Set parameters No. PC31 to PC34 correctly.
			5. Opposite sign has been set in position range output address increasing side (parameters No. PC37, PC38). Similarly, opposite sign has been set in position range output address decreasing side (parameters No. PC39, PC40).	Set parameters No. PC37 to PC40 correctly.
			6. The number of write times to EEP-ROM exceeded 100,000 due to parameter write, etc.	Change the servo amplifier.
			7. The torque limit switching dog system or torque limit switching data set system is selected for home position return in the point table positioning operation. (Parameter No. PC02)	These home position return types cannot be used. Set the parameter No.PC02 correctly.
		Point table setting is wrong.	8. Setting value is out of the setting range.	Set it correctly.

Display	Name	Definition	Cause	Action
A45	Main circuit device overheat	Main circuit device overheat	1. Servo amplifier faulty.	Change the servo amplifier.
			2. The power supply was turned on and off continuously by overloaded status.	The drive method is reviewed.
			3. Ambient temperature of servo motor is over 55℃ (131°F).	Check environment so that ambient temperature is 0 to 55℃ (32 to 131°F).
			4. Used beyond the specifications of close mounting.	Use within the range of specifications.
A46	Servo motor overheat	Servo motor temperature rise actuated the thermal sensor.	1. Ambient temperature of servo motor is over 40℃ (104°F).	Check environment so that ambient temperature is 0 to 40℃ (32 to 104°F).
			2. Servo motor is overloaded.	1. Reduce load. 2. Check operation pattern. 3. Use servo motor that provides larger output.
			3. Thermal sensor in encoder is faulty.	Change the servo motor.
A47	Cooling fan alarm	The cooling fan of the servo amplifier stopped, or its speed decreased to or below the alarm level.	Cooling fan life expiration (Refer to section 2.5.)	Change the cooling fan of the servo amplifier.
			Foreign matter caught in the cooling fan stopped rotation.	Remove the foreign matter.
			The power supply of the cooling fan failed.	Change the servo amplifier.
A50	Overload 1	Load exceeded overload protection characteristic of servo amplifier.	1. Servo amplifier is used in excess of its continuous output current.	1. Reduce load. 2. Check operation pattern. 3. Use servo motor that provides larger output.
			2. Servo system is instable and hunting.	1. Repeat acceleration/ deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			3. Machine struck something.	1. Check operation pattern. 2. Install limit switches.
			4. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			5. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off, the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.
			6. After Overload 2 (A51) occurred, turn OFF/ON the power supply to clear the alarm. Then the overload operation is repeated.	1. Reduce load. 2. Check operation pattern. 3. Use servo motor that provides larger output.

Display	Name	Definition	Cause	Action
A51	Overload 2	Machine collision or the like caused max. For the time of the alarm occurrence, refer to the section 12.1.	1. Machine struck something.	1. Check operation pattern. 2. Install limit switches.
			2. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			3. Servo system is instable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			4. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off, the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.
A52	Error excessive	The difference between the model position and the actual servo motor position exceeds three rotations. (Refer to the function block diagram in section 1.1.2.)	1. Acceleration/deceleration time constant is too small.	Increase the acceleration/deceleration time constant.
			2. Forward torque limit (parameter No.PA11) or reverse torque limit (parameter No.PA12) are too small.	Increase the torque limit value.
			3. Motor cannot be started due to torque shortage caused by power supply voltage drop.	1. Check the power supply capacity. 2. Use servo motor which provides larger output.
			4. Position loop gain (parameter No.PB08) value is small.	Increase set value and adjust to ensure proper operation.
			5. Servo motor shaft was rotated by external force.	1. When torque is limited, increase the limit value. 2. Reduce load. 3. Use servo motor that provides larger output.
			6. Machine struck something.	1. Check operation pattern. 2. Install limit switches.
			7. Encoder faulty	Change the servo motor.
			8. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
A61	Operation alarm	Setting mistake of auxiliary function.	"1" or "3" is set for the auxiliary function of point table No.255.	Set "0" or "2" for the value of auxiliary function.
A8A	Serial communication time-out error	Communication stopped for longer than the specified time.	1. Communication cable breakage.	Repair or change the communication cable
			2. Communication cycle longer than regulated time.	Shorten the communication cycle.
			3. Wrong protocol.	Correct protocol.
A8E	Serial communication error	Serial communication error occurred between servo amplifier and communication device (e.g. personal computer).	1. Communication cable fault (Open cable or short circuit)	Repair or change the cable.
			2. Communication device (e.g. personal computer) faulty	Change the communication device (e.g. personal computer).

Display	Name	Definition	Cause	Action
(Note) 888	Watchdog	CPU, parts faulty	Fault of parts in servo amplifier Checking method Alarm (888) occurs if power is switched on after disconnection of all cables but the control circuit power supply cable.	Change the servo amplifier.

Note. At power-on, "888" appears instantaneously, but it is not an error.

10.2.3 Remedies for warnings

CAUTION	・If an absolute position counter warning (AE3) occurred, always make home position setting again. Not doing so may cause unexpected operation.

POINT

・When any of the following alarms has occurred, do not resume operation by switching power of the servo amplifier OFF/ON repeatedly. The servo amplifier and servo motor may become faulty. If the power of the servo amplifier is switched OFF/ON during the alarms, allow more than 30 minutes for cooling before resuming operation.

・Excessive regenerative warning (AE0)

・Overload warning 1 (AE1)

If AE6 occur, the servo off status is established. If any other warning occurs, operation can be continued but an alarm may take place or proper operation may not be performed.
Remove the cause of warning according to this section. Use the optional MR Configurator to refer to a factor of warning occurrence.

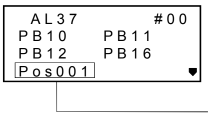
Display	Name	Definition		Cause	Action
A90	Home position return incomplete	In incremental system	Positioning operation was performed without home position return.	1. Positioning operation was performed without home position return.	Perform home position return.
			Home position return ended abnormally.	2. Home position return speed could not be decreased to creep speed. 3. Limit switch was actuated during home position return starting at other than position beyond dog.	Check home position return speed/creep speed/moving distance after proximity dog.
		In absolute position detection system	Positioning operation was performed without home position setting.	1. Positioning operation was performed without home position setting.	Perform home position setting.
			Home position setting ended abnormally.	2. Home position setting speed could not be decreased to creep speed. 3. Limit switch was actuated during home position setting starting at other than position beyond dog.	Check home position setting speed/creep speed/moving distance after proximity dog.
			Operation was performed without making home position setting while an absolute position erase (A25) is being occurred.	4. Voltage drop in encoder (Battery disconnected.)	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
				5. Battery voltage low. 6. Battery cable or battery is faulty.	Change the battery. Always make home position setting again.
A92	Open battery cable warning	Absolute position detection system battery voltage is low.		1. Battery cable is open.	Repair cable or changed.
				2. Battery voltage supplied from the servo amplifier to the encoder fell to about 3V or less. (Detected with the encoder)	Change the battery.
A96	Home position setting warning	Home position setting could not be made.		1. Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurrence.
				2. Command pulse entered after clearing of droop pulses.	Do not enter command pulse after clearing of droop pulses.
				3. Creep speed high.	Reduce creep speed.

Display	Name	Definition	Cause	Action
A98	Software limit warning	Software limit set in parameter is reached.	1. Software limit was set within actual operation range.	Set parameter No. PC31 to PC34 correctly.
			2. Point table of position data in excess of software limit was executed.	Set point table correctly.
			3. Software limit was reached during JOG operation or manual pulse generator operation.	Perform operation within software limit range.
A99	Stroke limit warning	The limit switch become valid.	The stroke end (LSP or LSN) of the direction which gave instructions was turned off.	Reexamine the operation pattern to turn LSP/LSN ON.
A9A	Option unit input data error warning	Setting error of BCD input data.	1. The minus symbol is set at the incremental value command.	Set the symbol correctly.
			2. The plus and minus symbols are set simultaneously.	
			3. The value of "9" or more is set to the first digit.	Set the BCD value correctly.
A9F	Battery warning	Voltage of battery for absolute position detection system reduced.	Battery voltage fell to 3.2V or less. (Detected with the servo amplifier)	Change the battery.
AE0	Excessive regenerative warning	There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative resistor or regenerative option.	Regenerative power increased to 85% or more of permissible regenerative power of built-in regenerative resistor or regenerative option. Checking method Call the status display and check regenerative load ratio.	1. Reduce frequency of positioning. 2. Change the regenerative option for the one with larger capacity. 3. Reduce load.
AE1	Overload warning 1	There is a possibility that overload alarm 1 or 2 may occur.	Load increased to 85% or more of overload alarm 1 or 2 occurrence level. Cause, checking method Refer to A50, A51.	Refer to A50, A51.
AE3	Absolute position counter warning	Absolute position encoder pulses faulty.	1. Noise entered the encoder.	Take noise suppression measures.
			2. Encoder faulty.	Change the servo motor.
		The multi-revolution counter value of the absolute position encoder exceeded the maximum revolution range.	3. The movement amount from the home position exceeded a 32767 rotation or 37268 rotation in succession.	Make home position setting again.
AE6	Servo forced stop warning	EMG is off.	External forced stop was made valid. (EMG was turned off.)	Ensure safety and deactivate forced stop.
AE8	Cooling fan speed reduction warning	The speed of the servo amplifier decreased to or below the warning level. This warning is not displayed with MR-J3-70T/100T among servo amplifiers equipped with a cooling fan.	Cooling fan life expiration. (Refer to section 2.5.)	Change the cooling fan of the servo amplifier.
			The power supply of the cooling fan is broken.	Change the servo amplifier.
AE9	Main circuit off warning	Servo-on (SON) was switched on with main circuit power off.		Switch on main circuit power.

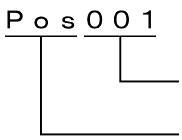
Display	Name	Definition	Cause	Action
AEC	Overload warning 2	Operation, in which a current exceeding the rating flew intensively in any of the U, V and W phases of the servo motor, was repeated.	During a stop, the status in which a current flew intensively in any of the U, V and W phases of the servo motor occurred repeatedly, exceeding the warning level.	1. Reduce the positioning frequency at the specific positioning address. 2. Reduce the load. 3. Replace the servo amplifier/ servo motor with the one of larger capacity.
AED	Output watt excess warning	The status, in which the output wattage (speed × torque) of the servo motor exceeded the rated output, continued steadily.	Continuous operation was performed with the output wattage (speed × torque) of the servo motor exceeding 150% of the rated output.	1. Reduce the servo motor speed. 2. Reduce the load.

10.3 Point table error

When a point table error occurs, the parameter error (A37) occurs. After the parameter No. of parameter error (A.37), the point table error details are displayed.



Point table error details
For the point table No.1 position data error



Point table No. with error

Error item
- Pos: position data
- Spd: speed
- Acc: acceleration time constant
- Dec: deceleration time constant
- Dwl: dwell
- Aux: auxiliary function
- Mcd: M code

10.4 MR-DP60 external digital display error

When MR-DP60 external digital display detects an error, the following alarms are displayed. The alarms are displayed only on the MR-DP60, but not on the servo amplifier display.

Display	Name	Definition	Cause	Action
AL. CPU	CPU error	CPU error	Faulty parts in the MR-D60.	Exchange the MR-D60.
AL. C0	Communication error	Communication error occurred between MR-DP60 and MR-J3-D01.	1. CN30 connector disconnected.	Connect correctly.
			2. Wire breakage of the cable.	Repair or exchange the cable.

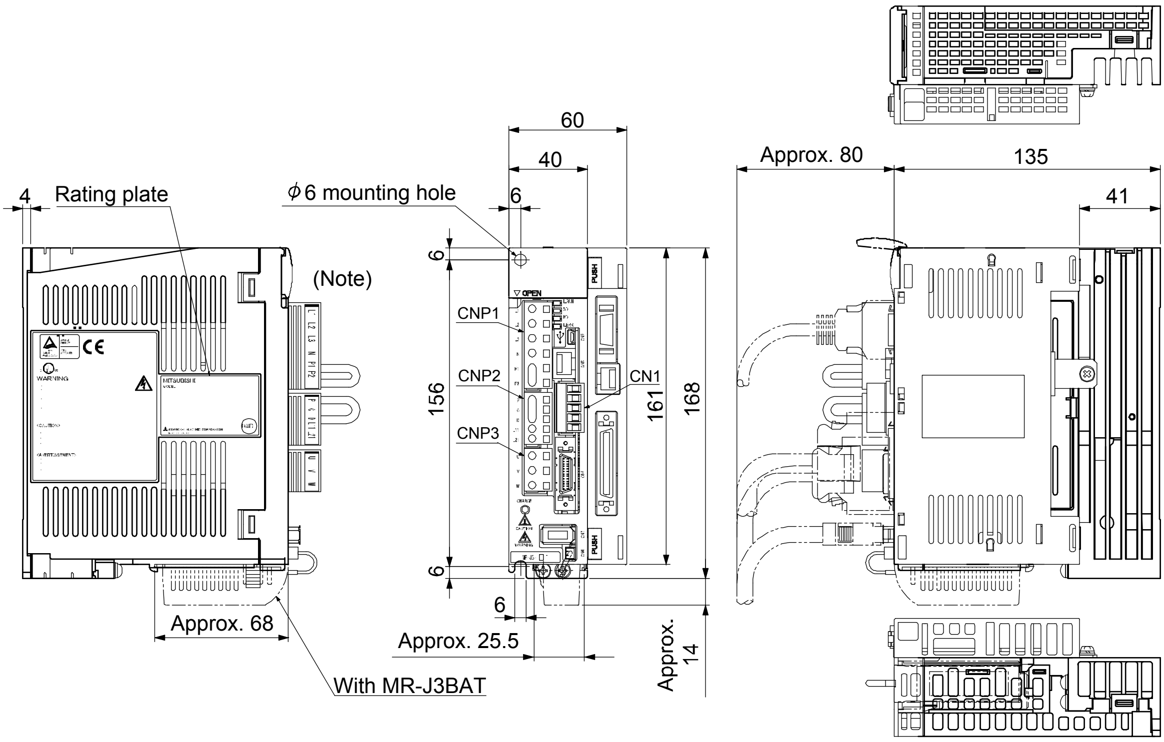
MEMO

11. OUTLINE DRAWINGS

11.1 Servo amplifier

(1) MR-J3-10T・MR-J3-20T
MR-J3-10T1・MR-J3-20T1

[Unit: mm]



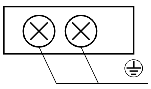
Note. This data applies to the 3-phase or 1-phase 200 to 230VAC power supply models.
For a single-phase, 100 to 120VAC power supply, refer to the terminal signal layout.

Mass: 0.8 [kg] (1.76 [lb])
(Servo amplifier alone)

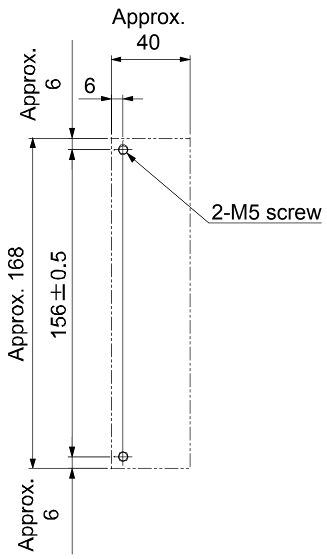
Terminal signal layout

	For 1-phase 100 to 120VAC		For 3-phase or 1-phase 200 to 230VAC
CNP1	L_1	CNP1	L_1
			L_2
	L_2		L_3
	N		N
	P_1		P_1
	P_2		P_2
CNP2	P	CNP2	P
	C		C
	D		D
	L_{11}		L_{11}
	L_{21}		L_{21}
CNP3	U	CNP3	U
	V		V
	W		W

PE terminal



Screw size: M4
Tightening torque: 1.2 [N・m] (10.6 [lb・in])



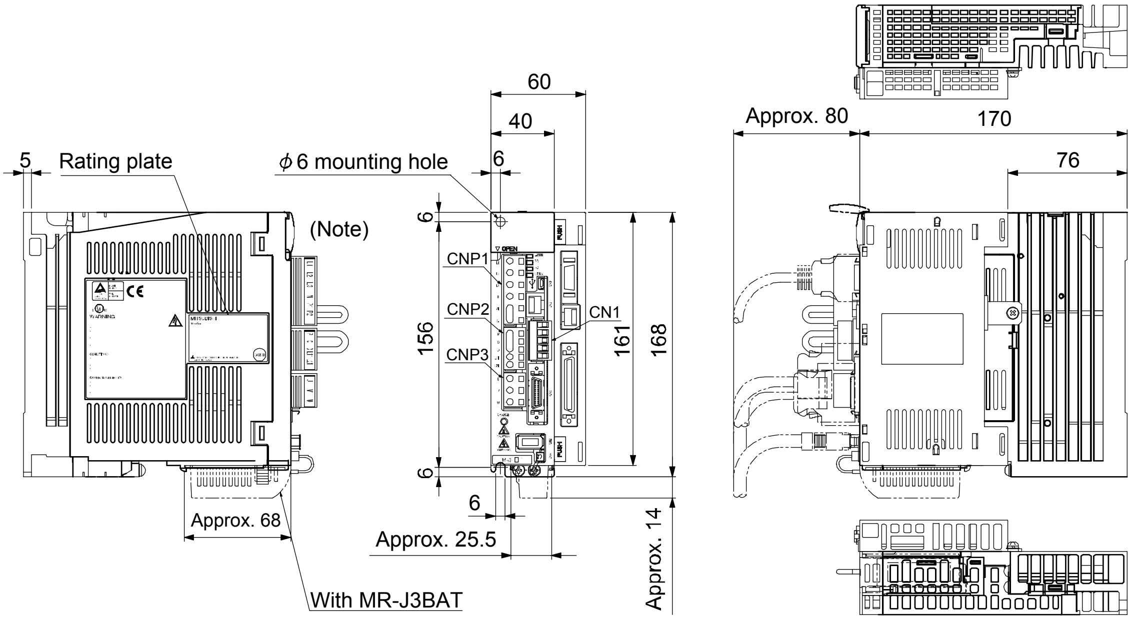
Mounting hole process drawing

Mounting screw
Screw size: M5
Tightening torque: 3.24[N・m] (28.7[lb・in])

(2) MR-J3-40T・MR-J3-60T

MR-J3-40T1

[Unit: mm]



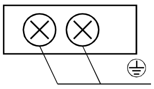
Note. This data applies to the 3-phase or 1-phase 200 to 230VAC power supply models.
For a single-phase, 100 to 120VAC power supply, refer to the terminal signal layout.

Mass: 1.0 [kg] (2.21 [lb])
(Servo amplifier alone)

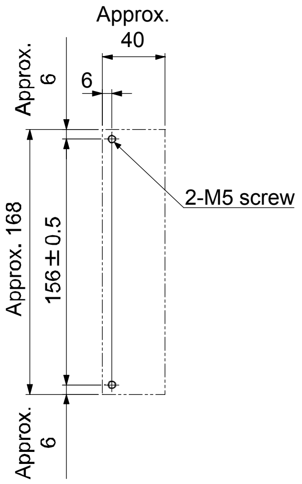
Terminal signal layout

	For 1-phase 100 to 120VAC		For 3-phase or 1-phase 200 to 230VAC
CNP1	L_1	CNP1	L_1
			L_2
	L_2		L_3
	N		N
	P_1		P_1
	P_2		P_2
CNP2	P	CNP2	P
	C		C
	D		D
	L_{11}		L_{11}
	L_{21}		L_{21}
CNP3	U	CNP3	U
	V		V
	W		W

PE terminal



Screw size: M4
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

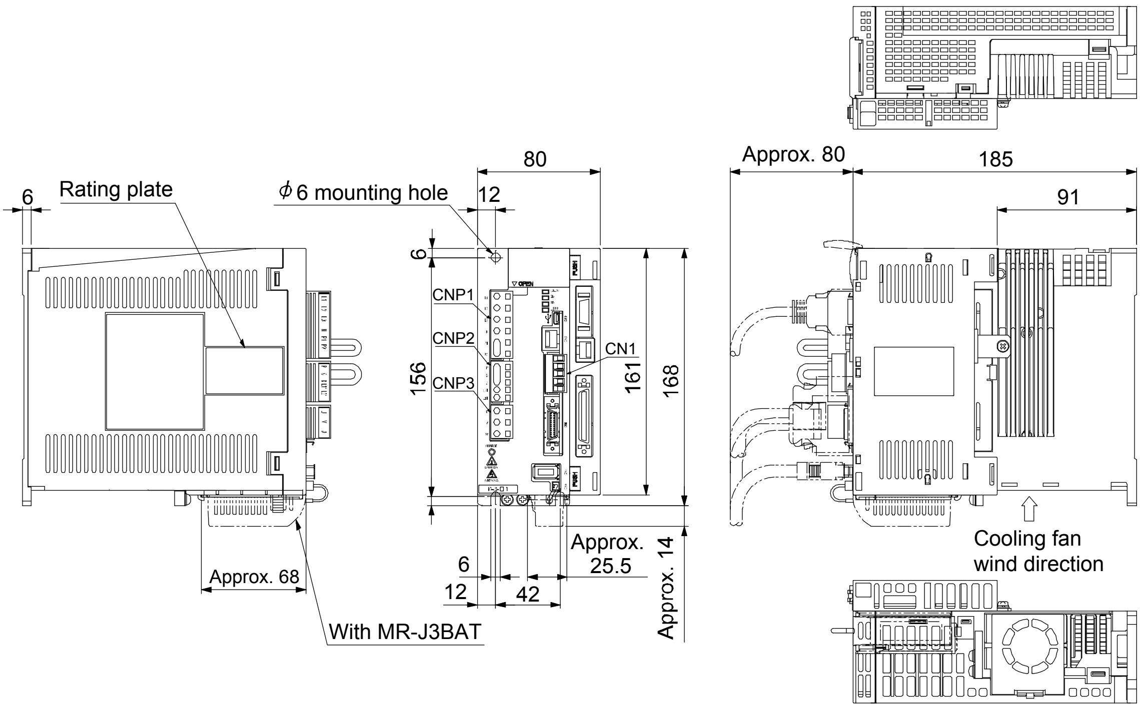


Mounting hole process drawing

Mounting screw
Screw size: M5
Tightening torque: 3.24[N・m] (28.7[lb・in])

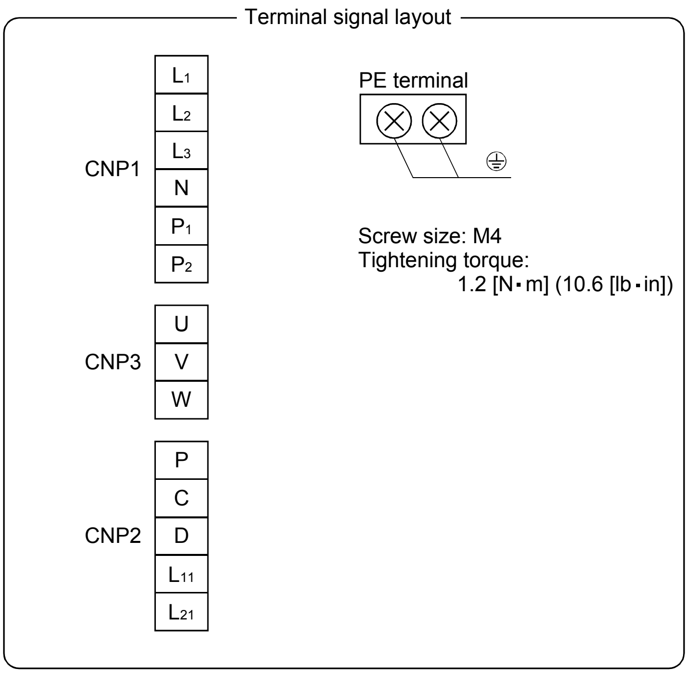
(3) MR-J3-70T・MR-J3-100T

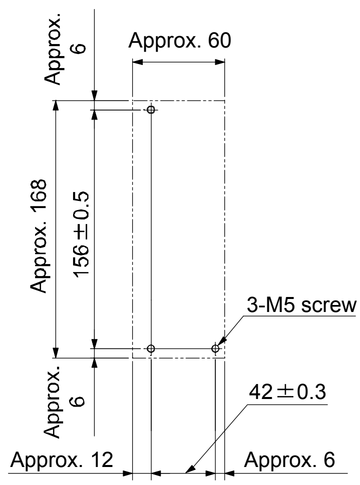
[Unit: mm]



Mass: 1.4 [kg] (3.09 [lb])

(Servo amplifier alone)



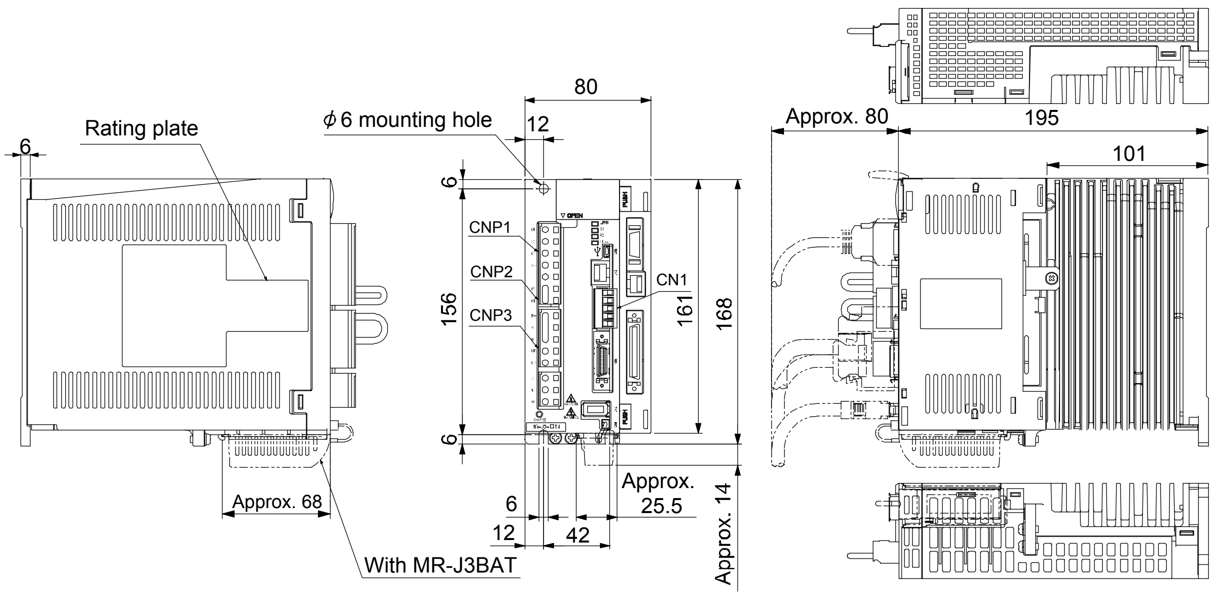


Mounting hole process drawing

Mounting screw
Screw size: M5
Tightening torque: 3.24[N・m] (28.7[lb・in])

(4) MR-J3-60T4・MR-J3-100T4

[Unit: mm]

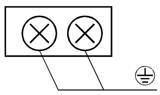


Mass: 1.4 [kg] (3.09 [lb])
(Servo amplifier alone)

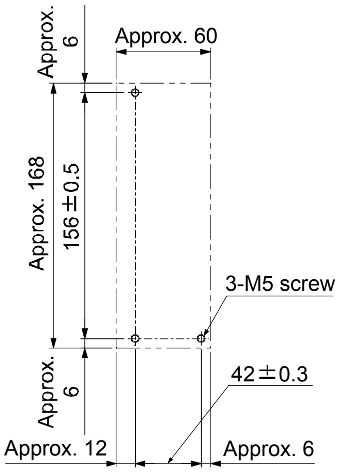
Terminal signal layout

CNP1	L1
	L2
	L3
	N−
	P1
	P2
CNP2	P+
	C
	D
	L11
	L21
CNP3	U
	V
	W

PE terminal



Screw size: M4
Tightening torque:
1.2 [N・m] (10.6 [lb・in])



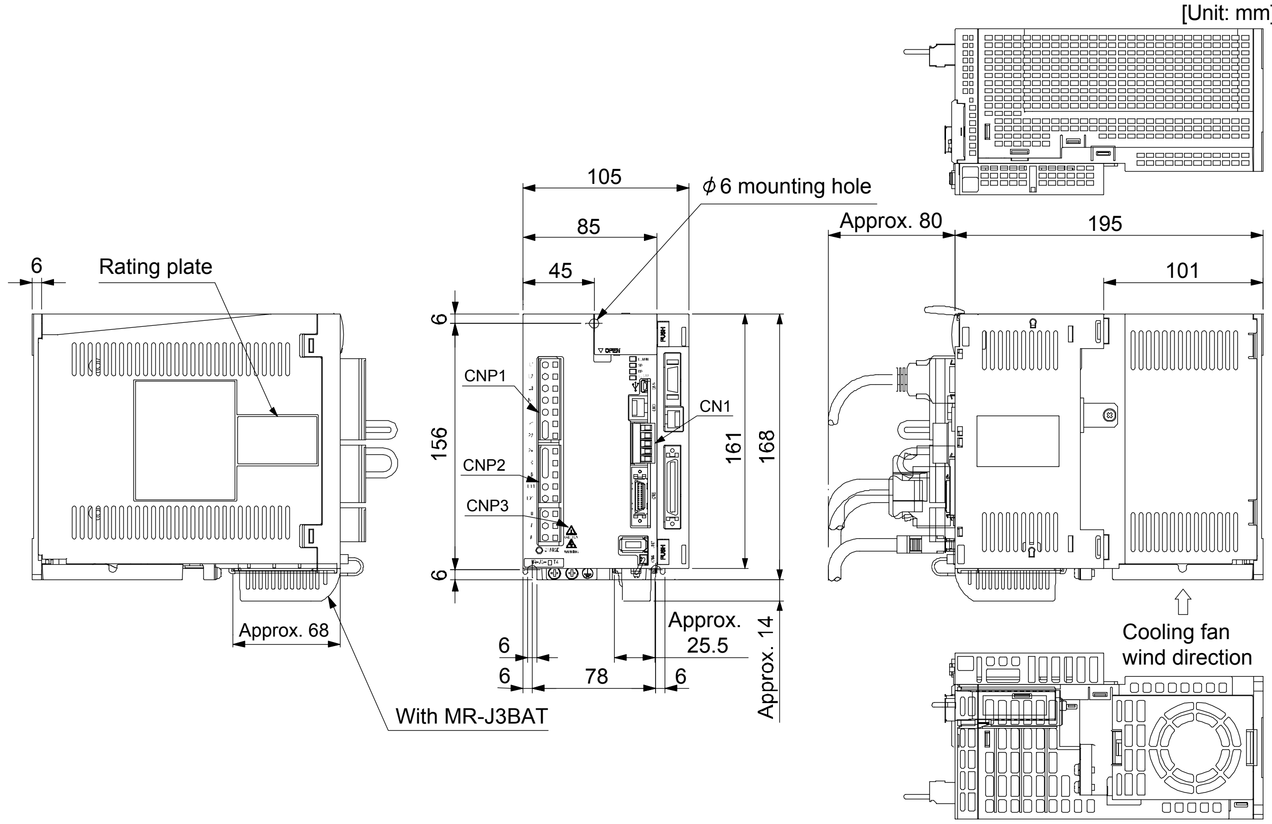
Mounting hole process drawing

Mounting screw
Screw size: M5
Tightening torque: 3.24[N・m] (28.7[lb・in])

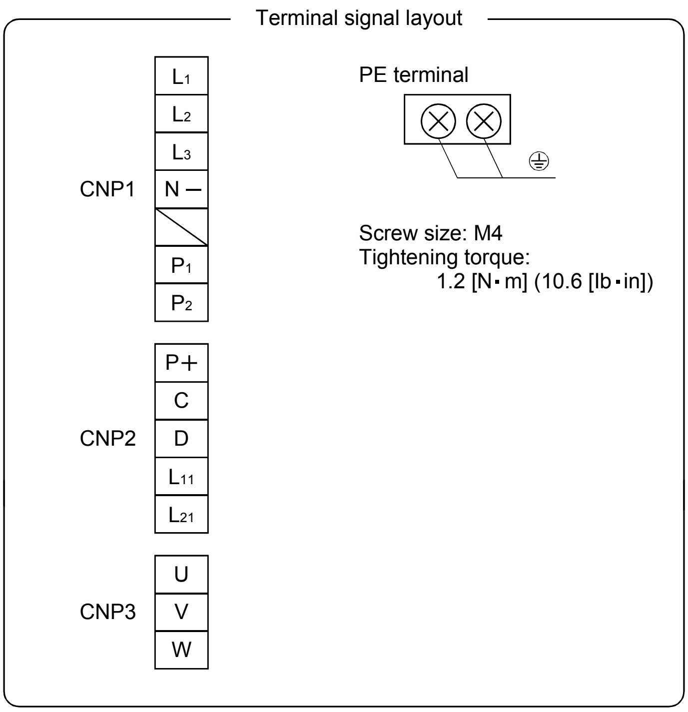
(5) MR-J3-200T(4)

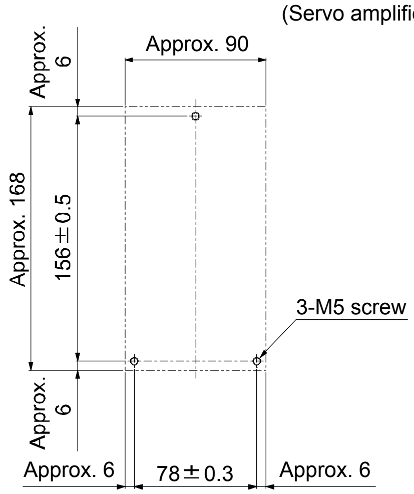
POINT
・Connectors (CNP1, CNP2, and CNP3) and appearance of MR-J3-200T servo amplifier have been changed from January 2008 production. Model name of the existing servo amplifier is changed to MR-J3-200T-RT. For MR-J3-200T-RT, refer to appendix 4.

[Unit: mm]



Mass: 2.1 [kg] (4.63 [lb])
(Servo amplifier alone)



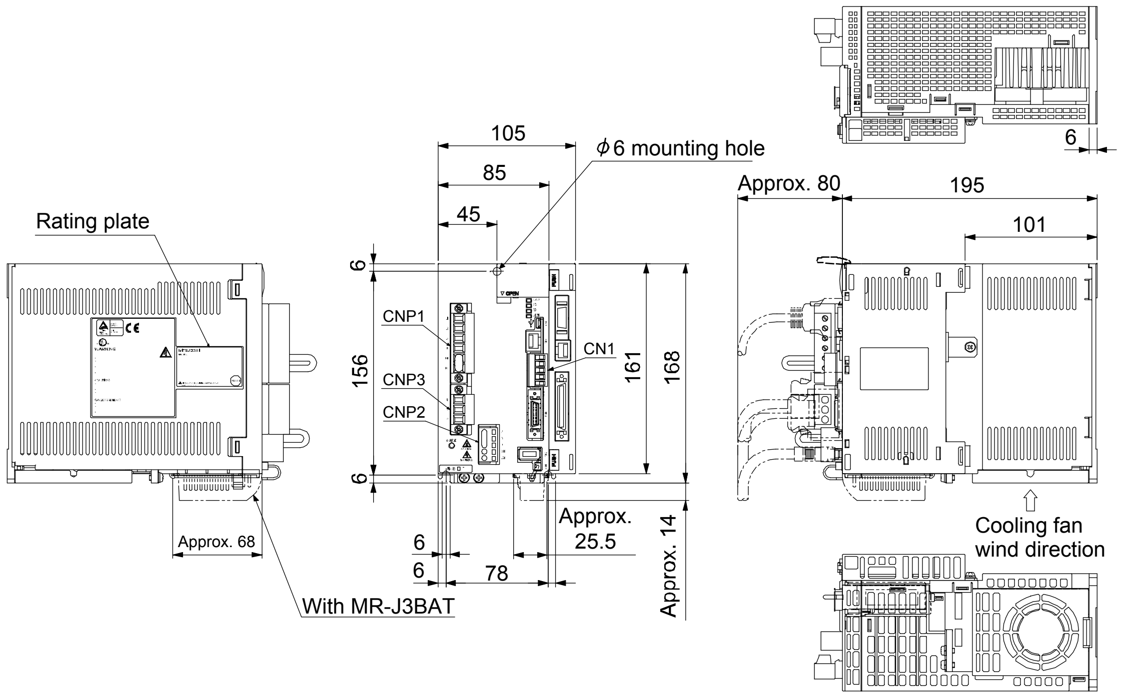


Mounting hole process drawing

Mounting screw
Screw size: M5
Tightening torque: 3.24[N・m] (28.7[lb・in])

(6) MR-J3-350T

[Unit: mm]



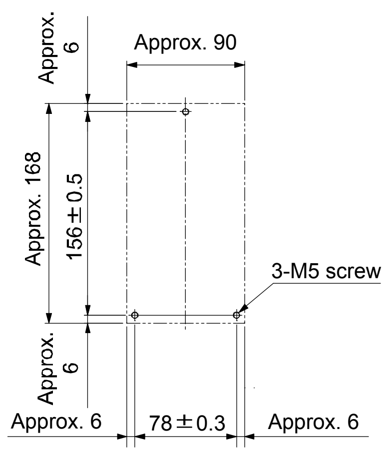
Mass: 2.3 [kg] (5.07 [lb])
(Servo amplifier alone)

Terminal signal layout

CNP1	L_1
	L_2
	L_3
	N
	P_1
	P_2
CNP3	U
	V
	W
CNP2	P
	C
	D
	L_{11}
	L_{21}

PE terminal

Screw size: M4
Tightening torque:
1.2 [N•m] (10.6 [lb•in])

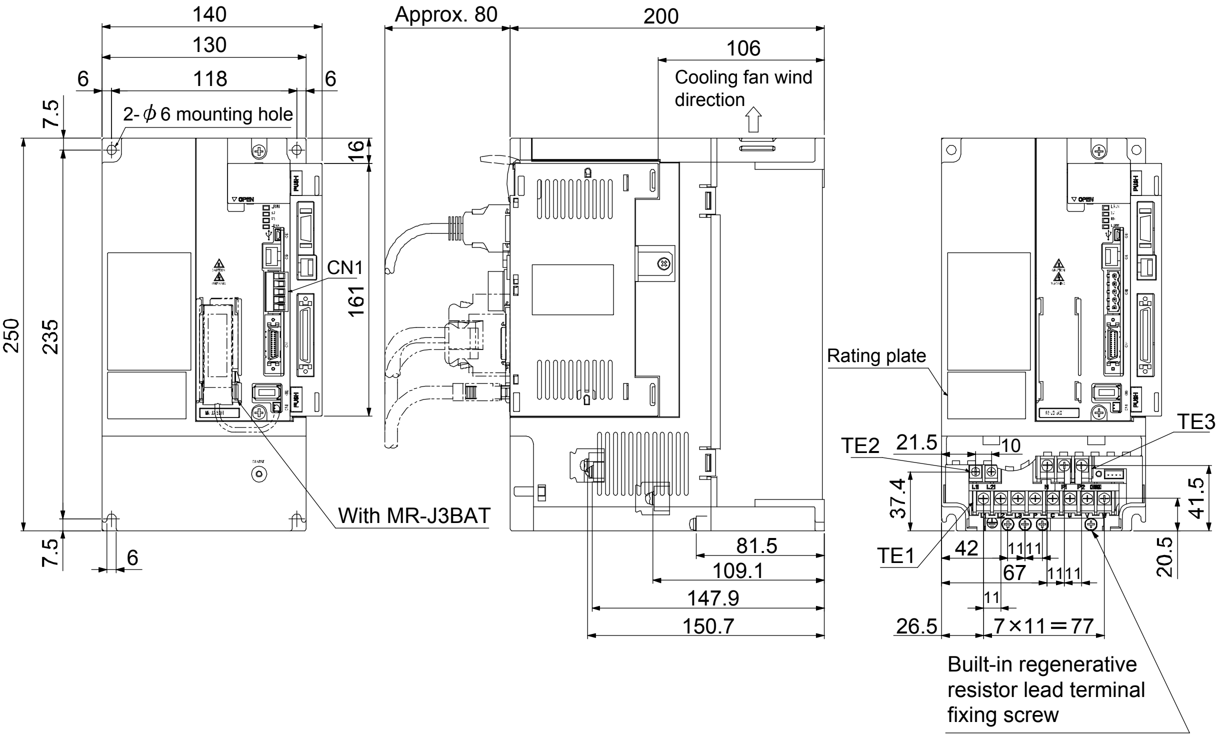


Mounting hole process drawing

Mounting screw
Screw size: M5
Tightening torque: 3.24[N・m] (28.7[lb・in])

(7) MR-J3-350T4・MR-J3-500T(4)

[Unit: mm]



Mass: 4.6 [kg] (10.1 [lb])
(Servo amplifier alone)

Terminal signal layout

TE1

L_1	L_2	L_3	P	C	U	V	W

Terminal screw: M4
Tightening torque: 1.2[N・m] (10.6 [lb・in])

TE2

L_{11}	L_{21}

Terminal screw: M3.5(Note)
Tightening torque: 0.8[N・m] (7.08 [lb・in])

TE3

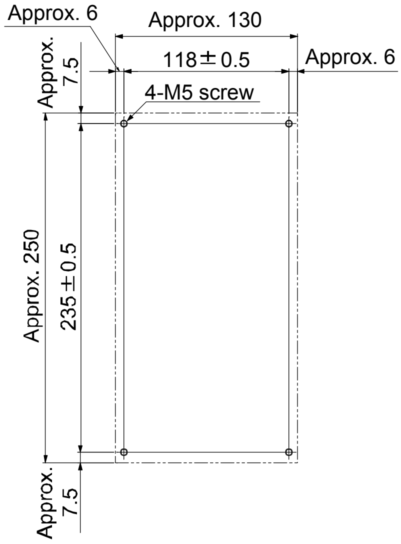
N	P_1	P_2

Terminal screw: M4
Tightening torque: 1.2[N・m] (10.6 [lb・in])

PE terminal

Terminal screw: M4
Tightening torque: 1.2[N・m] (10.6 [lb・in])

Built-in regenerative resistor lead terminal fixing screw



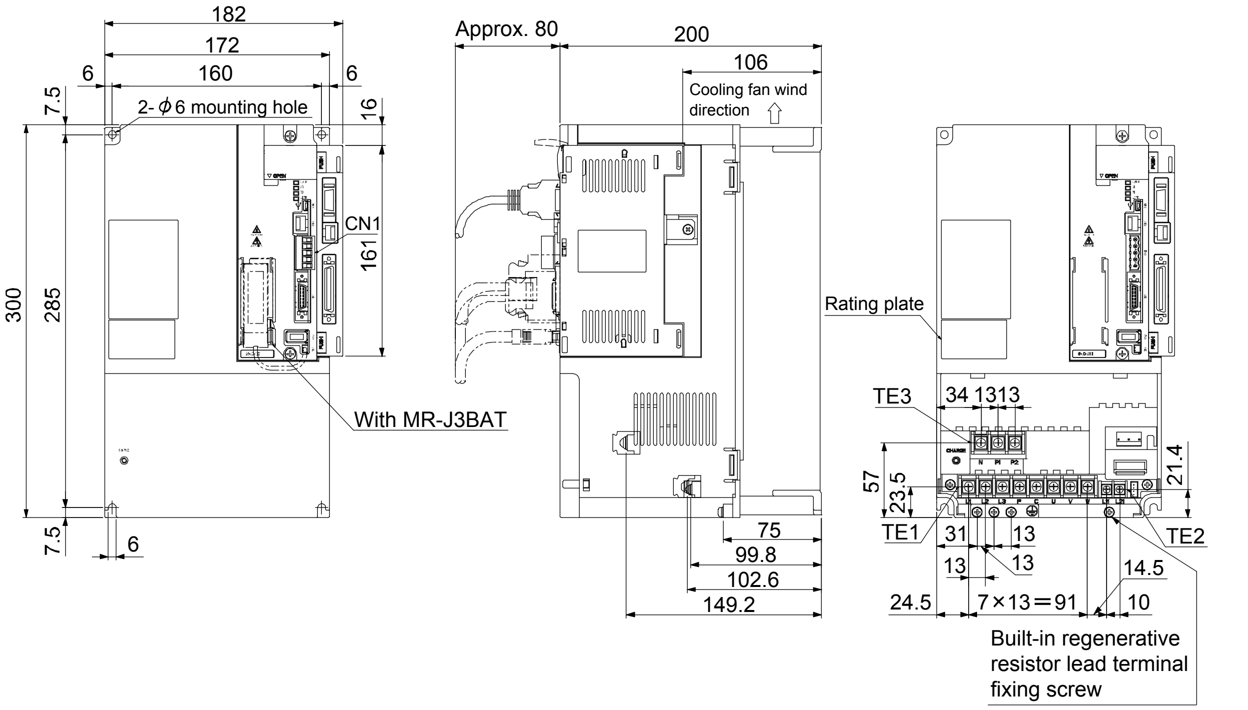
Mounting hole process drawing

Note. Screw size is M3.5 for the control circuit terminal block (TE2) of the servo amplifier manufactured in April 2007 or later. Screw size is M3 for the control terminal block (TE2) of the servo amplifier manufactured in March 2007 or earlier.

Mounting screw
Screw size: M5
Tightening torque: 3.24[N・m] (28.7[lb・in])

(8) MR-J3-700T(4)

[Unit: mm]



Mass: 6.2 [kg] (13.7[lb])

(Servo amplifier alone)

Terminal signal layout

TE1

L_1	L_2	L_3	P	C	U	V	W

Terminal screw: M4
Tightening torque: 1.2[N•m] (10.6 [lb•in])

TE2

L_{11}	L_{21}

Terminal screw: M3.5(Note)
Tightening torque: 0.8[N•m] (7.08 [lb•in])

TE3

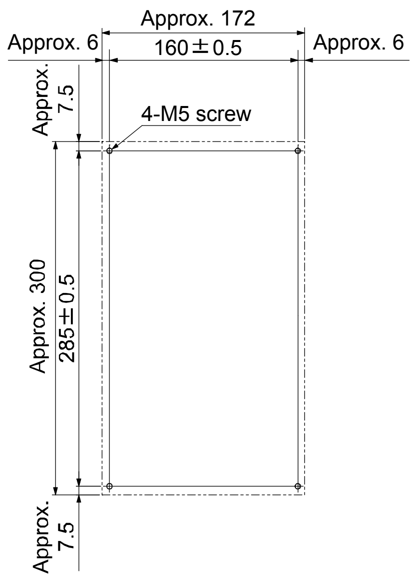
N	P_1	P_2

Terminal screw: M4
Tightening torque: 1.2[N•m] (10.6 [lb•in])

PE terminal

Terminal screw: M4
Tightening torque: 1.2[N•m] (10.6 [lb•in])

Built-in regenerative resistor lead terminal fixing screw



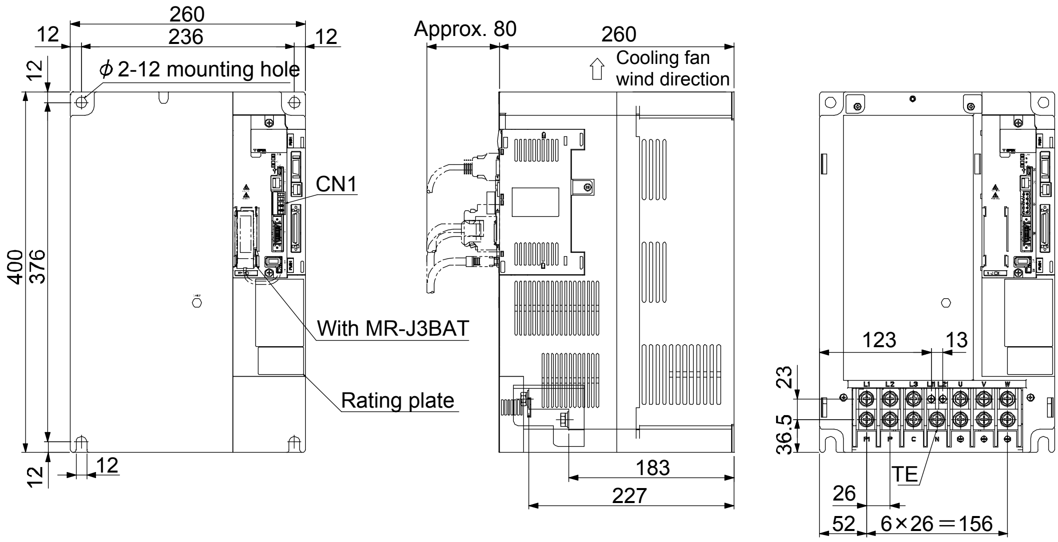
Mounting hole process drawing

Mounting screw
Screw size: M5
Tightening torque: 3.24[N・m] (28.7[lb・in])

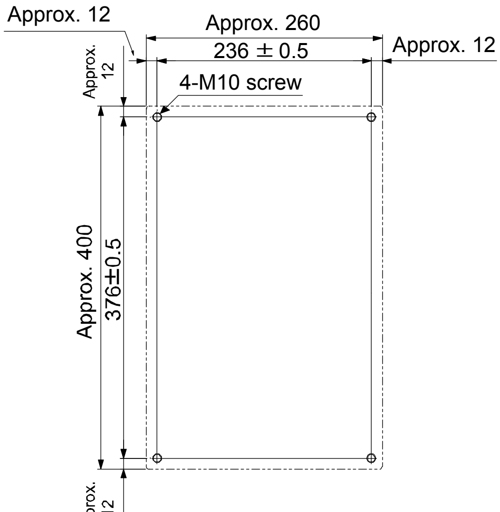
Note. Screw size is M3.5 for the control circuit terminal block (TE2) of the servo amplifier manufactured in April 2007 or later. Screw size is M3 for the control terminal block (TE2) of the servo amplifier manufactured in March 2007 or earlier.

(9) MR-J3-11KT(4) to 22KT(4)

[Unit: mm]



Servo amplifier	Mass[kg]([lb])
MR-J3-11KT(4)	18.0(40)
MR-J3-15KT(4)	18.0(40)
MR-J3-22KT(4)	19.0(42)



Mounting hole process drawing

Terminal signal layout

TE

L_1	L_2	L_3	L_{11} L_{21}	U	V	W
P_1	P	C	N	⏚	⏚	⏚

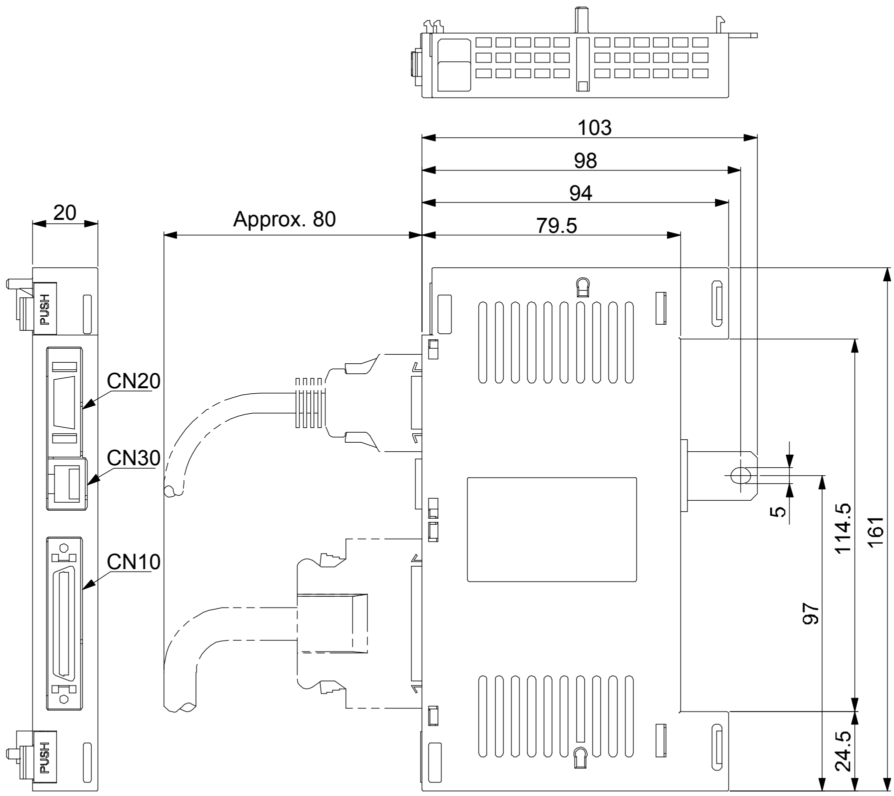
		L_1 · L_2 · L_3 · U · V · W · P1 · P · C · N · ⏚	L_{11} · L_{21}
MR-J3-11KT(4) MR-J3-15KT(4)	Screw size	M6	M4
	Tightening torque [(lb:in)][N · m]	3.0	1.2
MR-J3-22KT(4)	Screw size	M8	M4
	Tightening torque [(lb:in)][N · m]	6.0	1.2

Mounting screw

Servo amplifier	Screw size	Tightening torque [N · m]([lb · in])
MR-J3-11KT(4) MR-J3-15KT(4) MR-J3-22KT(4)	M10	26.5 (234.5)

11.2 MR-J3-D01 extension IO unit

[Unit: mm]

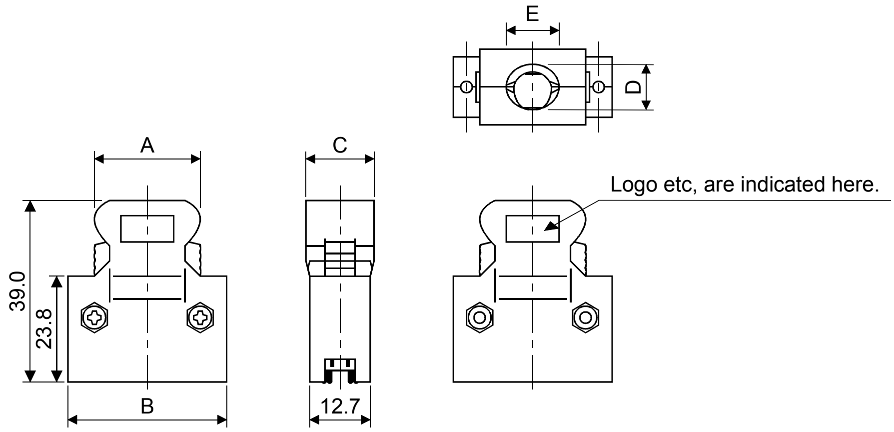


11.3 Connector

(1) Miniature delta ribbon (MDR) system (3M)

(a) One-touch lock type

[Unit: mm]

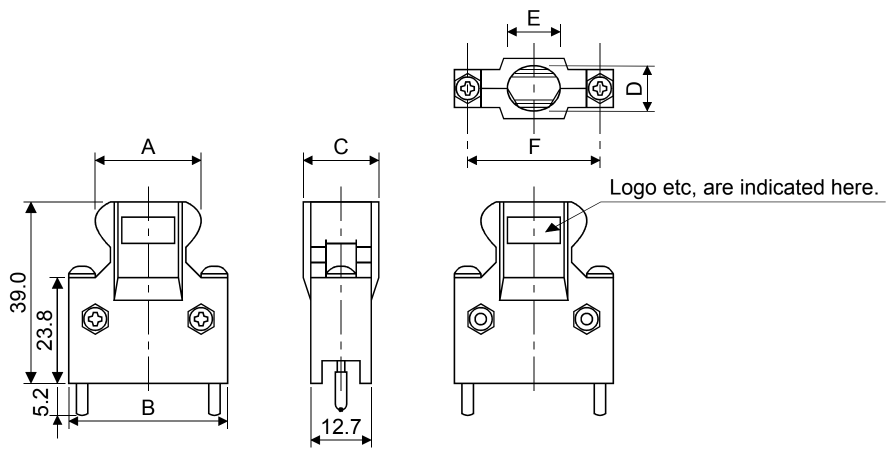


Connector	Shell kit	Each type of dimension				
		A	B	C	D	E
10150-3000PE	10350-52F0-008	41.1	52.4	18.0	14.0	17.0

(b) Jack screw M2.6 type

This is not available as option.

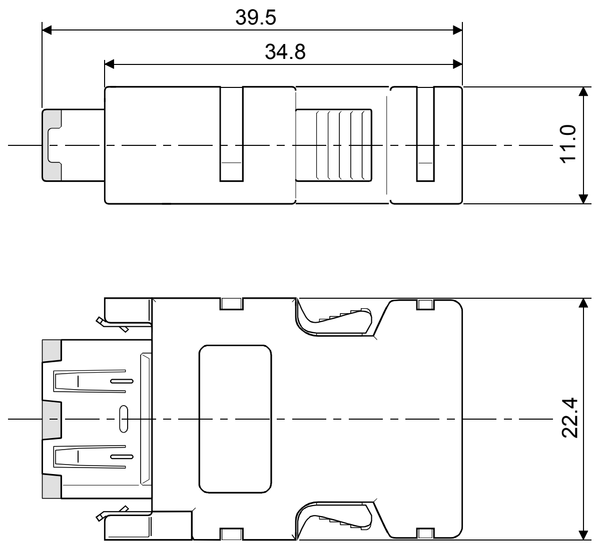
[Unit: mm]



Connector	Shell kit	Each type of dimension					
		A	B	C	D	E	F
10150-3000PE	10350-52A0-008	41.1	52.4	18.0	14.0	17.0	46.5

(2) SCR connector system (3M)

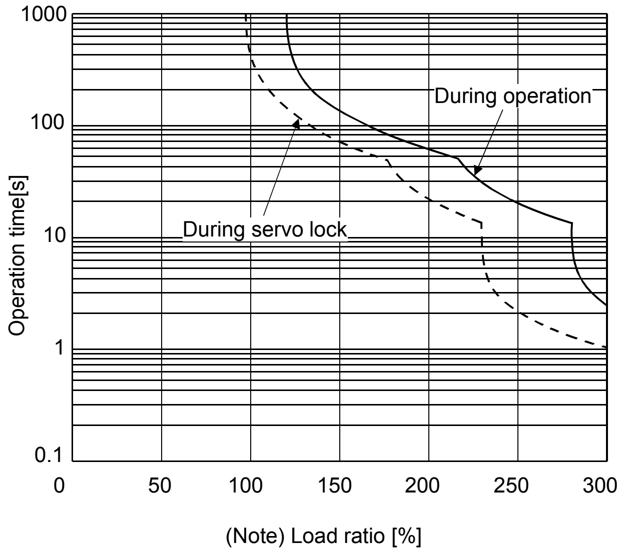
Receptacle: 36210-0100PL
Shell kit : 36310-3200-008



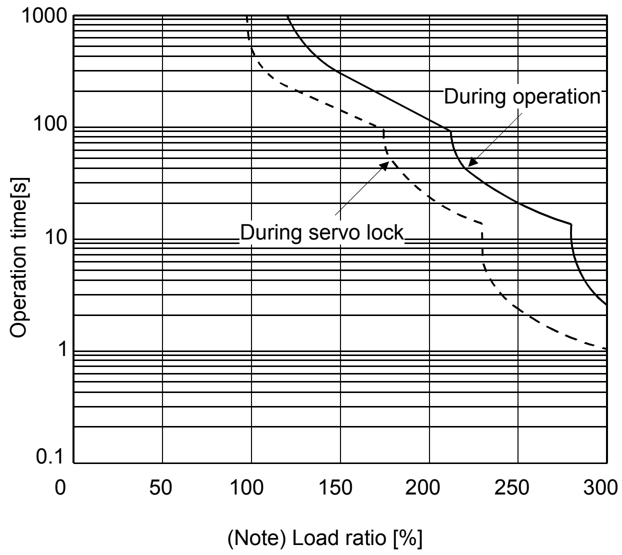
12. CHARACTERISTICS

12.1 Overload protection characteristics

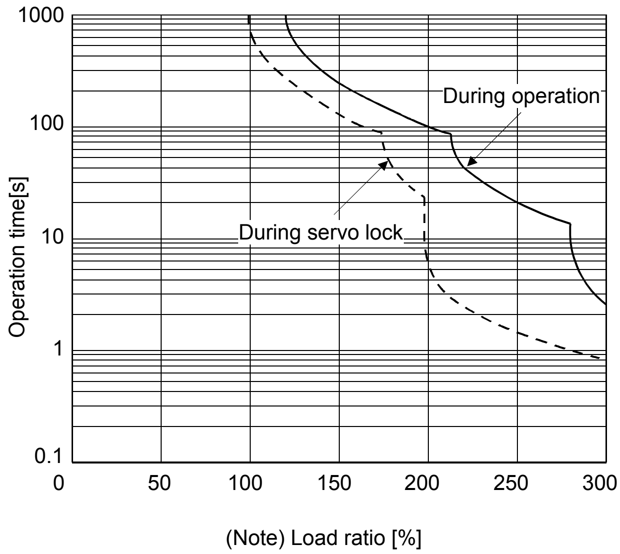
An electronic thermal relay is built in the servo amplifier to protect the servo motor and servo amplifier from overloads. Overload 1 alarm (A50) occurs if overload operation performed is above the electronic thermal relay protection curve shown in any of Figs 12.1. Overload 2 alarm (A51) occurs if the maximum current flew 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.
In a machine like the one for vertical lift application where unbalanced torque will be produced, it is recommended to use the machine so that the unbalanced torque is 70% or less of the rated torque.
When you carry out adhesion mounting of the servo amplifier, make circumference temperature into 0 to 45℃ (32 to 113℉), or use it at 75% or smaller effective load ratio.



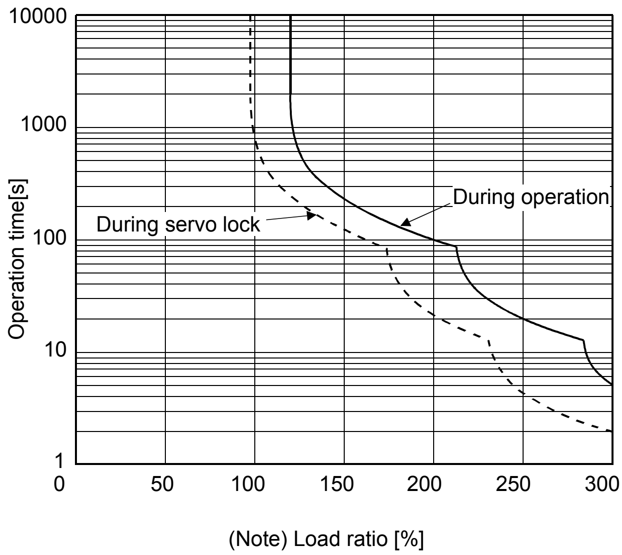
MR-J3-10T(1)



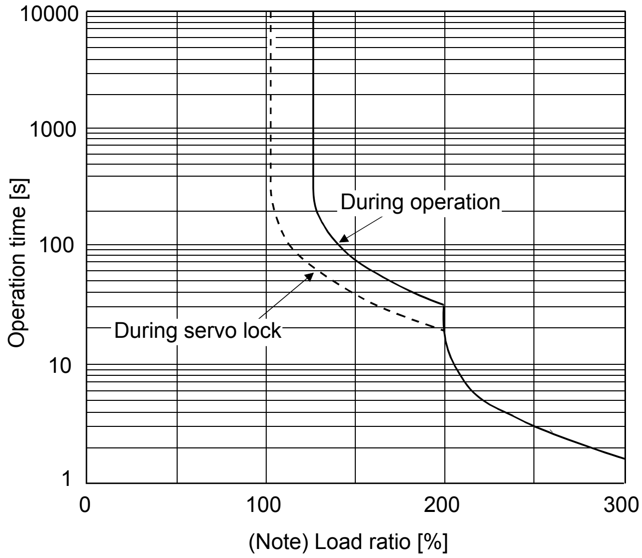
MR-J3-20T(1) · MR-J3-40T(1)
MR-J3-60T(4) to MR-J3-100T(4)



MR-J3-200T(4) · MR-J3-350T(4)



MR-J3-500T(4) · MR-J3-700T(4)



MR-J3-11KT(4) to MR-J3-22KT(4)

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 30r/min or less low-speed operation status, the servo amplifier may fail even when the electronic thermal relay protection is not activated.

Fig 12.1 Electronic thermal relay protection characteristics

12.2 Power supply equipment capacity and generated loss

(1) Amount of heat generated by the servo amplifier

Table 12.1 indicates servo amplifiers' power supply capacities and losses generated under rated load. For thermal design of an enclosure, use the values in Table 12.1 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 maximum 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 12.1 Power supply capacity and generated heat per servo amplifier at rated output

Servo amplifier	Servo motor	(Note 1) Power supply capacity[kVA]	(Note 2) Servo amplifier-generated heat[W]		Area required for heat dissipation [m²]
			At rated torque	With servo off	
MR-J3-10T (1)	HF-MP053	0.3	25	15	0.5
	HF-MP13	0.3	25	15	0.5
	HF-KP053 · 13	0.3	25	15	0.5
MR-J3-20T (1)	HF-MP23	0.5	25	15	0.5
	HF-KP23	0.5	25	15	0.5
MR-J3-40T (1)	HF-MP43	0.9	35	15	0.7
	HF-KP43	0.9	35	15	0.7
MR-J3-60T (4)	HF-SP52 (4)	1.0	40	15	0.8
	HF-SP51	1.0	40	15	0.8
	HC-LP52	1.0	40	15	0.8
MR-J3-70T	HF-MP73	1.3	50	15	1.0
	HF-KP73	1.3	50	15	1.0
	HC-UP72	1.3	50	15	1.0
MR-J3-100T (4)	HF-SP102 (4)	1.7	50	15	1.0
	HF-SP81	1.5	50	15	1.0
	HC-LP102	1.7	50	15	1.0
MR-J3-200T (4)	HF-SP152 (4)	2.5	90	20	1.8
	HF-SP202 (4)	3.5	90	20	1.8
	HF-SP121	2.1	90	20	1.8
	HF-SP201	3.5	90	20	1.8
	HC-RP103	1.8	50	15	1.0
	HC-RP153	2.5	90	20	1.8
	HC-UP152	2.5	90	20	1.8
	HC-LP152	2.5	90	20	1.8
MR-J3-350T (4)	HF-SP352 (4)	5.5	130	20 (25) (Note 3)	2.7
	HC-RP203	3.5	90	20	1.8
	HC-UP202	3.5	90	20	1.8
	HC-LP202	3.5	90	20	1.8
	HF-SP301	4.8	120	20	2.4
MR-J3-500T (4)	HF-SP502 (4)	7.5	195	25	3.9
	HC-RP353	5.5	135	25	2.7
	HC-RP503	7.5	195	25	3.9
	HC-UP352	5.5	195	25	3.9
	HC-UP502	7.5	195	25	3.9
	HC-LP302	4.5	120	25	2.4
	HA-LP502	7.5	195	25	3.9
	HF-SP421	6.7	160	25	3.2

Servo amplifier	Servo motor	(Note 1) Power supply capacity[kVA]	(Note 2) Servo amplifier-generated heat[W]		Area required for heat dissipation [m^2]
			At rated torque	With servo off	
MR-J3-700T (4)	HF-SP702 (4)	10.0	300	25	6.0
	HA-LP702	10.6	300	25	6.0
	HA-LP601 (4)	10.0	260	25	5.2
	HA-LP701M (4)	11.0	300	25	6.0
MR-J3-11KT (4)	HC-LP11K2 (4)	16.0	530	45	11.0
	HC-LP801 (4)	12.0	390	45	7.8
	HC-LP12K1 (4)	18.0	580	45	11.6
	HC-LP11K1M (4)	16.0	530	45	11.0
MR-J3-15KT (4)	HC-LP15K2 (4)	22.0	640	45	13.0
	HC-LP15K1 (4)	22.0	640	45	13.0
	HC-LP15K1M (4)	22.0	640	45	13.0
MR-J3-22KT (4)	HC-LP22K2 (4)	33.0	850	55	17.0
	HC-LP20K1 (4)	30.1	775	55	15.5
	HC-LP25K1	37.6	970	55	19.4
	HC-LP22K1M (4)	33.0	850	55	17.0

Note 1. Note that the power supply capacity will vary according to the power supply impedance. This value assumes that the power factor improving reactor is not used.
2. Heat generated during regeneration is not included in the servo amplifier-generated heat. To calculate heat generated by the regenerative option, refer to section 13.2.
3. For 400V class, the value is within the ( ).

(2) Heat dissipation area for enclosed servo amplifier

The enclosed control box (hereafter called the control box) which will contain the servo amplifier should be designed to ensure that its temperature rise is within +10℃ (+50°F) at the ambient temperature of 40℃ (104°F). (With a 5℃ (41°F) safety margin, the system should operate within a maximum 55℃ (131°F) limit.) The necessary enclosure heat dissipation area can be calculated by Equation 12.1.

$$A = \frac{P}{K \cdot \Delta T} \qquad (12.1)$$

where, A : Heat dissipation area [m^2]

P : Loss generated in the control box [W]

ΔT : Difference between internal and ambient temperatures [℃]

K : Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with Equation 12.1, assume that P is the sum of all losses generated in the enclosure. Refer to table 12.1 for heat generated by the servo amplifier. "A" indicates the effective area for heat dissipation, but if the enclosure is directly installed on an insulated wall, that extra amount must be added to the enclosure's surface area.

The required heat dissipation area will vary wit the conditions in the enclosure. If convection in the enclosure is poor and heat builds up, effective heat dissipation will not be possible. Therefore, arrangement of the equipment in the enclosure and the use of a cooling fan should be considered.

Table 12.1 lists the enclosure dissipation area for each servo amplifier when the servo amplifier is operated at the ambient temperature of 40℃ (104°F) under rated load.

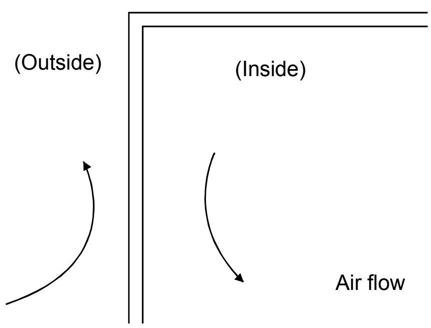


Fig. 12.2 Temperature distribution in enclosure

When air flows along the outer wall of the enclosure, effective heat exchange will be possible, because the temperature slope inside and outside the enclosure will be steeper.

12.3 Dynamic brake characteristics

12.3.1 Dynamic brake operation

(1) Calculation of coasting distance

Fig. 12.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use Equation 12.2 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) in this section.)

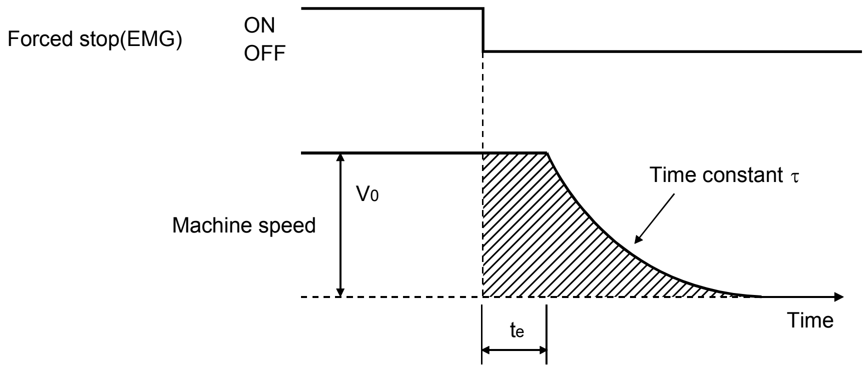


Fig. 12.3 Dynamic brake operation diagram

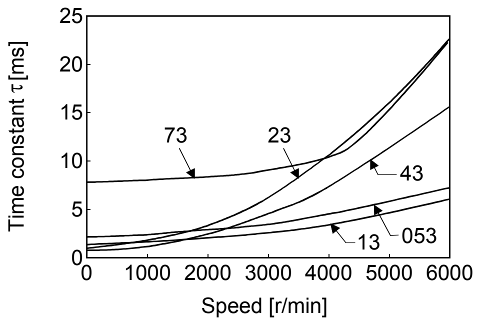
$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \quad \text{(12.2)}$$

L_{max} : Maximum coasting distance .... [mm][in]
V_o : Machine rapid feed rate .... [mm/min][in/min]
J_M : Servo motor inertial moment .... [kg・cm^2][oz・in^2]
J_L : Load inertia moment converted into equivalent value on servo motor shaft .... [kg・cm^2][oz・in^2]
τ : Brake time constant .... [s]
t_e : Delay time of control section .... [s]
For 7kW or less servo, there is internal relay delay time of about 30ms. For 11k to 22kW servo, there is delay time of about 100ms caused by a delay of the external relay and a delay of the magnetic contactor built in the external dynamic brake.

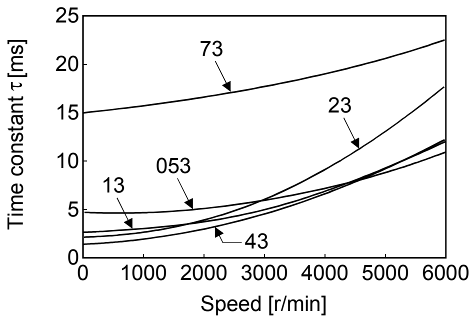
(2) Dynamic brake time constant

The following shows necessary dynamic brake time constant τ for the equations (12.2).

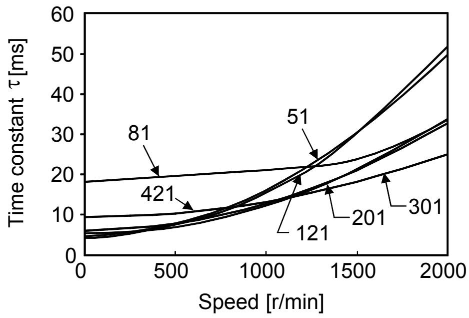
(a) 200V class servo motor



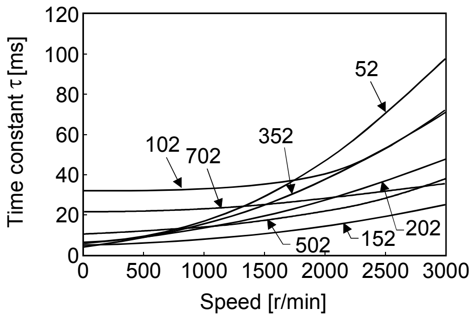
HF-MP series



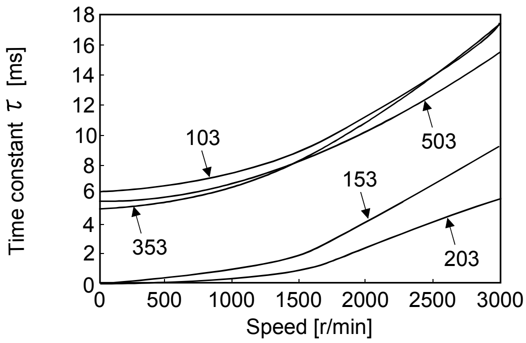
HF-KP series



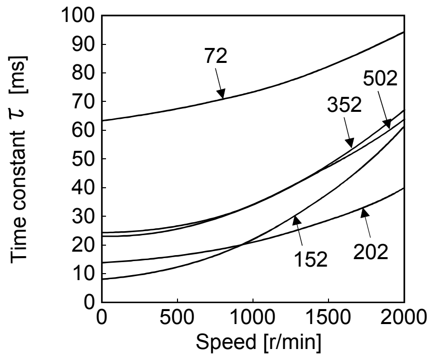
HF-SP1000r/min series



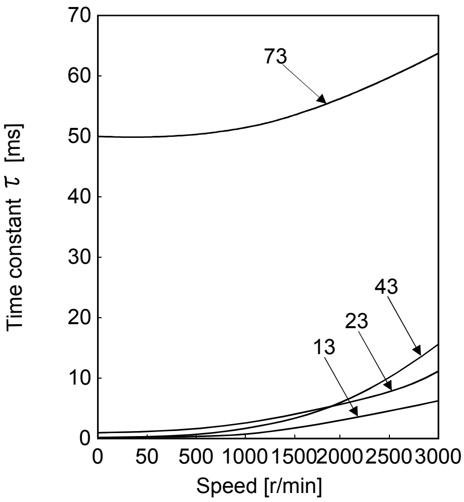
HF-SP2000r/min series



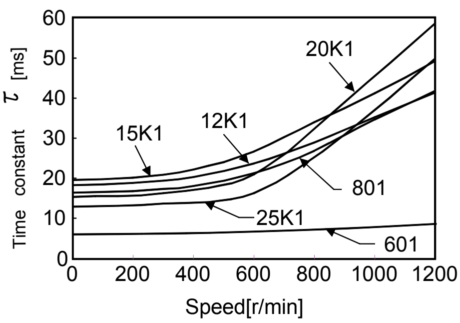
HC-RP series



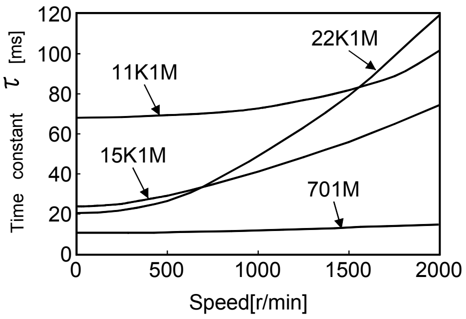
HC-UP2000r/min series



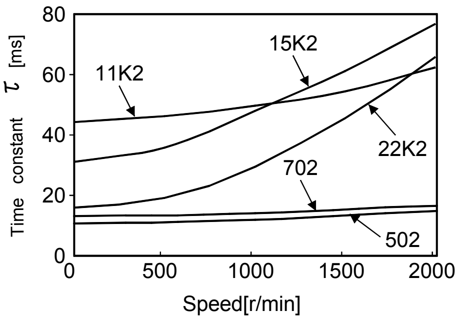
HC-UP3000r/min series



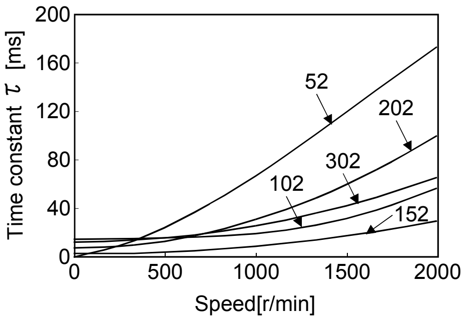
HA-LP1000r/min series



HA-LP1500r/min series

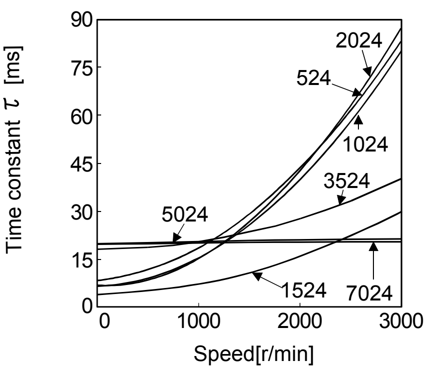


HA-LP2000r/min series

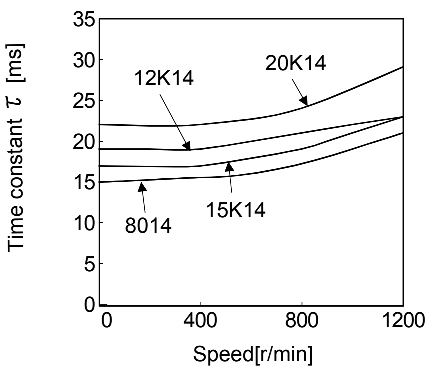


HC-LP series

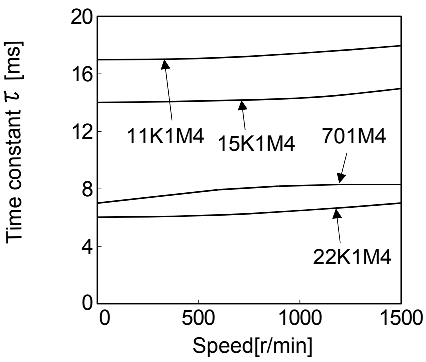
(b) 400V class servo motor



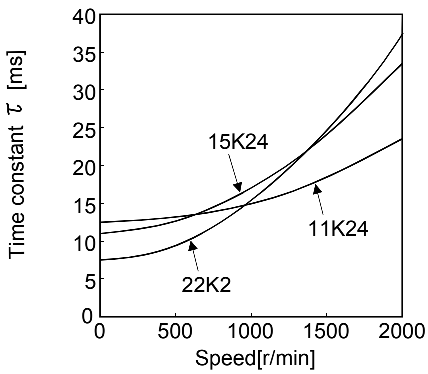
HA-SP2000r/min series



HA-LP1000r/min series



HA-LP1500r/min series



HA-LP2000r/min series

12.3.2 The dynamic brake at the load inertia moment

Use the dynamic brake under the load inertia moment ratio indicated in the following table. If the load inertia moment is higher than this value, the built-in dynamic brake may burn. If there is a possibility that the load inertia moment may exceed the value, contact Mitsubishi.
The values of the load inertia moment ratio in the table are the values at the maximum rotation speed of the servo motor.

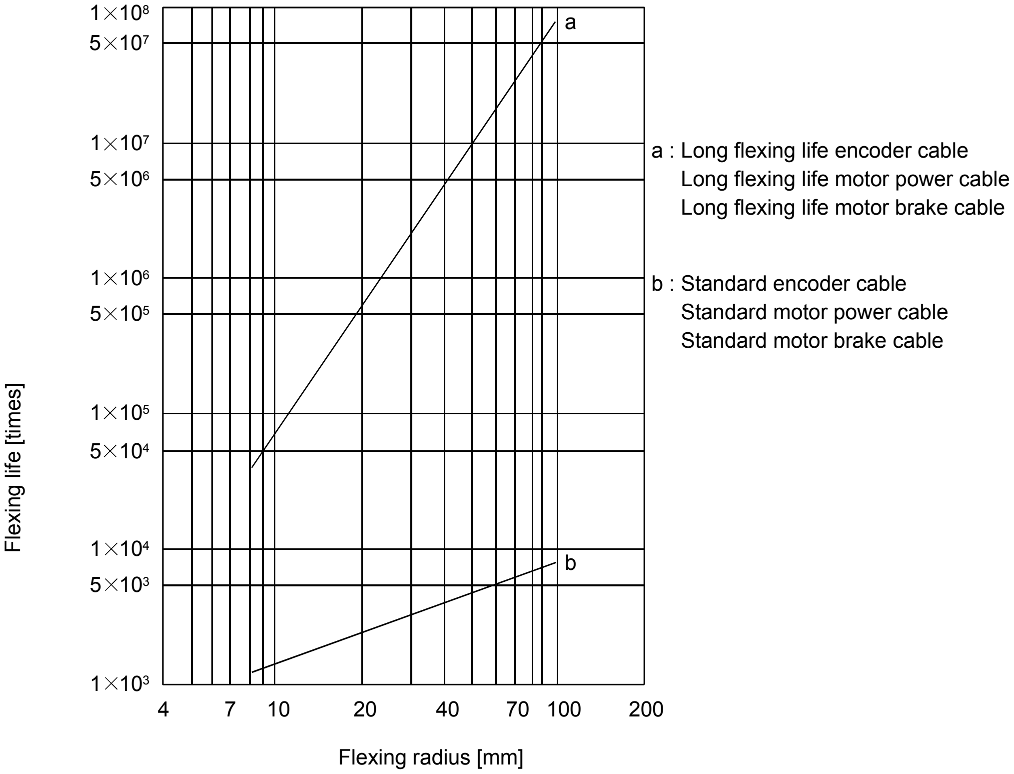
Servo amplifier	Servo motor									
	HF-KP□	HF-MP□	HF-SP□1	HF-SP□2	HC-RP□	HC-UP□	HC-LP□	HA-LP□1	HA-LP□1M	HA-LP□2
MR-J3-10T(1)	30	30								
MR-J3-20T(1)	30	30								
MR-J3-40T(1)	30	30								
MR-J3-60T			30	30			30			
MR-J3-70T	30	30				30				
MR-J3-100T			30	30			30			
MR-J3-200T			30	30	30	30	30			
MR-J3-350T			16	16	16	16	16			
MR-J3-500T			15	15	15	15	15			15
MR-J3-700T				5 (Note 1)				5 (Note 1)	5 (Note 1)	5 (Note 1)
MR-J3-11KT (Note 2)								30	30	30
MR-J3-15KT (Note 2)								30	30	30
MR-J3-22KT (Note 2)								30	30	30

Servo amplifier	Servo motor			
	HF-SP□4	HA-LP□14	HA-LP□1M4	HA-LP□24
MR-J3-60T4	5 (Note 1)			
MR-J3-100T4	5 (Note 1)			
MR-J3-200T4	5 (Note 1)			
MR-J3-350T4	5 (Note 1)			
MR-J3-500T4	5 (Note 1)			
MR-J3-700T4	5 (Note 1)	10	10	
MR-J3-11KT4 (Note 2)		30	30	30
MR-J3-15KT4 (Note 2)		30	30	30
MR-J3-22KT4 (Note 2)		30	30	30

Note 1. The load inertia moment ratio is 15 at the rated rotation speed.
2. When the external dynamic brake is used.

12.4 Cable flexing life

The flexing life of the cables is shown below. This graph calculated values. Since they are not guaranteed values, provide a little allowance for these values.



12.5 Inrush currents at power-on of main circuit and control circuit

The following table indicates the inrush currents (reference data) that will flow when the maximum permissible voltage (200V class: 253VAC, 400V class: 528VAC) is applied at the power supply capacity of 2500kVA and the wiring length of 1m.

Servo Amplifier	Inrush Currents (A_{0-p})	
	Main circuit power supply (L_1, L_2, L_3)	Control circuit power supply (L_{11}, L_{21})
MR-J3-10T1 to 40T1	38A (Attenuated to approx. 14A in 10ms)	20 to 30A (Attenuated to approx. 0A in 1 to 2ms)
MR-J3-10T to 60T	30A (Attenuated to approx. 5A in 10ms)	
MR-J3-70T・100T	54A (Attenuated to approx. 12A in 10ms)	
MR-J3-200T・350T	120A (Attenuated to approx. 12A in 20ms)	
MR-J3-500T	44A (Attenuated to approx. 20A in 20ms)	30A (Attenuated to approx. 0A in 3ms)
MR-J3-700T	88A (Attenuated to approx. 20A in 20ms)	
MR-J3-11KT	235A (Attenuated to approx. 20A in 20ms)	
MR-J3-15KT		
MR-J3-22KT		
MR-J3-60T4・100T4	100A (Attenuated to approx. 5A in 10ms)	40 to 50A (Attenuated to approx. 0A in 2ms)
MR-J3-200T4	120A (Attenuated to approx. 12A in 20ms)	
MR-J3-350T4・500T4	66A (Attenuated to approx. 10A in 20ms)	41A (Attenuated to approx. 0A in 3ms)
MR-J3-700T4	67A (Attenuated to approx. 34A in 20ms)	
MR-J3-11KT4	325A (Attenuated to approx. 20A in 20ms)	45A (Attenuated to approx. 0A in 3ms)
MR-J3-15KT4		
MR-J3-22KT4		

Since large inrush currents flow in the power supplies, always use no-fuse breakers and magnetic contactors. (Refer to section 13.10.)
When circuit protectors are used, it is recommended to use the inertia delay type that will not be tripped by an inrush current.

13. OPTIONS AND AUXILIARY EQUIPMENT

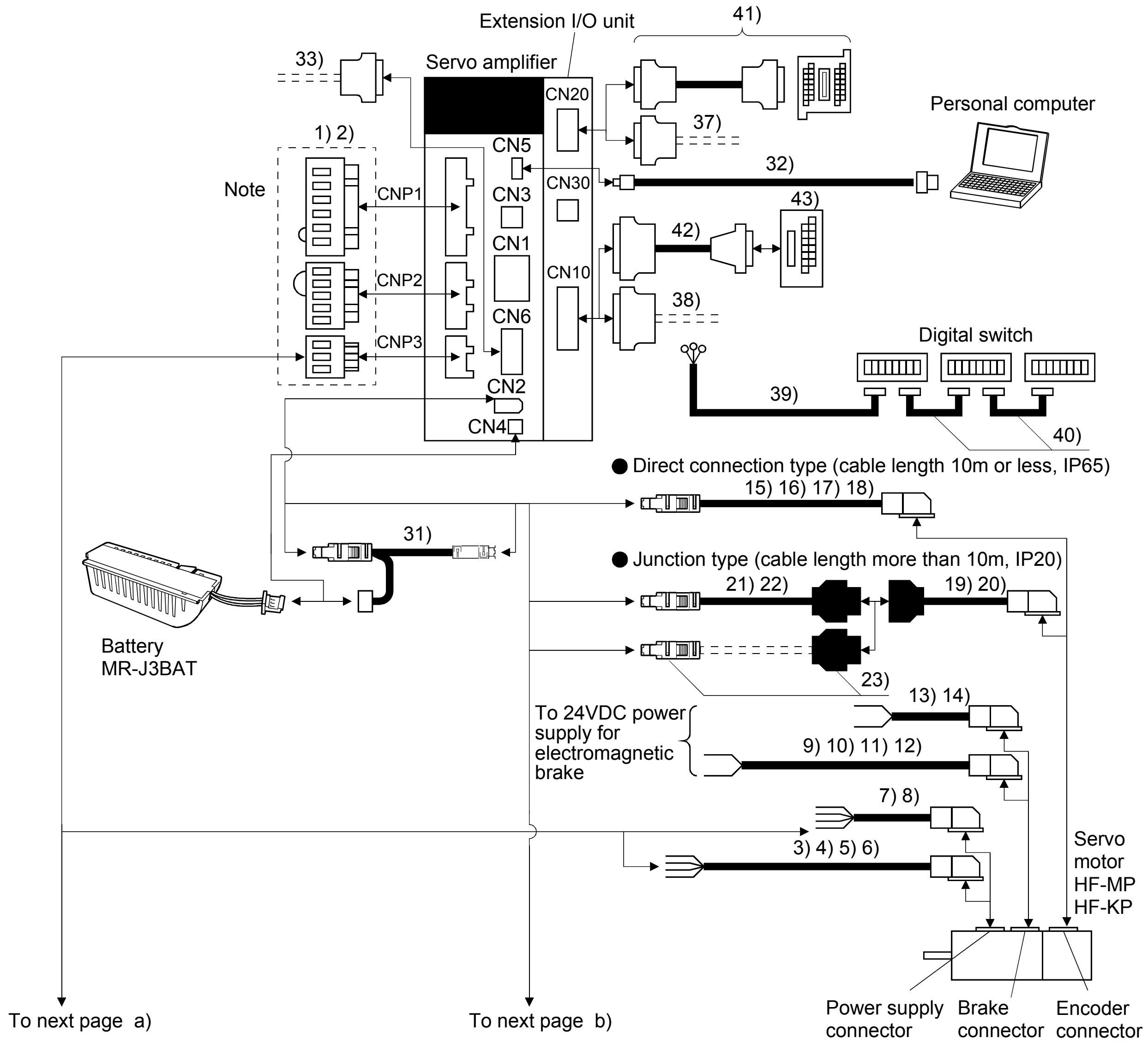
⚠WARNING	· Before connecting any option or peripheral equipment, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P(+) and N(−) is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, always confirm from the front of the servo amplifier whether the charge lamp is off or not.

⚠CAUTION	· Use the specified auxiliary equipment and options. Unspecified ones may lead to a fault or fire.

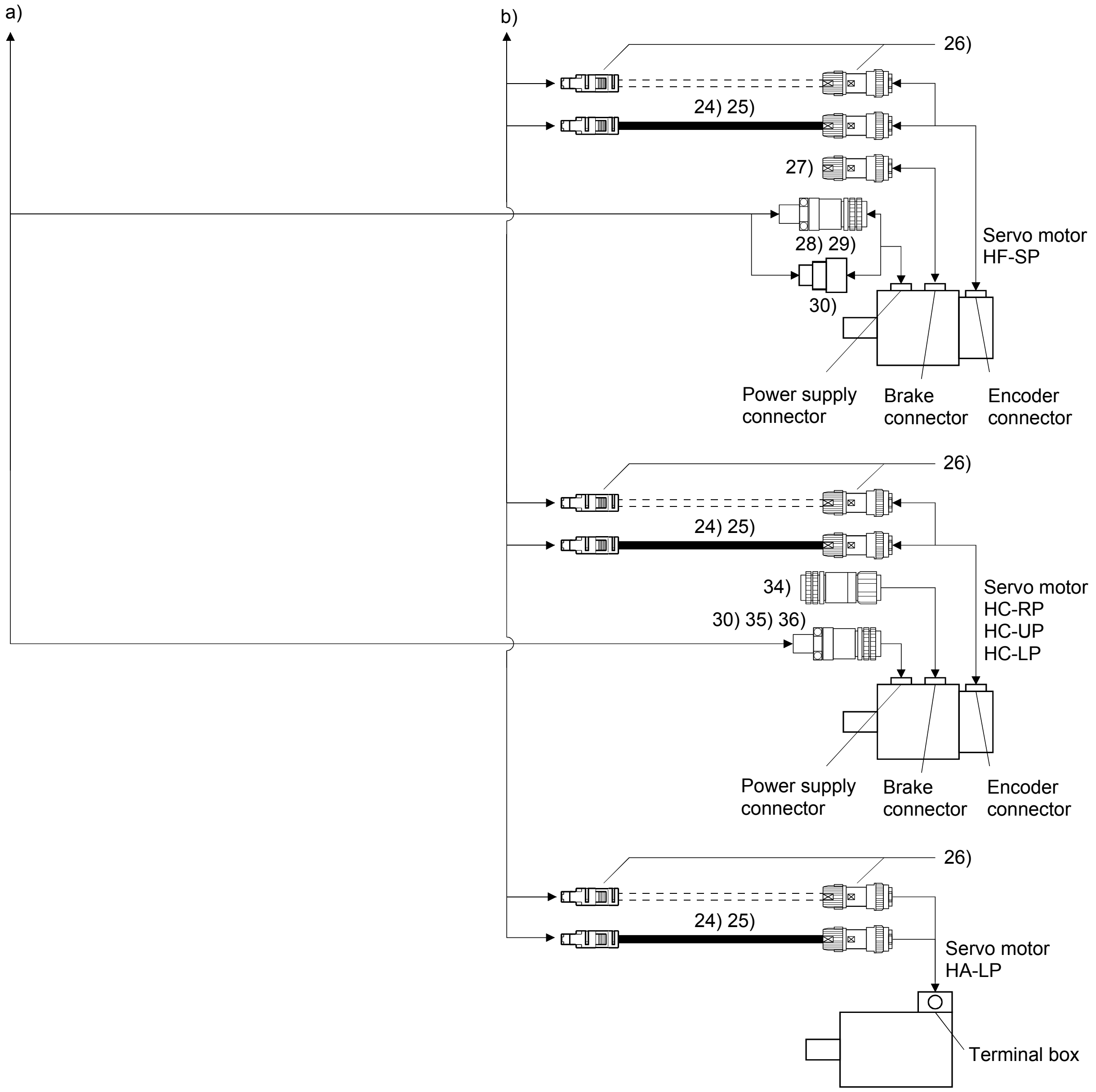
13.1 Cable/connector sets

As the cables and connectors used with this servo, purchase the options indicated in this section.

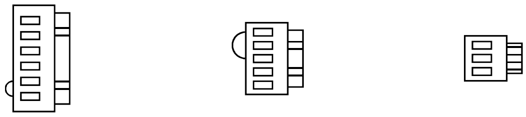
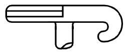
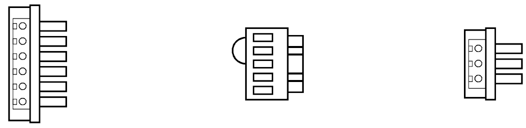
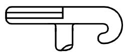
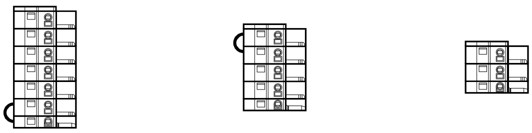
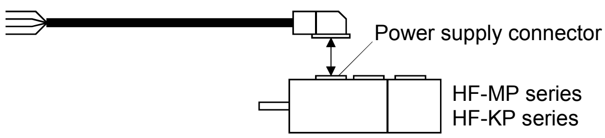
13.1.1 Combinations of cable/connector sets

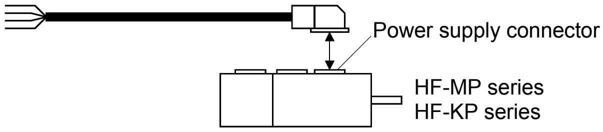
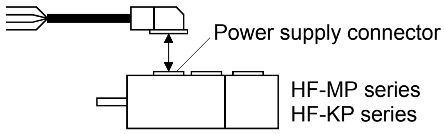
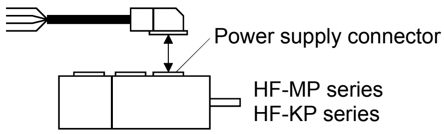
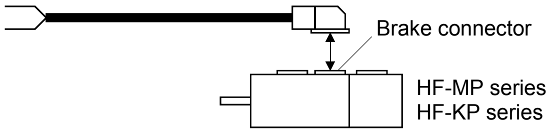
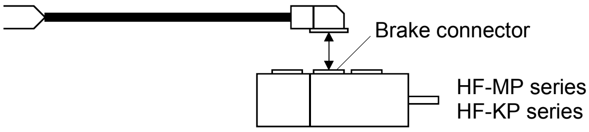
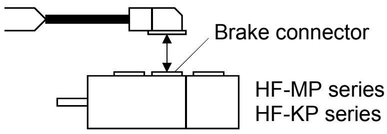
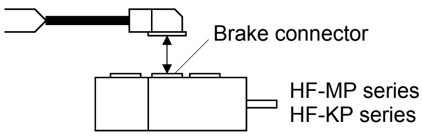
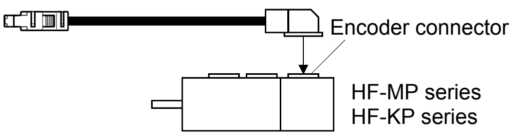


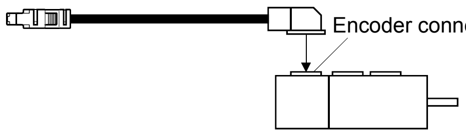
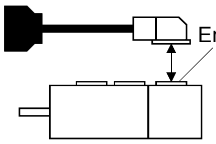
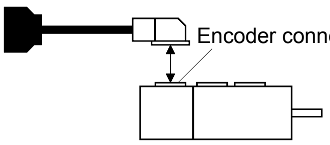
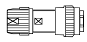
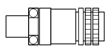
Note. Connectors for 3.5kW or less. For 5kW or more, terminal blocks.

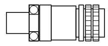
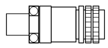
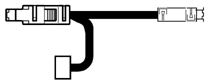
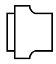
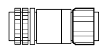
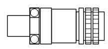
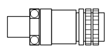
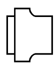
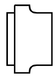


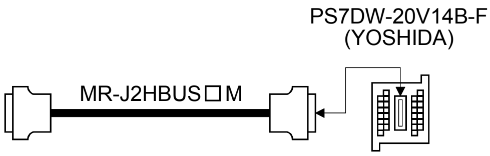
a)
b)
26)
24) 25)
27)
28) 29)
30)
Servo motor
HF-SP
Power supply connector
Brake connector
Encoder connector
26)
24) 25)
34)
30) 35) 36)
Servo motor
HC-RP
HC-UP
HC-LP
Power supply connector
Brake connector
Encoder connector
26)
24) 25)
Servo motor
HA-LP
Terminal box

No.	Product	Model	Description	Application
1)	Servo amplifier power supply connector		 CNP1 connector: 54928-0670 (Molex) CNP2 connector: 54928-0520 (Molex) CNP3 connector: 54928-0370 (Molex) <Applicable cable example> Wire size: 0.14mm^2(AWG26) to 2.5mm^2 (AWG14) Cable finish OD: to ϕ3.8mm  REC. Lever: 54932-0000 (Molex)	Supplied with servo amplifiers of 1kW or less in 100V class and 200V class
2)	Servo amplifier power supply connector		 CNP1 connector: PC4/6-STF-7.62-CRWH (Phoenix Contact) CNP2 connector: 54928-0520 (Molex) CNP3 connector: PC4/3-STF-7.62-CRWH (Phoenix Contact) <Applicable cable example> Wire size: 0.2mm^2 (AWG24) to 5.5mm^2 (AWG10) Cable finish OD: to ϕ5mm  REC. Lever: 54932-0000 (Molex)	Supplied with servo amplifiers of 3.5kW in 200V class
			 CNP1 connector: 721-207/026-000 (Plug) (WAGO) CNP2 connector: 721-205/026-000 (Plug) (WAGO) CNP3 connector: 721-203/026-000 (Plug) (WAGO) <Applicable cable example> Wire size: 0.08mm^2 (AWG28) to 2.5mm^2 (AWG12) Cable finish OD: to ϕ4.1mm  REC. Lever: 231-131 (WAGO)	Supplied with servo amplifiers of 2kW in 200V class and 2kW in 400V class
3)	Motor power supply cable	MR-PWS1CBL □ M-A1-L Cable length: 2・5・10m	 Refer to section 13.1.3 for details.	IP65 Load side lead
4)	Motor power supply cable	MR-PWS1CBL □ M-A1-H Cable length: 2・5・10m		IP65 Load side lead Long flex life

No.	Product	Model	Description	Application
5)	Motor power supply cable	MR-PWS1CBL ☐ M-A2-L Cable length: 2・5・10m	 Refer to section 13.1.3 for details.	IP65 Opposite-to-load side lead
6)	Motor power supply cable	MR-PWS1CBL ☐ M-A2-H Cable length: 2・5・10m		IP65 Opposite-to-load side lead Long flex life
7)	Motor power supply cable	MR-PWS2CBL03M-A1-L Cable length: 0.3m	 Refer to section 13.1.3 for details.	IP55 Load side lead
8)	Motor power supply cable	MR-PWS2CBL03M-A2-L Cable length: 0.3m	 Refer to section 13.1.3 for details.	IP55 Opposite-to-load side lead
9)	Motor brake cable	MR-BKS1CBL ☐ M-A1-L Cable length: 2・5・10m	 Refer to section 13.1.4 for details.	IP65 Load side lead
10)	Motor brake cable	MR-BKS1CBL ☐ M-A1-H Cable length: 2・5・10m		IP65 Load side lead Long flex life
11)	Motor brake cable	MR-BKS1CBL ☐ M-A2-L Cable length: 2・5・10m	 Refer to section 13.1.4 for details.	IP65 Opposite-to-load side lead
12)	Motor brake cable	MR-BKS1CBL ☐ M-A2-H Cable length: 2・5・10m		IP65 Opposite-to-load side lead Long flex life
13)	Motor brake cable	MR-BKS2CBL03M-A1-L Cable length: 0.3m	 Refer to section 13.1.4 for details.	IP55 Load side lead
14)	Motor brake cable	MR-BKS2CBL03M-A2-L Cable length: 0.3m	 Refer to section 13.1.4 for details.	IP55 Opposite-to-load side lead
15)	Encoder cable	MR-J3ENCBL ☐ M-A1-L Cable length: 2・5・10m	 Refer to section 13.1.2 (1) for details.	IP65 Load side lead
16)	Encoder cable	MR-J3ENCBL ☐ M-A1-H Cable length: 2・5・10m		IP65 Opposite-to-load side lead Long flex life

No.	Product	Model	Description	Application
17)	Encoder cable	MR-J3ENCBL □ M-A2-L Cable length: 2・5・10m	 Refer to section 13.1.2 (1) for details.	IP65 Opposite-to-load side lead
18)	Encoder cable	MR-J3ENCBL □ M-A2-H Cable length: 2・5・10m		IP65 Opposite-to-load side lead Long flex life
19)	Encoder cable	MR-J3JCBL03M-A1-L Cable length: 0.3m	 Refer to section 13.1.2 (3) for details.	IP20 Load side lead
20)	Encoder cable	MR-J3JCBL03M-A2-L Cable length: 0.3m	 Refer to section 13.1.2 (3) for details.	IP20 Opposite-to-load side lead
21)	Encoder cable	MR-EKCBL □ M-L Cable length: 20・30m	 For HF-MP・HF-KP series Refer to section 13.1.2 (2) for details.	IP20
22)	Encoder cable	MR-EKCBL □ M-H Cable length: 20・30・40・50m		IP20 Long flex life
23)	Encoder connector set	MR-ECNM	 For HF-MP・HF-KP series Refer to section 13.1.2 (2) for details.	IP20
24)	Encoder cable	MR-J3ENSCBL □ M-L Cable length: 2・5・10・20・30m	 For HF-SP・HF-LP・HC-UP・HC-LP・HC-RP series Refer to section 13.1.2 (4) for details.	IP67 Standard flex life
25)	Encoder cable	MR-J3ENSCBL □ M-H Cable length: 2・5・10・20・30・40・50m		IP67 Long flex life
26)	Encoder connector set	MR-J3SCNS	 For HF-SP・HF-LP・HC-UP・HC-LP・HC-RP series Refer to section 13.1.2 (4) for details.	IP67
27)	Brake connector set	MR-BKCNS1	Straight plug: CM10-SP2S-L Socket contact: CM10-#22SC(S2)-100 (DDK)  For HF-SP series	IP67
28)	Power supply connector set	MR-PWCNS4	Plug: CE05-6A18-10SD-D-BSS Cable clamp: CE3057-10A-1-D (DDK) Example of applicable cable Applicable wire size: 2mm^2 (AWG14) to 3.5mm^2 (AWG12) Cable finish ϕD: ϕ10.5 to 14.1mm  For HF-SP51・81 For HF-SP52 to 152	IP67

No.	Product	Model	Description	Application
29)	Power supply connector set	MR-PWCNS5	Plug: CE05-6A22-22SD-D-BSS Cable clamp: CE3057-12A-1-D (DDK) Example of applicable cable Applicable wire size: 5.5mm^2 (AWG10) to 8mm^2 (AWG8) Cable finish ϕD: ϕ12.5 to 16mm  For HF-SP121 to 301 For HF-SP202 to 502	IP67
30)	Power supply connector set	MR-PWCNS3	Plug: CE05-6A32-17SD-D-BSS Cable clamp: CE3057-20A-1-D (DDK) Example of applicable cable Applicable wire size: 14mm^2 (AWG6) to 22mm^2 (AWG4) Cable finish ϕ D: ϕ 22 to 23.8mm  For HF-SP421 For HF-SP702 For HA-LP702	IP67 Be sure to use this when corresponding to EN Standard.
31)	Cable for connecting battery	MR-J3BTCBL03M	 Refer to section 13.1.2 (5) for details.	For connection of battery
32)	USB cable	MR-J3USBCBL3M Cable length: 3m	For CN5 connector minB connector (5-pin) For personal computer connector A connector 	For connection with PC-AT compatible personal computer
33)	Connector set	MR-J2CMP2	 Connector: 10126-3000PE Shell kit: 10326-52F0-008(3M or equivalent)	
34)	Break connector set	MR-BKCN	Plug: D/MS3106A10SL-4S (D190) (DDK) For cable connector: YS010-5-8 (Daiwa Dengyo) Example of applicable cable Applicable wire size: 0.3mm^2 (AWG22) to 1.25mm^2 (AWG16) Cable finish: ϕ5 to 8.3mm  For HA-LP For HC-UP For HC-LP	EN standard compliant IP65
35)	Power supply connector set	MR-PWCNS1	Plug: CE05-6A22-23SD-D-BSS Cable clamp: CE3057-12A-2-D (DDK) Example of applicable cable Applicable wire size: 2mm^2 (AWG14) to 3.5mm^2 (AWG12) Cable finish: ϕ9.5 to 13mm  For HC-UP For HC-LP For HC-RP	Be sure to use this when corresponding to EN standard IP65
36)	Power supply connector set	MR-PWCNS2	Plug: CE05-6A24-10SD-D-BSS Cable clamp: CE3057-16A-2-D (DDK) Example of applicable cable Applicable wire size: 5.5mm^2 (AWG10) to 8mm^2 (AWG8) Cable finish: ϕ13 to 15.5mm  For HA-LP For HC-UP For HC-LP For HC-RP	
37)	Connector set	MR-CCN1	 Connector: 10120-3000PE Shell kit: 10320-52F0-008(3M or equivalent)	
38)	Connector set	MR-J3CN1	 Connector: 10150-3000PE Shell kit: 10350-52F0-008(3M or equivalent)	

No.	Product	Model	Description	Application
39)	Digital switch cable	MR-DSCBL□M-G	 Refer to section 3.2.2 and section 13.19 for details.	For digital switch
40)	Digital switch cable	MR-DSCBL□	 Refer to section 3.2.2 and section 13.19 for details.	For digital switch junction
41)	Junction terminal block (Recommend-ed)		 The junction terminal block PS7DW-20V14B-F is not an option from us. For using the junction terminal block, our option MR-J2HBUS□M is necessary. Refer to section 13.21 for details.	
42)	Junction terminal block cable	MR-J2M-CN1TBL□M Cable length: 0.5・1m (Refer to section 13.22)	For junction terminal block connector Connector: D7950-B500FL (3M) CN1 connector Connector: 10150-3000PE Shell kit: 10350-3210-000 (3M or equivalent) 	For junction terminal block connection
43)	Junction terminal block cable	MR-TB50	Refer to section 13.22.	

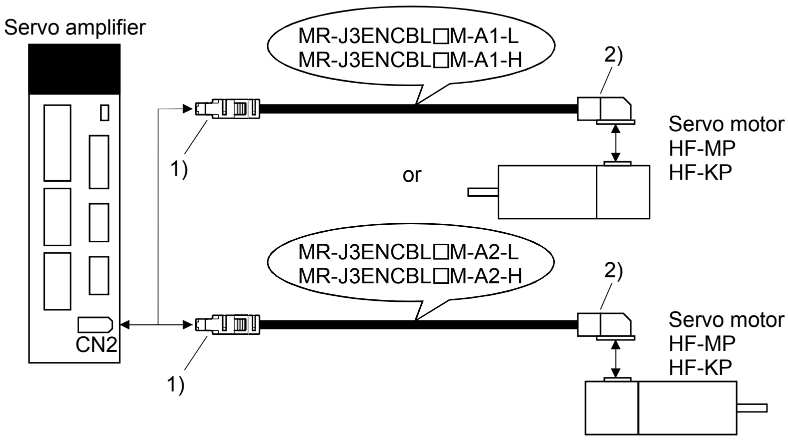
13.1.2 Encoder cable/connector sets

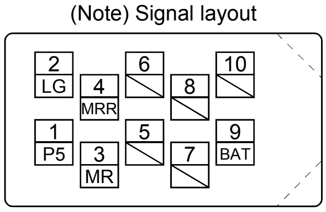
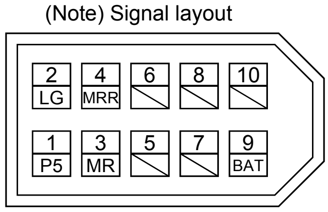
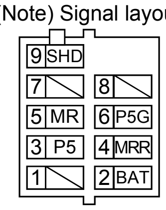
(1) MR-J3ENCBL □ M-A1-L/H・MR-J3ENCBL □ M-A2-L/H

These cables are encoder cables for the HF-MP・HF-KP series servo motors. The numerals in the Cable Length field of the table are the symbols entered in the □ part of the cable model. The cables of the lengths with the symbols are available.

Cable Model	Cable Length							Protective Structure	Flex Life	Application
	2m	5m	10m	20m	30m	40m	50m			
MR-J3ENCBL □ M-A1-L	2	5	10					IP65	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-J3ENCBL □ M-A1-H	2	5	10					IP65	Long flex	
MR-J3ENCBL □ M-A2-L	2	5	10					IP65	Standard	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-J3ENCBL □ M-A2-H	2	5	10					IP65	Long flex	

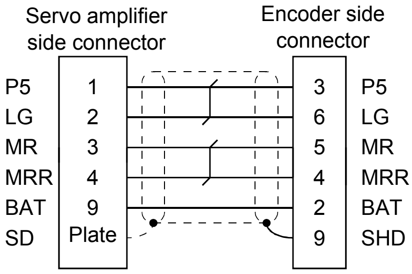
(a) Connection of servo amplifier and servo motor



Cable Model	1) For CN2 Connector	2) For Encoder Connector
MR-J3ENCBL □ M-A1-L MR-J3ENCBL □ M-A1-H MR-J3ENCBL □ M-A2-L MR-J3ENCBL □ M-A2-H	Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) Connector set: 54599-1019(Molex) (Note) Signal layout  View seen from wiring side. or (Note) Signal layout  View seen from wiring side. Note. Keep open the pins shown with ▧. Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.	Connector: 1674320-1 Crimping tool for ground clip: 1596970-1 Crimping tool for receptacle contact: 1596847-1 (Tyco Electronics) (Note) Signal layout  View seen from wiring side. Note. Keep open the pin shown with an ▧.

(b) Cable internal wiring diagram

MR-J3ENCBL2M-L/-H
MR-J3ENCBL5M-L/-H
MR-J3ENCBL10M-L/-H



(2) MR-EKCBL □ M-L/H

POINT

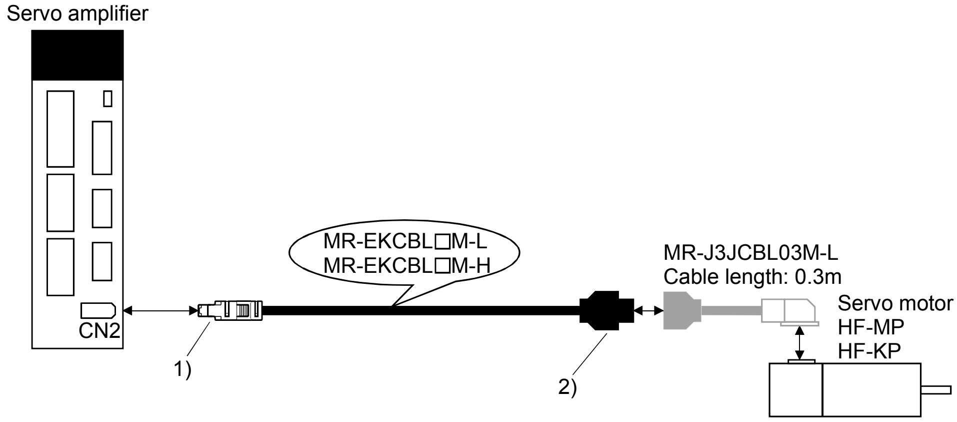
- The following encoder cables are of four-wire type. When using any of these encoder cables, set parameter No. PC22 to "1 □ □ □" to select the four-wire type.
  MR-EKCBL30M-L
  MR-EKCBL30M-H
  MR-EKCBL40M-H
  MR-EKCBL50M-H

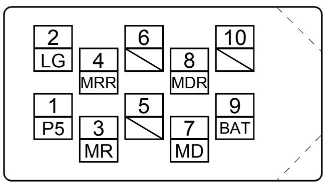
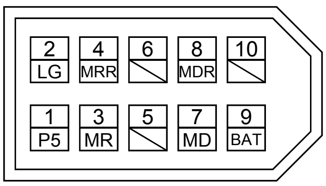
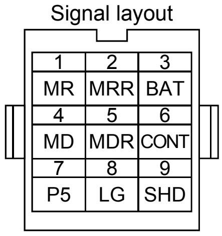
The servo amplifier and servo motor cannot be connected with these cables only. The servo motor side encoder cable (MR-J3JCBL03M-A1-L or MR-J3JCBL03M-A2-L) is required.
The numerals in the Cable Length field of the table are the symbols entered in the □ part of the cable model. The cables of the lengths with the symbols are available.

Cable Model	Cable Length							Protective Structure	Flex Life	Application
	2m	5m	10m	20m	30m	40m	50m			
MR-EKCBL □ M-L				20	(Note) 30			IP20	Standard	For HF-MP · HF-KP servo motor Use in combination with MR-J3JCBL03M-A1-L or MR-J3JCBL03M-A2-L.
MR-EKCBL □ M-H				20	(Note) 30	(Note) 40	(Note) 50	IP20	Long flex	

Note. Four-wire type cable.

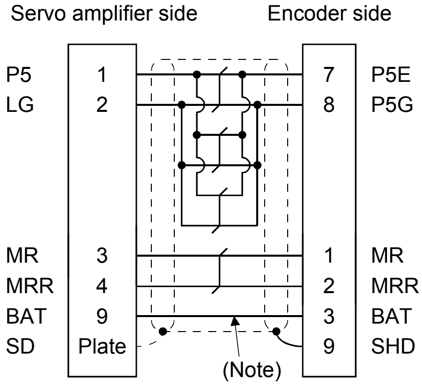
(a) Connection of servo amplifier and servo motor



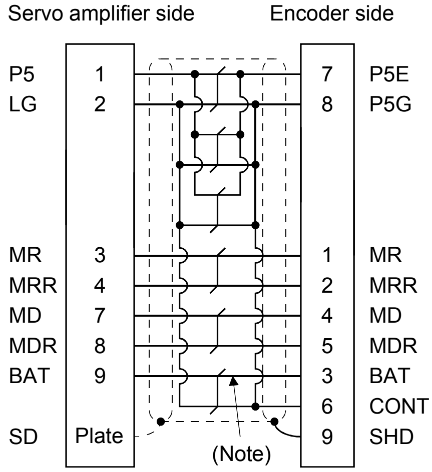
Cable Model	1) Servo amplifier side Connector	2) Encoder side Connector
MR-EKCBL □ M-L MR-EKCBL □ M-H	Receptacle: 36210-0100PL Shell kit: 536310-3200-008 (3M) Connector set: 54599-1019 (Molex) (Note) Signal layout  View seen from wiring side. or (Note) Signal layout  View seen from wiring side. Note. Keep open the pins shown with ⧅. Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.	Housing: 1-172161-9 Connector pin: 170359-1 (Tyco Electronics or equivalent) Cable clamp: MTI-0002 (Toa Electric Industries) Signal layout  View seen from wiring side.

(b) Internal wiring diagram

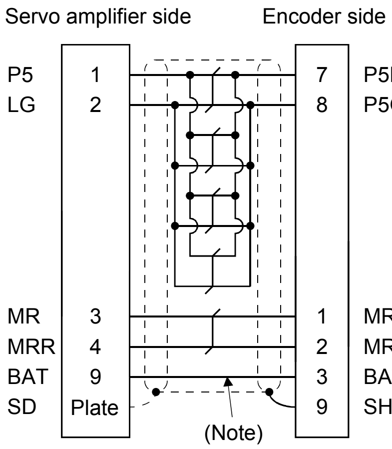
MR-EKCBL20M-L



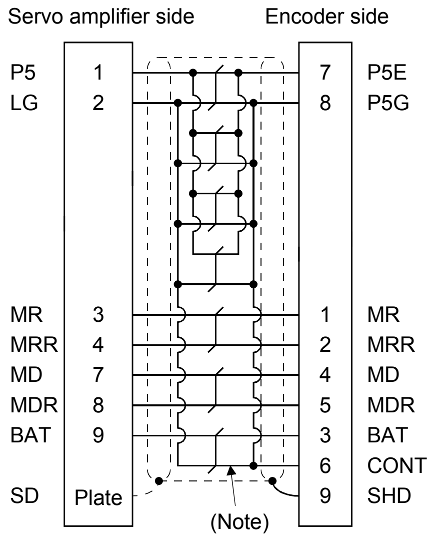
MR-EKCBL30M-L



MR-EKCBL20M-H



MR-EKCBL30M-H
MR-EKCBL40M-H
MR-EKCBL50M-H



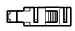
Note. Always make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

When fabricating the cable, use the wiring diagram corresponding to the length indicated below.

Cable Flex Life	Applicable Wiring Diagram	
	Less than 10m	30m to 50m
Standard	MR-EKCBL20M-L	
Long flex	MR-EKCBL20M-H	MR-EKCBL30M-H MR-EKCBL40M-H MR-EKCBL50M-H

(c) When fabricating the encoder cable

When fabricating the cable, prepare the following parts and tool, and fabricate it according to the wiring diagram in (b). Refer to section 13.9 for the specifications of the used cable.

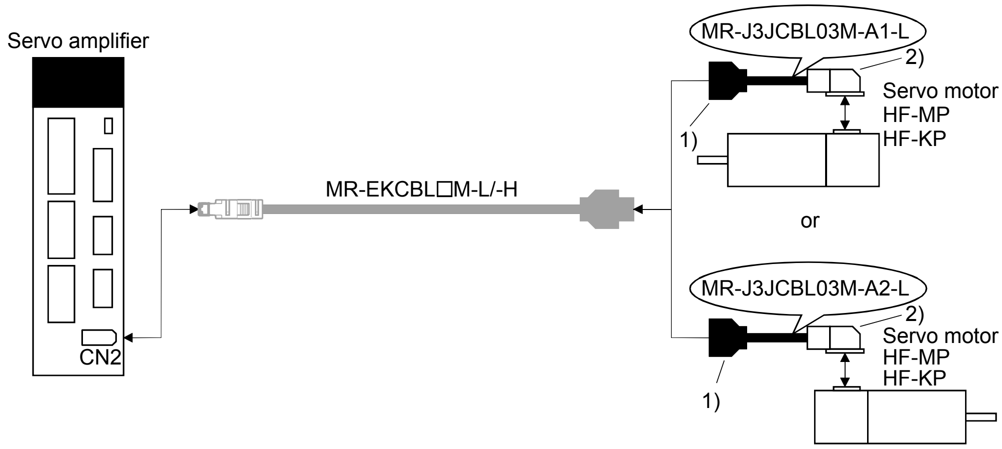
<table>
<tr><th>Parts/Tool</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">Connector set</td><td colspan="2">MR-ECNM</td></tr>
<tr><td>
Servo amplifier side connector
Receptacle: 36210-0100PL
Shell kit: 536310-3200-008
(3M)
Or
Connector set: 54599-1019(Molex)</td><td>
Encoder side connector
Housing: 1-172161-9
Connector pin: 170359-1
(Tyco Electronics or equivalent)
Cable clamp: MTI-0002
(Toa Electric Industries)</td></tr>
</table>

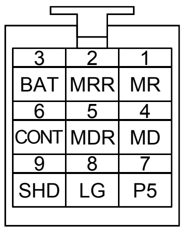
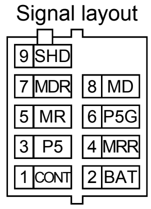
(3) MR-J3JCBL03M-A1-L・MR-J3JCBL03M-A2-L

The servo amplifier and servo motor cannot be connected with these cables only. The servo motor side encoder cable (MR-EKCBL □ M-L/H) is required.

<table>
<tr><th>Cable Model</th><th>Cable Length</th><th>Protective Structure</th><th>Flex Life</th><th>Application</th></tr>
<tr><td>MR-J3JCBL03M-A1-L</td><td rowspan="2">0.3m</td><td rowspan="2">IP20</td><td rowspan="2">Standard</td><td>For HF-MP・HF-KP servo motor
Load side lead
Use in combination with MR-EKCBL □ M-L/H.</td></tr>
<tr><td>MR-J3JCBL03M-A2-L</td><td>For HF-MP・HF-KP servo motor
Opposite-to-load side lead
Use in combination with MR-EKCBL □ M-L/H.</td></tr>
</table>

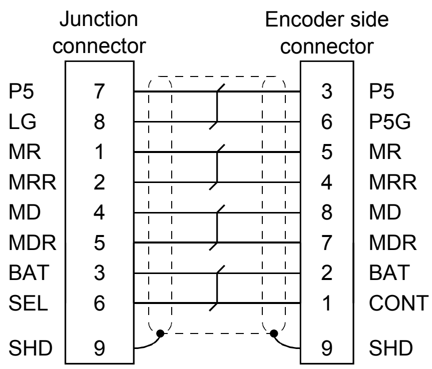
(a) Connection of servo amplifier and servo motor



Cable Model	1) Junction Connector	2) For Encoder Connector
MR-J3JCBL03M-A1-L	Housing: 1-172169-9 Contact: 1473226-1 Cable clamp: 316454-1 (Tyco Electronics) Signal layout  View seen from wiring side.	Connector: 1674320-1 Crimping tool for ground clip: 1596970-1 Crimping tool for receptacle contact: 1596847-1 (Tyco Electronics) Signal layout  View seen from wiring side.
MR-J3JCBL03M-A2-L		

(b) Internal wiring diagram

MR-J3JCBL03M-A1-L

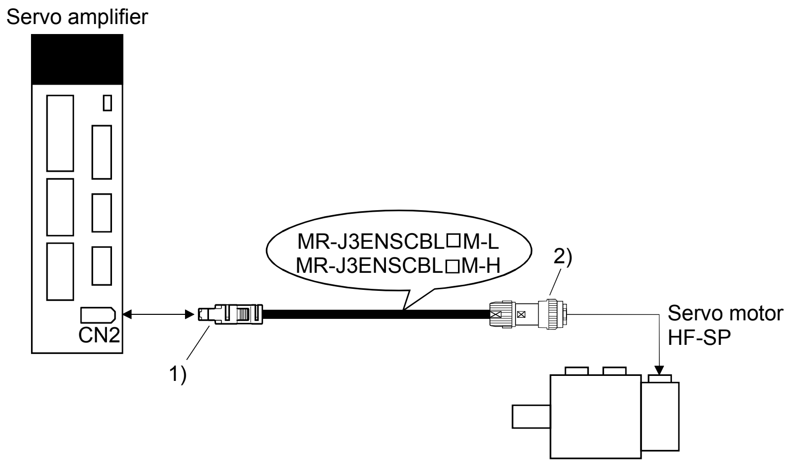


(4) MR-J3ENSCBL □ M-L・MR-J3ENSCBL □ M-H

These cables are detector cables for HF-SP・HA-LP・HC-RP・HC-UP・HC-LP Series servo motors. The number in the cable length column of the table indicates the symbol filling the square □ in the cable model. Cable lengths corresponding to the specified symbols are prepared.

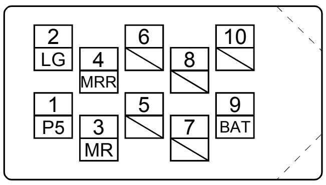
Cable Model	Cable Length							Protective Structure	Flex Life	Application
	2m	5m	10m	20m	30m	40m	50m			
MR-J3ENSCBL □ M-L	2	5	10	20	30			IP67	Standard	For HF-SP・HA-LP・HC-RP・HC-UP・HC-LP servo motor
MR-J3ENSCBL □ M-H	2	5	10	20	30	40	50	IP67	Long flex	

(a) Connection of servo amplifier and servo motor



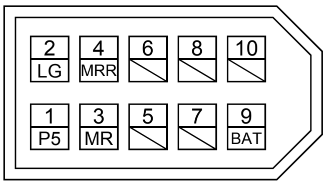
<table>
<tr><th>Cable Model</th><th>1) For CN2 Connector</th><th>2) For Encoder Connector</th></tr>
<tr><td>MR-J3ENSCBL □
M-L</td><td rowspan="2">Receptacle: 36210-0100PL
Shell kit: 536310-3200-008
(3M)

Connector set: 54599-1019
(Molex)

(Note) Signal layout


View seen from wiring side.

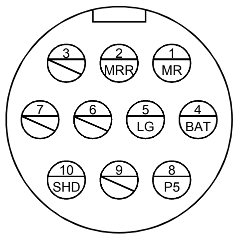
or

(Note) Signal layout


View seen from wiring side.

Note. Keep open the pins shown with ⧅. Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.</td><td rowspan="2">In case of 10m or shorter cables
Straight plug: CM10-SP10S-M
Socket contact: CM10-#22SC(C1)-100
Crimping tool: 357J-50446 (DDK)
Applicable cable AWG20 to 22

In case of 20m or longer cables
Straight plug: CM10-SP10S-M
Socket contact: CM10-#22SC(C2)-100
Crimping tool: 357J-50447 (DDK)
Applicable cable AWG23 to 28

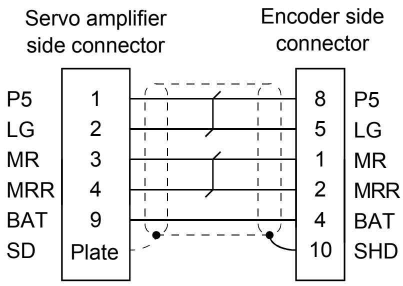
(Note) Signal layout


View seen from wiring side

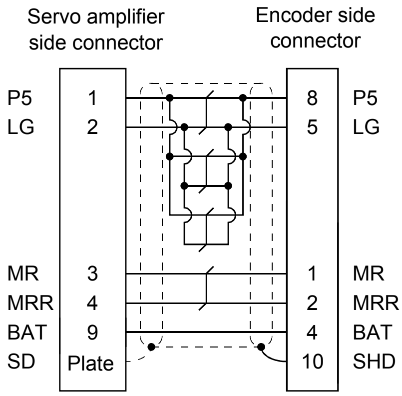
Note. Keep open the pin shown with an ⦸.</td></tr>
<tr><td>MR-J3ENSCBL □
M-H</td></tr>
</table>

(b) Internal wiring diagram

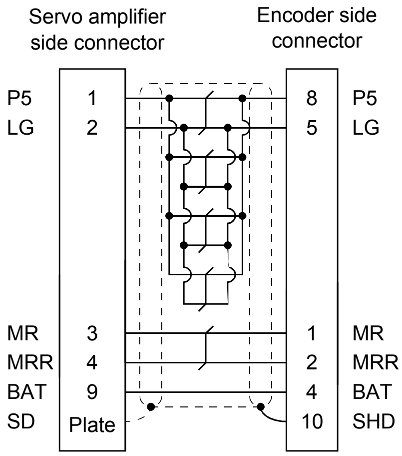
MR-J3ENSCBL2M-L/H
MR-J3ENSCBL5M-L/H
MR-J3ENSCBL10M-L/H



MR-J3ENSCBL20M-L
MR-J3ENSCBL30M-L

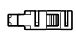
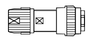


MR-J3ENSCBL20M-H
MR-J3ENSCBL30M-H
MR-J3ENSCBL40M-H
MR-J3ENSCBL50M-H



(c) When fabricating the encoder cable

When fabricating the cable, prepare the following parts and tool, and fabricate it according to the wiring diagram in (b). Refer to section 13.9 for the specifications of the used cable.

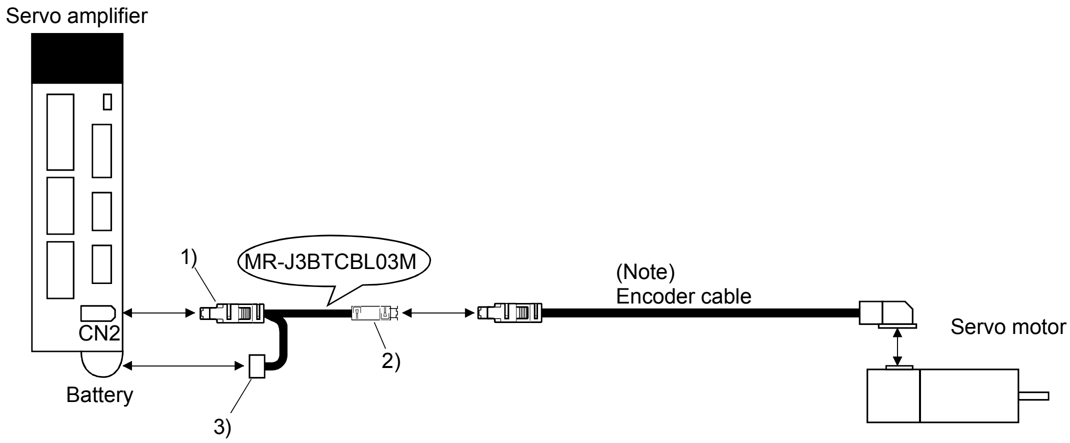
Parts/Tool	Description	
Connector set	MR- J3SCNS (Option)  Servo amplifier side connector Receptacle: 36210-0100PL Shell kit: 536310-3200-008 (3M) Or Connector set: 54599-1019 (Molex)	 Encoder side connector Straight plug: CM10-SP10S-M Socket contact: CM10-#22SC(S1)-100 Applicable wire size: AWG20 or less Recommended tightening jig: 357J-51456T (DDK)

(5) MR-J3BTCBL03M

This cable is a battery connection cable. Use this cable to retain the current position even if the detector cable is disconnected from the servo amplifier.

Cable Model	Cable Length	Application
MR-J3BTCBL03M	0.3m	For HF-MP・HF-KP・HF-SP servo motor

(a) Connection of servo amplifier and servo motor



Note. For the detector cable, refer to (1), (2), (3) and (4) in this section.

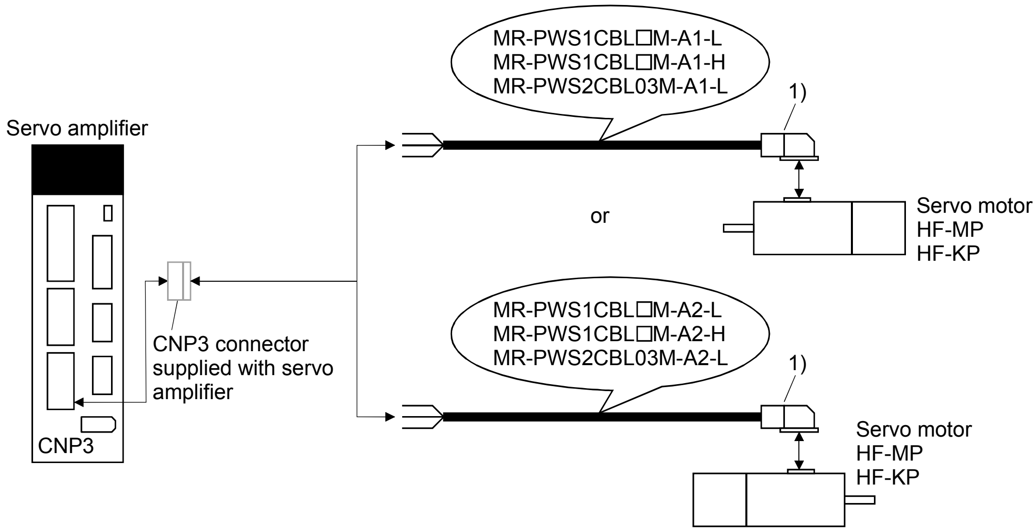
Cable Model	1) For CN2 Connector	1) Junction Connector	2) For Battery Connector
MR-J3BTCBL03M	Receptacle: 36210-0100PL Shell kit: 536310-3200-008 (3M) Or Connector set: 54599-1019 (Molex)	Plug: 36110-3000FD Shell kit: 36310-F200-008 (3M)	Connector: DF3-2EP-2C Contact: DF3-EP2428PCA (Hirose Denki)

13.1.3 Motor power supply cables

These cables are motor power supply cables for the HF-MP・HF-KP series servo motors. The numerals in the Cable Length field of the table are the symbols entered in the □ part of the cable model. The cables of the lengths with the symbols are available.
Refer to section 3.10 when wiring.

Cable Model	Cable Length				Protective Structure	Flex Life	Application
	0.3m	2m	5m	10m			
MR-PWS1CBL □ M-A1-L		2	5	10	IP65	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL □ M-A2-L		2	5	10	IP65	Standard	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-PWS1CBL □ M-A1-H		2	5	10	IP65	Long flex	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL □ M-A2-H		2	5	10	IP65	Long flex	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-PWS2CBL □ M-A1-L	03				IP55	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-PWS2CBL □ M-A2-L	03				IP55	Standard	For HF-MP・HF-KP servo motor Opposite-to-load side lead

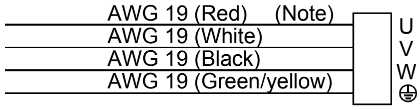
(1) Connection of servo amplifier and servo motor



<table>
<tr><th>Cable Model</th><th colspan="2">1) For Motor Power Supply Connector</th></tr>
<tr><td>MR-PWS1CBL □ M-A1-L</td><td rowspan="4">Connector: JN4FT04SJ1-R
Hod, socket insulator
Bushing, ground nut
Contact: ST-TMH-S-C1B-100-(A534G)
Crimping tool: CT160-3-TMH5B
(Japan Aviation Electronics Industry)</td><td rowspan="6">Signal layout
1 ⏚
2 U
3 V
4 W
View seen from wiring side.</td></tr>
<tr><td>MR-PWS1CBL □ M-A2-L</td></tr>
<tr><td>MR-PWS1CBL □ M-A1-H</td></tr>
<tr><td>MR-PWS1CBL □ M-A2-H</td></tr>
<tr><td>MR-PWS2CBL03M-A1-L</td><td rowspan="2">Connector: JN4FT04SJ2-R
Hod, socket insulator
Bushing, ground nut
Contact: ST-TMH-S-C1B-100-(A534G)
Crimping tool: CT160-3-TMH5B
(Japan Aviation Electronics Industry)</td></tr>
<tr><td>MR-PWS2CBL03M-A2-L</td></tr>
</table>

(2) Internal wiring diagram

MR-PWS1CBL□M-A1-H MR-PWS1CBL□M-A2-H
MR-PWS2CBL03M-A1-L MR-PWS2CBL03M-A2-L



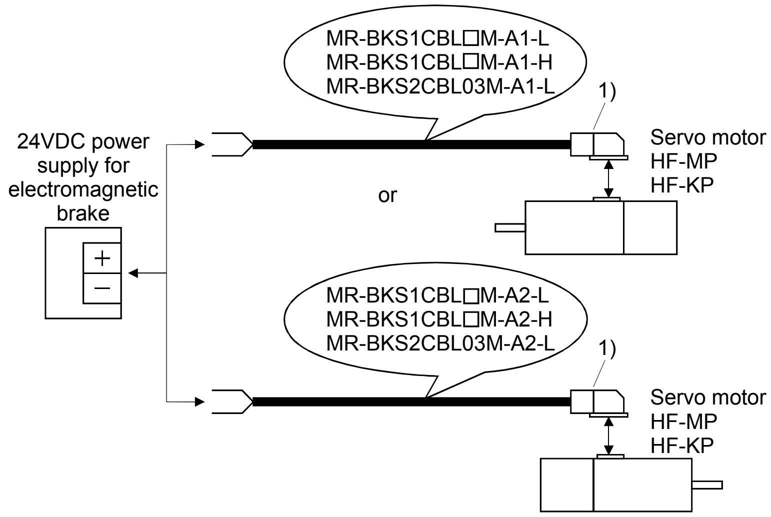
Note. These are not shielded cables.

13.1.4 Motor brake cables

These cables are motor brake cables for the HF-MP・HF-KP series servo motors. The numerals in the Cable Length field of the table are the symbols entered in the □ part of the cable model. The cables of the lengths with the symbols are available.
Refer to section 3.11 when wiring.

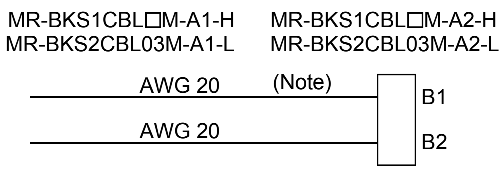
Cable Model	Cable Length				Protective Structure	Flex Life	Application
	0.3m	2m	5m	10m			
MR-PWS1CBL □ M-A1-L		2	5	10	IP65	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL □ M-A2-L		2	5	10	IP65	Standard	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-PWS1CBL □ M-A1-H		2	5	10	IP65	Long flex	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL □ M-A2-H		2	5	10	IP65	Long flex	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-PWS2CBL □ M-A1-L	03				IP55	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-PWS2CBL □ M-A2-L	03				IP55	Standard	For HF-MP・HF-KP servo motor Opposite-to-load side lead

(1) Connection of servo amplifier and servo motor



Cable Model	1) For Motor Brake Connector	
MR-BKS1CBL □ M-A1-L MR-BKS1CBL □ M-A2-L MR-BKS1CBL □ M-A1-H MR-BKS1CBL □ M-A2-H	Connector: JN4FT02SJ1-R Hod, socket insulator Bushing, ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT160-3-TMH5B (Japan Aviation Electronics Industry)	Signal layout 1 B1 2 B2 View seen from wiring side.
MR-BKS2CBL03M-A1-L MR-BKS2CBL03M-A2-L	Connector: JN4FT02SJ2-R Hod, socket insulator Bushing, ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT160-3-TMH5B (Japan Aviation Electronics Industry)	

(2) Internal wiring diagram



Note. These are not shielded cables.

13.2 Regenerative options

⚠CAUTION	• The specified combinations of regenerative options and servo amplifiers may only be used. Otherwise, a fire may occur.

(1) Combination and regenerative power

The power values in the table are resistor-generated powers and not rated powers.

Servo amplifier	Regenerative power[W]							
	Built-in regenerative resistor	MR-RB032 [40Ω]	MR-RB12 [40Ω]	MR-RB30 [13Ω]	MR-RB31 [6.7Ω]	MR-RB32 [40Ω]	(Note 1) MR-RB50 [13Ω]	(Note 1) MR-MB51 [6.7Ω]
MR-J3-10T (1)		30						
MR-J3-20T (1)	10	30	100					
MR-J3-40T (1)	10	30	100					
MR-J3-60T	10	30	100					
MR-J3-70T	20	30	100			300		
MR-J3-100T	20	30	100			300		
MR-J3-200T	100			300			500	
MR-J3-350T	100			300			500	
MR-J3-500T	130				300			500
MR-J3-700T	170				300			500

Servo amplifier	Regenerative power[W]						
	Built-in regenerative resistor	MR-RB1H-4 [82Ω]	(Note 1) MR-RB3M-4 [120Ω]	(Note 1) MR-RB3G-4 [47Ω]	(Note 1) MR-RB5G-4 [47Ω]	(Note 1) MR-RB34-4 [26Ω]	(Note 1) MR-RB54-4 [26Ω]
MR-J3-60T4	15	100	300				
MR-J3-100T4	15	100	300				
MR-J3-200T4	100			300	500		
MR-J3-350T4	100			300	500		
MR-J3-500T4	130					300	500
MR-J3-700T4	170					300	500

Servo amplifier	(Note 2) Regenerative power[W]						
	External regenerative resistor (Accessory)	MR-RB5E [6Ω]	MR-RB9P [4.5Ω]	MR-RB9F [3Ω]	MR-RB6B-4 [20Ω]	MR-RB60-4 [12.5Ω]	MR-RB6K-4 [10Ω]
MR-J3-11KT	500 (800)	500 (800)					
MR-J3-15KT	850 (1300)		850 (1300)				
MR-J3-22KT	850 (1300)			850 (1300)			
MR-J3-11KT4	500 (800)				500 (800)		
MR-J3-15KT4	850 (1300)					850 (1300)	
MR-J3-22KT4	850 (1300)						850 (1300)

Note 1. Always install a cooling fan.

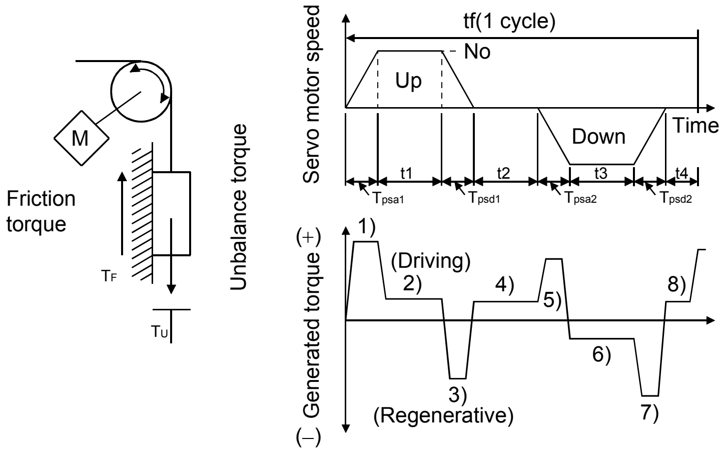
2. Values in parentheses assume the installation of a cooling fan.

(2) Selection of the regenerative option

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

Use the following table to calculate the regenerative energy.



Formulas for calculating torque and energy in operation

Regenerative power	Torque applied to servo motor [N・m]	Energy [J]
1)	$T_1 = \frac{(J_L+J_M)\cdot N_0}{9.55\times10^4}\cdot\frac{1}{T_{psa1}} + T_U + T_F$	$E_1 = \frac{0.1047}{2}\cdot N_0\cdot T_1\cdot T_{psa1}$
2)	$T_2 = T_U + T_F$	$E_2 = 0.1047\cdot N_0\cdot T_2\cdot t_1$
3)	$T_3 = \frac{-(J_L+J_M)\cdot N_0}{9.55\times10^4}\cdot\frac{1}{T_{psd1}} + T_U + T_F$	$E_3 = \frac{0.1047}{2}\cdot N_0\cdot T_3\cdot T_{psd1}$
4), 8)	$T_4 = T_U$	$E_4 \geq 0$ (No regeneration)
5)	$T_5 = \frac{(J_L+J_M)\cdot N_0}{9.55\times10^4}\cdot\frac{1}{T_{psa2}} - T_U + T_F$	$E_5 = \frac{0.1047}{2}\cdot N_0\cdot T_5\cdot T_{psa2}$
6)	$T_6 = -T_U + T_F$	$E_6 = 0.1047\cdot N_0\cdot T_6\cdot t_3$
7)	$T_7 = \frac{-(J_L+J_M)\cdot N_0}{9.55\times10^4}\cdot\frac{1}{T_{psd2}} - T_U + T_F$	$E_7 = \frac{0.1047}{2}\cdot N_0\cdot T_7\cdot T_{psd2}$

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

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-J3-10T	55	9
MR-J3-10T1	55	4
MR-J3-20T	70	9
MR-J3-20T1	70	4
MR-J3-40T	85	11
MR-J3-40T1	85	10
MR-J3-60T(4)	85	11
MR-J3-70T	80	18
MR-J3-100T	80	18
MR-J3-100T4	80	12

Servo amplifier	Inverse efficiency[%]	Capacitor charging[J]
MR-J3-200T	85	40
MR-J3-200T4	85	25
MR-J3-350T	85	40
MR-J3-350T4	85	36
MR-J3-500T(4)	90	45
MR-J3-700T(4)	90	70
MR-J3-11KT(4)	90	120
MR-J3-15KT(4)	90	170
MR-J3-22KT(4)	90	250

Inverse efficiency (η) :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.

$$ER\ [J] = \eta \cdot Es - Ec$$

Calculate the power consumption of the regenerative option on the basis of single-cycle operation period tf [s] to select the necessary regenerative option.

$$PR\ [W] = ER/tf$$

(3) Parameter setting

Set parameter No. PA02 according to the option to be used.

Parameter No. PA02

0	0		

Selection of regenerative option

00: Regenerative option is not used
- For MR-J3-10T, regenerative resistor is not used.
- For MR-J3-20T・40T・60T(4) to 700T(4) built-in regenerative resistor is used.
- Supplied regenerative resistors or regenerative option is used with the MR-J3-11KT(4) to 22KT(4) servo amplifier.

01: FR-BU2-(H)・FR-RC-(H)・FR-CV-(H)
02: MR-RB032
03: MR-RB12
04: MR-RB32
05: MR-RB30
06: MR-RB50(Cooling fan is required)
08: MR-RB31
09: MR-RB51(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)
FA:When regenerative resistors or regenerative option supplied to MR-J3-11KT(4) to 22KT(4) are cooled by cooling fans to increase

The following are setting values for regenerative resistor and regenerative option which are used with a servo amplifier of 11k to 22kW.

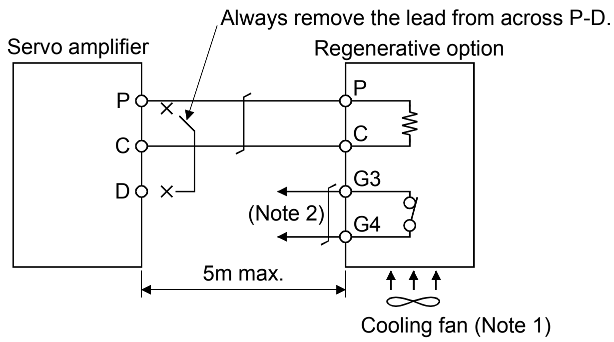
Regenerative resistor, regenerative option	Setting value
Standard supplied regenerative resistor	00
Standard supplied regenerative resistor (with a cooling fan to cool it)	FA
MR-RB5E	00
MR-RB5E (with a cooling fan to cool it)	FA
MR-RB9P	00
MR-RB9P (with a cooling fan to cool it)	FA
MR-RB9F	00
MR-RB9F (with a cooling fan to cool it)	FA
MR-RB6B-4	00
MR-RB6B-4 (with a cooling fan to cool it)	FA
MR-RB60-4	00
MR-RB60-4 (with a cooling fan to cool it)	FA
MR-RB6K-4	00
MR-RB6K-4 (with a cooling fan to cool it)	FA

(4) Connection of the regenerative option

POINT
- When the MR-RB50・MR-RB51・MR-RB3M-4・MR-RB3G-4・MR-RB5G-4・MR-RB34-4・MR-RB54-4 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 13.9.

The regenerative option will cause a temperature rise of ＋100℃ relative to the ambient temperature. Fully examine heat dissipation, installation position, used cables, etc. before installing the option. For wiring, use flame-resistant cables and keep them clear of the regenerative option body. Always use twisted cables of max. 5m length for connection with the servo amplifier.

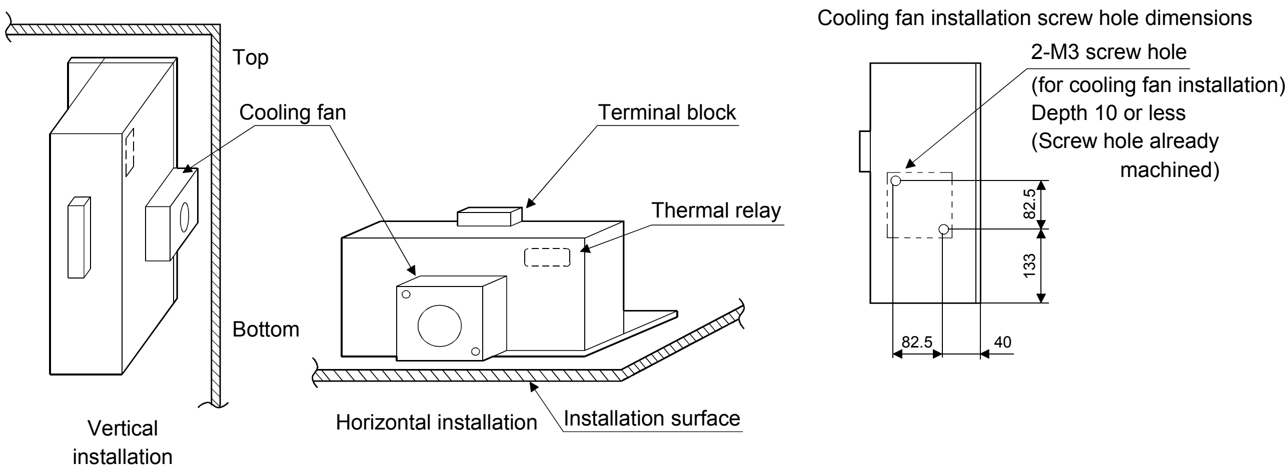
(a) MR-J3-350T or less ・ MR-J3-200T4 or less
Always remove the wiring from across P-D and fit the regenerative option across P-C.
The G3 and G4 terminals act as a thermal sensor. G3-G4 is disconnected when the regenerative option overheats abnormally.



Note 1. When using the MR-RB50, MR-RB3M-4, MR-RB3G-4 or MR-RB5G-4 forcibly cool it with a cooling fan (92×92, minimum air flow : 1.0m^3).
2. Make up a sequence which will switch off the magnetic contactor (MC) when abnormal heating occurs.
G3-G4 contact specifications
Maximum voltage: 120V AC/DC
Maximum current: 0.5A/4.8VDC
Maximum capacity: 2.4VA

For the MR-RB50, MR-RB3M-4, MR-RB3G-4 or MR-RB5G-4 install the cooling fan as shown.

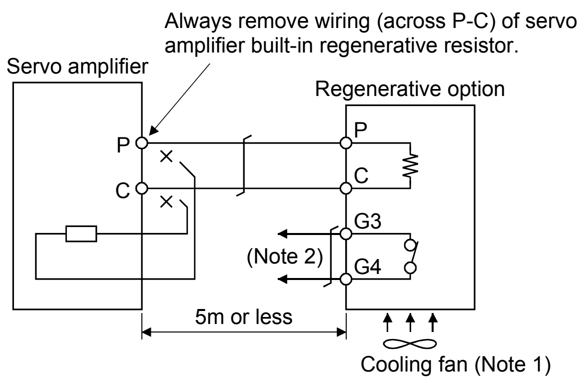
[Unit : mm]



(b) MR-J3-350T4・MR-J3-500T(4)・MR-J3-700T(4)

Always remove the wiring (across P-C) of the servo amplifier built-in regenerative resistor and fit the regenerative option across P-C.

The G3 and G4 terminals act as a thermal sensor. G3-G4 is opened when the regenerative option overheats abnormally.

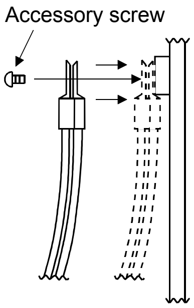


Note 1. When using the MR-RB51, MR-RB3G-4, MR-RB5G-4, MR-RB-34-4 or MR-RB54-4, forcibly cool it with a cooling fan (92×92, minimum air flow : $1.0m^3$).

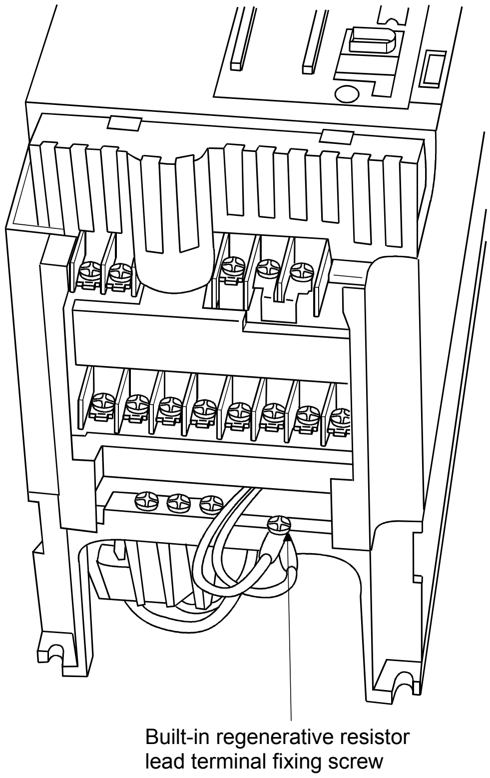
2. Make up a sequence which will switch off the magnetic contactor (MC) when abnormal heating occurs.
G3-G4 contact specifications
Maximum voltage: 120V AC/DC
Maximum current: 0.5A/4.8VDC
Maximum capacity: 2.4VA

When using the regenerative resistor option, remove the servo amplifier's built-in regenerative resistor terminals (across P-C), fit them back to back, and secure them to the frame with the accessory screw as shown below.

Mounting method

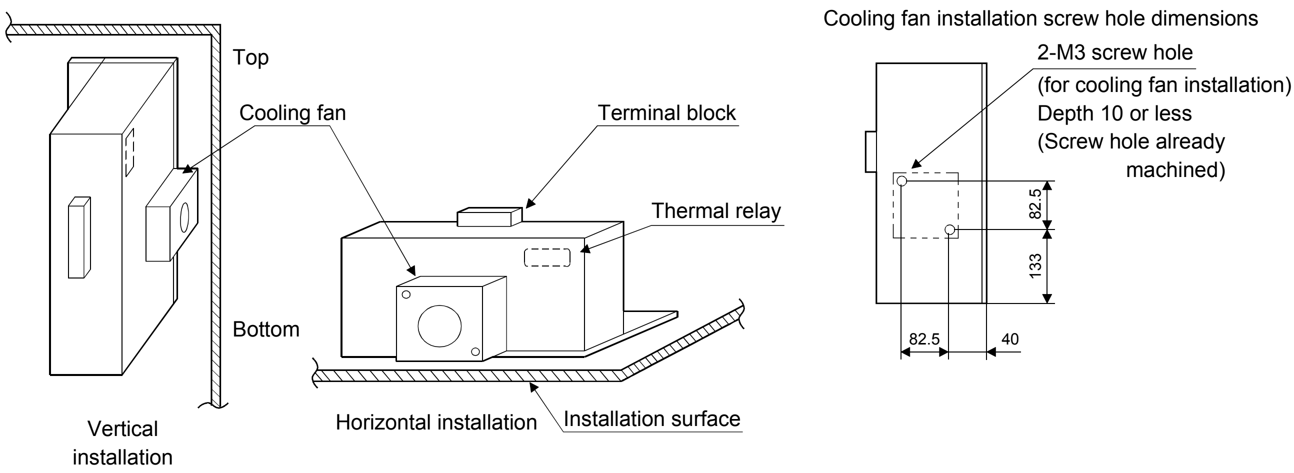


The drawing below shows the MR-J3-350T4 and MR-J3-500T(4). Refer to section 11.1 (6) Outline drawings for the position of the fixing screw for MR-J3-700T(4).



For the MR-RB51, MR-RB3G-4, MR-RB5G-4, MR-RB34-4 or MR-RB54-4 install the cooling fan as shown.

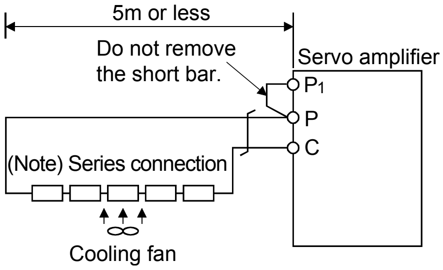
[Unit : mm]



(c) MR-J3-11KT(4) to MR-J3-22KT(4) (when using the supplied regenerative resistor)

⚠CAUTION	・The regenerative resistor supplied with 11 kW to 22 kW servo amplifiers does not have a protect 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 70mm. Cooling the resistors with two cooling fans (92×92, minimum air flow : 1.0m^3) improves the regeneration capability. In this case, set "□□FA" in parameter No. 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-RB5E, 9P, 9F, 6B-4, 60-4 and 6K-4) provided by Mitsubishi Electric Corporation.

Servo Amplifier	Regenerative Resistor	Regenerative Power [W]		Resistance [Ω]	Number of Resistors
		Normal	Cooling		
MR-J3-11KT	GRZG400-1.5Ω	500	800	6	4
MR-J3-15KT	GRZG400-0.9Ω	850	1300	4.5	5
MR-J3-22KT	GRZG400-0.6Ω	850	1300	3	5
MR-J3-11KT4	GRZG400-5.0Ω	500	800	20	4
MR-J3-15KT4	GRZG400-2.5Ω	850	1300	12.5	5
MR-J3-22KT4	GRZG400-2.0Ω	850	1300	10	5

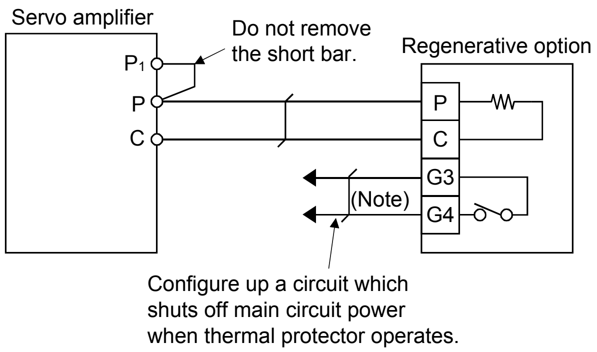
(d) MR-J3-11KT(4)-PX to MR-J3-22KT(4)-PX (when using the regenerative option)

The MR-J3-11KT(4)-PX to MR-J3-22KT(4)-PX servo amplifiers are not supplied with regenerative resistors. When using any of these servo amplifiers, always use the MR-RB5E, 9P, 9F, 6B-4, 60-4 and 6K-4 regenerative option.

The MR-RB5E, 9P, 9F, 6B-4, 60-4 and 6K-4 are regenerative options that have encased the GRZG400-1.5Ω, GRZG400-0.9Ω, GRZG400-0.6Ω, GRZG400-5.0Ω, GRZG400-2.5Ω, GRZG400-2.0Ω respectively. When using any of these regenerative options, make the same parameter setting as when using the GRZG400-1.5Ω, GRZG400-0.9Ω, GRZG400-0.6Ω, GRZG400-5.0Ω, GRZG400-2.5Ω, GRZG400-2.0Ω (supplied regenerative resistors or regenerative option is used with 11kW or more servo amplifier).

Cooling the regenerative option with cooling fans improves regenerative capability.

The G3 and G4 terminals are for the thermal protector. G3-G4 is opened when the regenerative option overheats abnormally.



Note. Specifications of contact across G3-G4

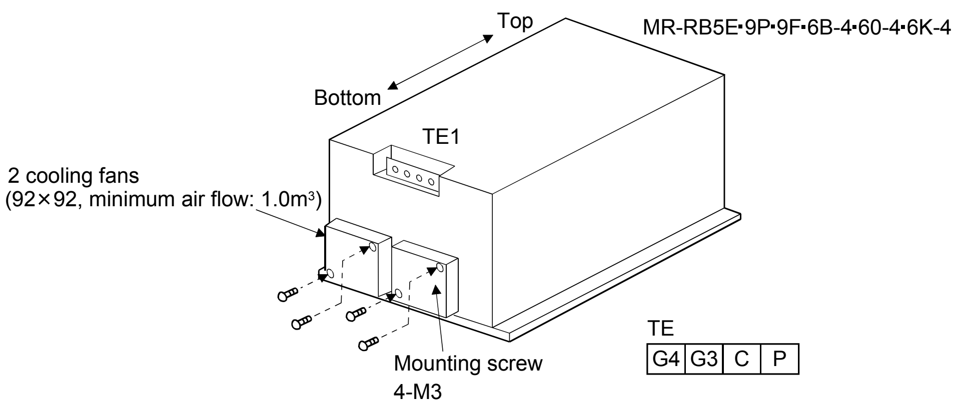
Maximum voltage : 120V AC/DC

Maximum current : 0.5A/4.8VDC

Maximum capacity : 2.4VA

Servo amplifier	Regenerative option model	Resistance [Ω]	Regenerative power [W]	
			Without cooling fans	With cooling fans
MR-J3-11KT-PX	MR-RB5E	6	500	800
MR-J3-15KT-PX	MR-RB9P	4.5	850	1300
MR-J3-22KT-PX	MR-RB9F	3	850	1300
MR-J3-11KT4-PX	MR-RB6B-4	20	500	800
MR-J3-15KT4-PX	MR-RB60-4	12.5	850	1300
MR-J3-22KT4-PX	MR-RB6K-4	10	850	1300

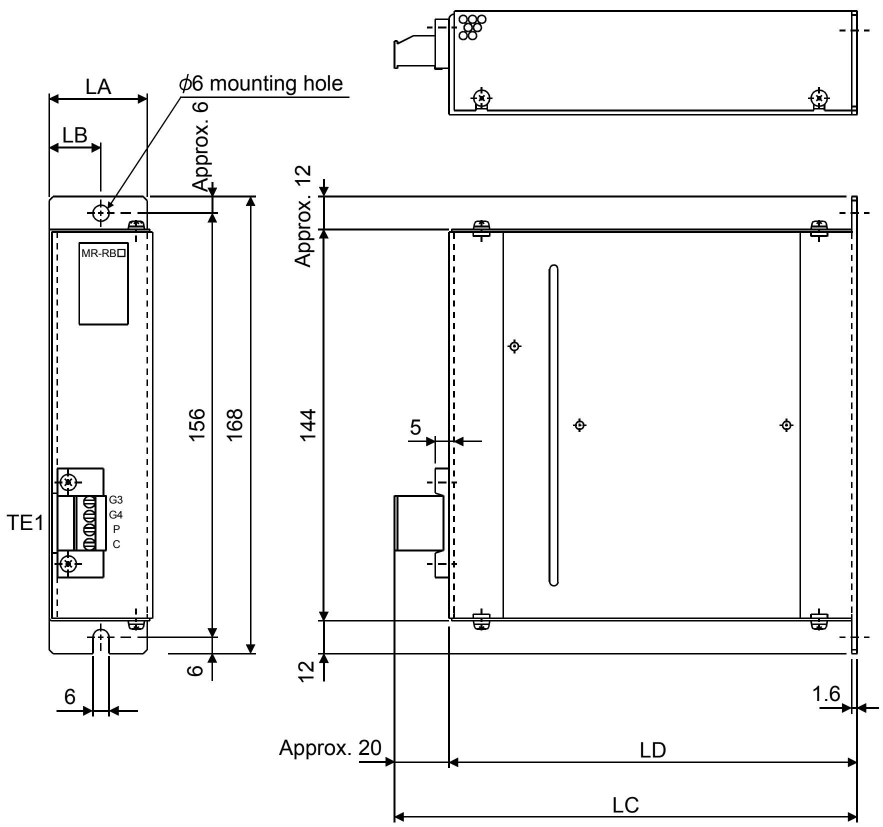
When using cooling fans, install them using the mounting holes provided in the bottom of the regenerative option. In this case, set "□ □FA" in parameter No. PA02.



(5) Outline dimension drawings

(a) MR-RB032 · MR-RB12

[Unit: mm (in)]



· TE1

Terminal block

G3
G4
P
C

Terminal screw: M3

Tightening torque: 0.5 to 0.6 [N · m]

(4 to 5 [lb · in])

· Mounting screw

Screw size: M5

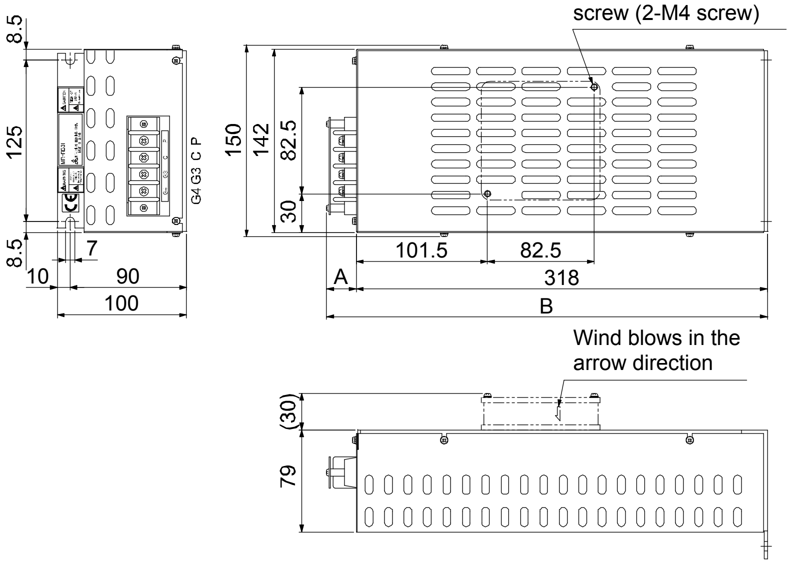
Tightening torque: 3.24 [N · m]

(28.7 [lb · in])

Regenerative option	Variable dimensions				Mass	
	LA	LB	LC	LD	[kg]	[lb]
MR-RB032	30	15	119	99	0.5	1.1
MR-RB12	40	15	169	149	1.1	2.4

(b) MR-RB30 · MR-RB31 · MR-RB32 · MR-RB34-4 · MR-RB3M-4 · MR-RB3G-4

[Unit: mm (in)]



· TE1

Terminal block

P
C
G3
G4

Terminal screw: M4

Tightening torque: 1.2 [N · m] (10.62 [lb · in])

· Mounting screw

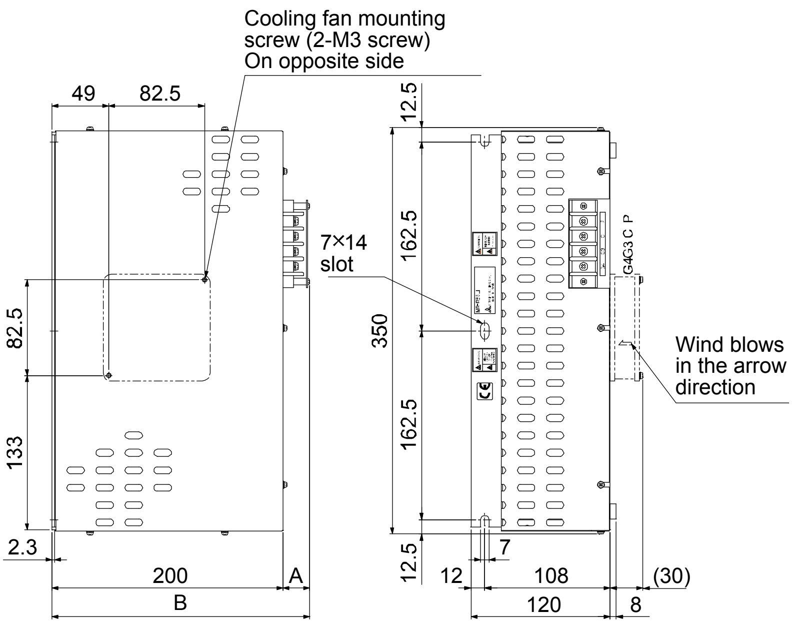
Screw size: M6

Tightening torque: 5.4 [N · m] (47.79 [lb · in])

Regenerative option	Variable dimensions		Mass [kg] (lb)
	A	B	
MR-RB30	17	335	2.9 (6.4)
MR-RB31			
MR-RB32			
MR-RB34-4	23	341	
MR-RB3M-4			
MR-RB3G-4			

(c) MR-RB50 · MR-RB51 · MR-RB54-4 · MR-RB5G-4

[Unit: mm (in)]



· Terminal block

P
C
G3
G4

Terminal screw: M4

Tightening torque: 1.2 [N · m] (10.62 [lb · in])

· Mounting screw

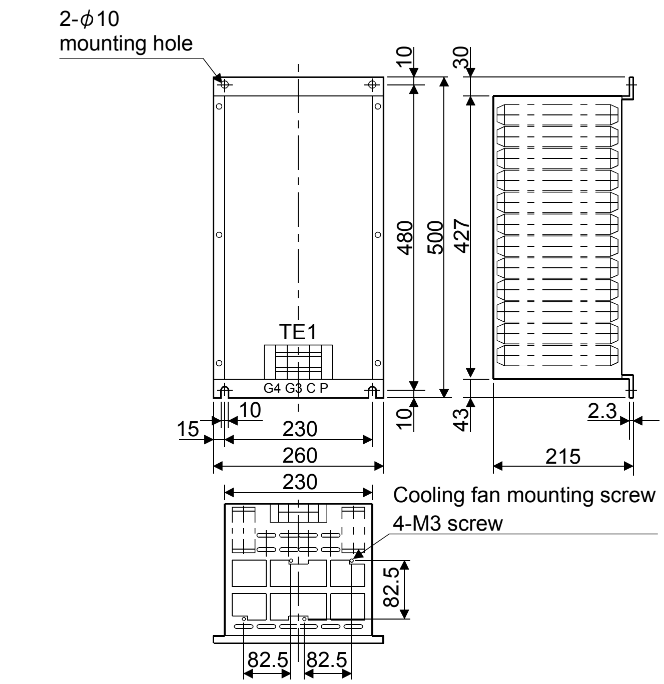
Screw size: M6

Tightening torque: 5.4 [N · m] (47.79 [lb · in])

Regenerative option	Variable dimensions		Mass [kg] (lb)
	A	B	
MR-RB50	17	217	5.6 (12.3)
MR-RB51			
MR-RB54-4	23	233	
MR-RB5G-4			

(d) MR-RB5E · MR-RB9P · MR-RB9F · MR-RB6B-4 · MR-RB60-4 · MR-RB6K-4

[Unit: mm (in)]



· Terminal block

G4	G3	C	P

Terminal screw: M5

Tightening torque: 2.0 [N · m] (17.70 [lb · in])

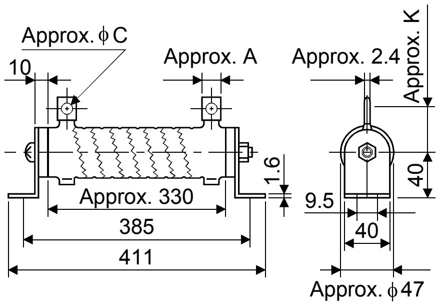
· Mounting screw

Screw size: M8

Tightening torque: 13.2 [N · m] (116.83 [lb · in])

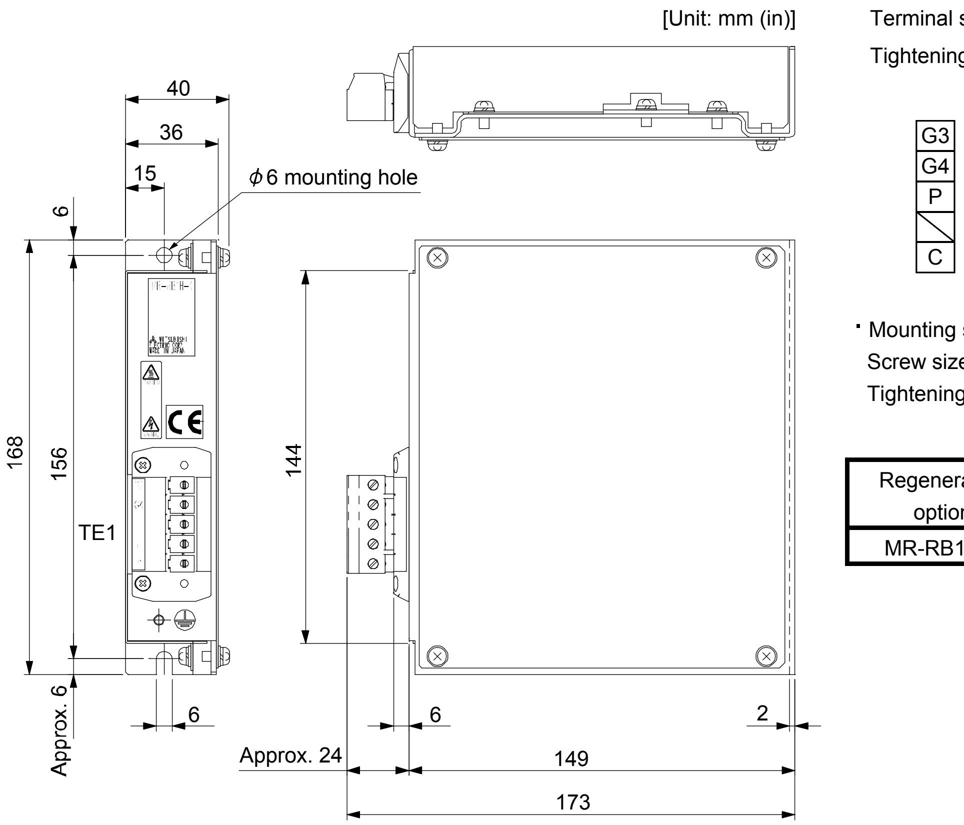
Regenerative option	Mass	
	[kg]	[lb]
MR-RB5E	10	22.0
MR-RB9P	11	24.3
MR-RB9F	11	24.3
MR-RB6B-4	10	22.0
MR-RB60-4	11	24.3
MR-RB6K-4	11	24.3

(e) GRZG400-1.5Ω · GRZG400-0.9Ω · GRZG400-0.6Ω · GRZG400-5.0Ω · GRZG400-2.5Ω · GRZG400-2.0Ω (standard accessories)



Regenerative brake	Variable dimensions			Mounting screw size	Tightening torque [N · m] ([lb·in])	Mass [kg] ([lb])
	A	C	K			
GRZG400-1.5Ω	10	5.5	39	M8	13.2 (116.83)	0.8 (1.76)
GRZG400-0.9Ω						
GRZG400-0.6Ω	16	8.2	46			
GRZG400-5.0Ω	10	5.5	39			
GRZG400-2.5Ω						
GRZG400-2.0Ω						

(f) MR-RB1H-4



Terminal screw: M3

Tightening torque: 0.5 to 0.6 [N・m]
(4.43 to 5.31 [lb・in])

・Mounting screw
Screw size: M5
Tightening torque: 3.2 [N・m]
(28.32 [lb・in])

Regenerative option	Mass [kg] ([lb])
MR-RB1H-4	1.1 (2.4)

13.3 FR-BU2-(H) brake unit

POINT

- Use a 200V class brake unit and a resistor unit with a 200V class servo amplifier, and a 400V class brake unit and a resistor unit with a 400V class servo amplifier. Combination of different voltage class units and servo amplifier cannot be used.
- Install a brake unit and a resistor unit on a flat surface vertically. When the unit is installed horizontally or diagonally, the heat dissipation effect diminishes.
- Temperature of the resistor unit case rises to higher than 100℃. Keep cables and flammable materials away from the case.
- Ambient temperature condition of the brake unit is between －10℃ (14℉) and ＋50℃ (122℉). Note that the condition is different from the ambient temperature condition of the servo amplifier (between 0℃ (32℉) and ＋55℃ (131℉)).
- Configure the circuit to shut down the power-supply with the alarm output of the brake unit and resistor unit under abnormal condition.
- Use the brake unit with a combination indicated in section 13.3.1.
- 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 the parameter No.PA02 of the servo amplifier to "□□01".
When using the brake unit, always refer to the FR-BU2-(H) Brake Unit Instruction Manual.

13.3.1 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]	Total resistance [Ω]	Applicable servo amplifier
200V class	FR-BU2-15K	FR-BR-15K	1	0.99	8	MR-J3-500T (Note)
			2(parallel)	1.98	4	MR-J3-500T MR-J3-700T MR-J3-11KT MR-J3-15KT
	FR-BU2-30K	FR-BR-30K	1	1.99	4	MR-J3-500T MR-J3-700T MR-J3-11KT MR-J3-15KT
	FR-BU2-55K	FR-BR-55K	1	3.91	2	MR-J3-11KT MR-J3-15KT MR-J3-22KT
		MT-BR5-55K	1	5.5	2	MR-J3-22KT
400V class	FR-BU2-H30K	FR-BR-H30K	1	1.99	16	MR-J3-500T4 MR-J3-700T4 MR-J3-11KT4
	FR-BU2-H55K	FR-BR-H55K	1	3.91	8	MR-J3-11KT4 MR-J3-15KT4 MR-J3-22KT4
	FR-BU2-H75K	MT-BR5-H75K	1	7.5	6.5	MR-J3-22KT4

Note. The combination is limited only when using with the servo motors HC-LP302, HC-RP353, HA-LP502 or HC-UP352.

13.3.2 Brake unit parameter setting

Normally, when using the FR-BU2-(H), changing parameters is not necessary. Whether a parameter can be changed or not is listed below.

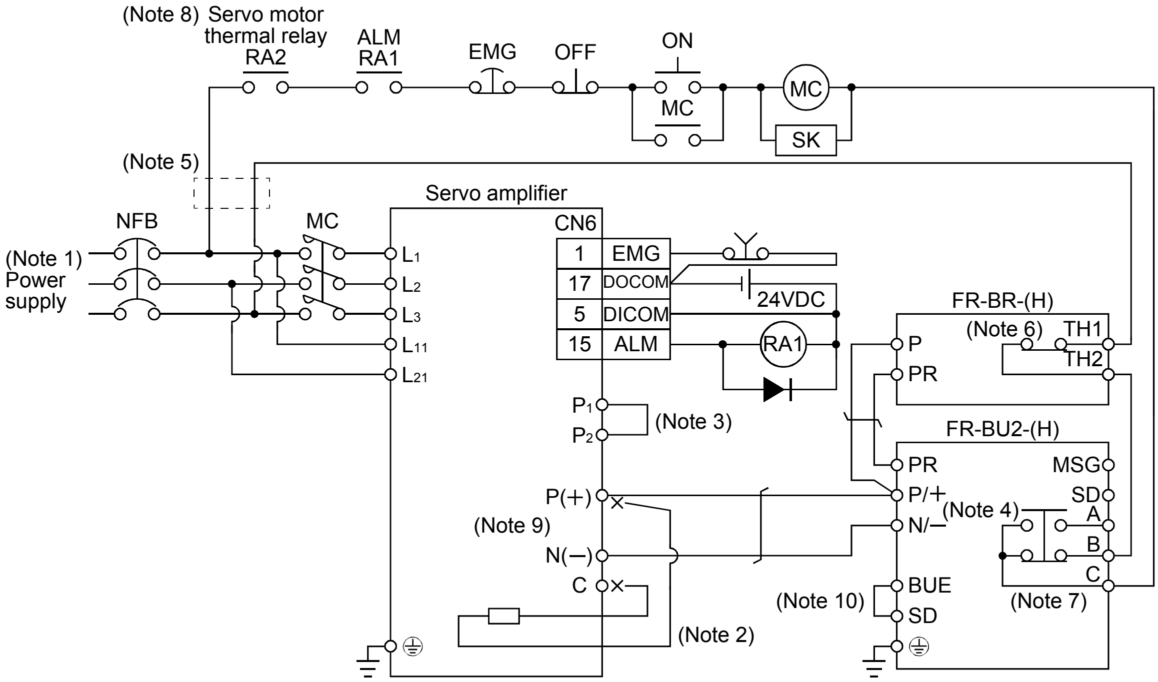
Parameter		Change possible /impossible	Remarks
No.	Name		
0	Brake mode switchover	Impossible	Do not change the parameter.
1	Monitor display data selection	Possible	Refer to the FR-BU2-(H) Brake Unit Instruction Manual.
2	Input terminal function selection 1	Impossible	Do not change the parameter.
3	Input 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		

13.3.3 Connection example

POINT
・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



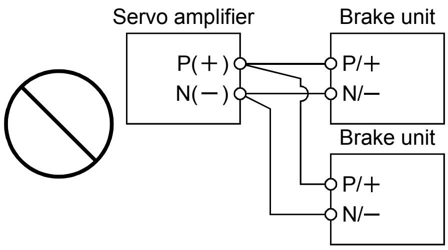
Note 1. For power supply specifications, refer to section 1.2.

2. For the servo amplifier of 5k and 7kW, always disconnect the lead of built-in regenerative resistor, which is connected to the P and C terminals. For the servo amplifier of 11k to 22kW, do not connect a supplied regenerative resistor to the P and C terminals.
3. Always connect P_1 and P_2 terminals (P_1 and P for the servo amplifier of 11k to 22kW) (Factory-wired). When using the power factor improving DC reactor, refer to section 13.11.
4. Connect the P/＋ and N/－ terminals of the brake unit to a correct destination. Wrong connection results in servo amplifier and brake unit malfunction.
5. For 400VAC class, a step-down transformer is required.
6. Contact rating: 1b contact, 110VAC_5A/220VAC_3A
   Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
7. Contact rating: 230VAC_0.3A/30VDC_0.3A
   Normal condition: B-C is conducting/A-C is not conducting. Abnormal condition: B-C is not conducting/A-C is conducting.
8. For the servo amplifier of 11kW or more, connect the thermal relay censor of the servo amplifier.
9. Do not connect more than one cable to each P(＋) and N(－) terminals of the servo amplifier.
10. Always connect BUE and SD terminals (Factory-wired).

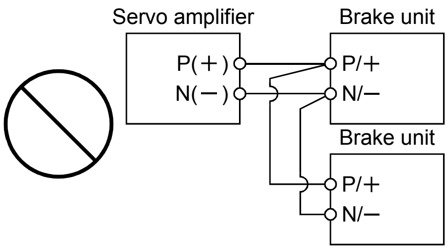
(b) When connecting two brake units to a servo amplifier

POINT

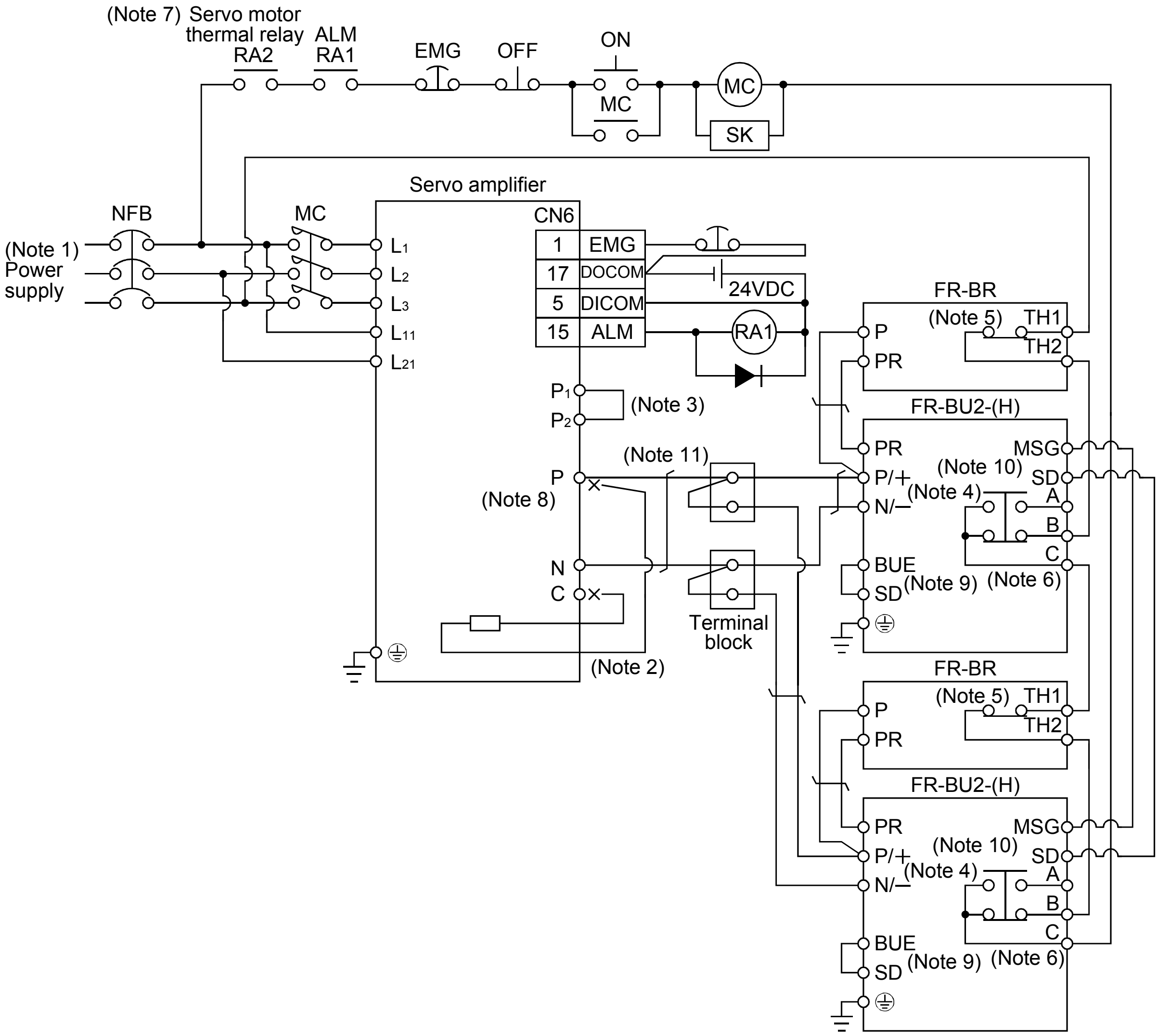
- To use brake units with a parallel connection, use two sets of FR-BU2 brake unit. Combination with other brake unit results in alarm occurrence or malfunction.
- Always connect the master and slave terminals (MSG and SD) of the two brake units.
- Do not connect the servo amplifier and brake units as below. Connect the cables with a terminal block to distribute as indicated in this section.



Connecting two cables to P and N terminals



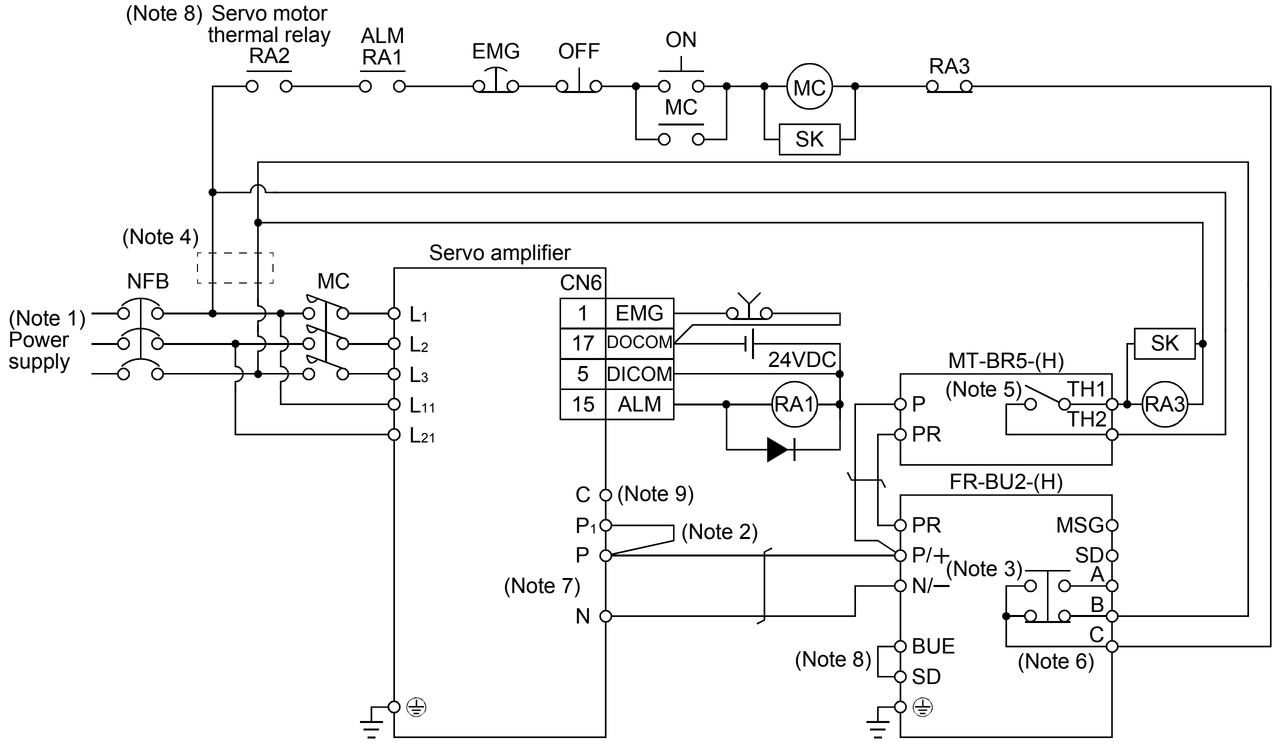
Passing wiring



Note 1. For power supply specifications, refer to section 1.2.

2. For the servo amplifier of 5k and 7kW, always disconnect the lead of built-in regenerative resistor, which is connected to the P and C terminals. For the servo amplifier of 11k and 15kW, do not connect a supplied regenerative resistor to the P and C terminals.
3. Always connect P_1 and P_2 terminals (P_1 and P for the servo amplifier of 11k and 15kW) (Factory-wired). When using the power factor improving DC reactor, refer to section 13.11.
4. Connect the P/＋ and N/－ terminals of the brake unit to a correct destination. Wrong connection results in servo amplifier and brake unit malfunction.
5. Contact rating: 1b contact, 110VAC_5A/220VAC_3A
   Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
6. Contact rating: 230VAC_0.3A/30VDC_0.3A
   Normal condition: B-C is conducting/A-C is not conducting. Abnormal condition: B-C is not conducting/A-C is conducting.
7. For the servo amplifier of 11kW or more, connect the thermal relay censor of the servo amplifier.
8. Do not connect more than one cable to each P and N terminals of the servo amplifier.
9. Always connect BUE and SD terminals (Factory-wired).
10. Connect the MSG and SD terminals of the brake unit to a correct destination. Wrong connection results in servo amplifier and brake unit malfunction.
11. 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) in this section.

(2) Combination with MT-BR5-(H) resistor unit

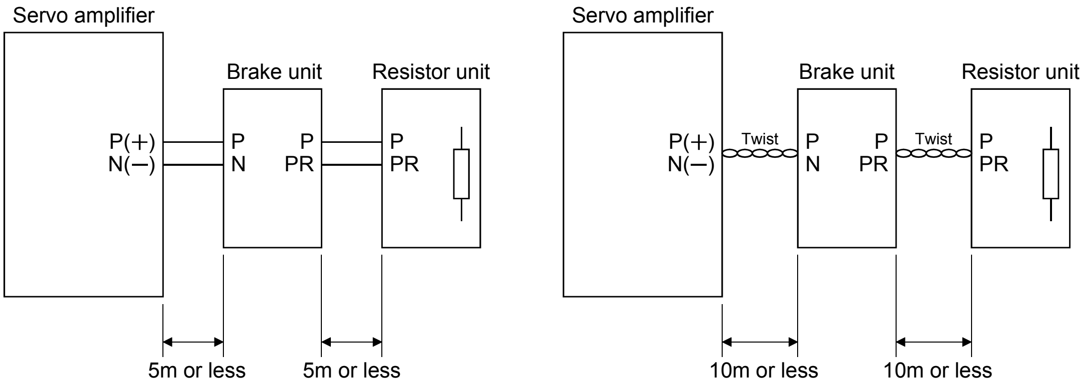


Note 1. For power supply specifications, refer to section 1.2.

2. Always connect P_1 and P(+) terminals (Factory-wired). When using the power factor improving DC reactor, refer to section 13.11.
3. Connect the P/+ and N/− terminals of the brake unit to a correct destination. Wrong connection results in servo amplifier and brake unit malfunction.
4. For the servo amplifier of 400V class, a step-down transformer is required.
5. Contact rating: 1a contact, 110VAC_5A/220VAC_3A
   Normal condition: TH1-TH2 is not conducting. Abnormal condition: TH1-TH2 is conducting.
6. Contact rating: 230VAC_0.3A/30VDC_0.3A
   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. For the servo amplifier of 22kW, do not connect a supplied regenerative resistor to the P and C terminals.

(3) Precautions for wiring

The cables between the servo amplifier and the brake unit, and between the resistor unit and the brake unit should be as short as possible. Always twist the cable longer than 5m (twist five times or more per one meter). Even when the cable is twisted, the cable should be less than 10m. Using cables longer than 5m without twisting or twisted cables longer than 10m, may result in the brake unit malfunction.

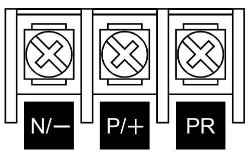


(4) Cables

(a) Cables for the brake unit

For the brake unit, HIV wire (600V Grade heat-resistant polyvinyl chloride insulated wire) is recommended.

1) Main circuit terminal

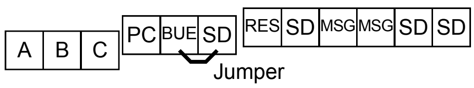


Terminal block

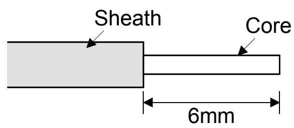
Brake unit		Main circuit terminal screw size	Crimping terminal N/−, P/+, PR, ⏚	Tightening torque [N・m] [(lb・in)]	Wire size N/−, P/+, PR, ⏚ HIV wire [mm^2]	Wire size N/−, P/+, PR, ⏚ AWG
200V class	FR-BU2-15K	M4	5.5-4	1.5(13.3)	3.5	12
	FR-BU2-30K	M5	5.5-5	2.5(22.1)	5.5	10
	FR-BU2-55K	M6	14-6	4.4(38.9)	14	6
400V class	FR-BU2-H30K	M4	5.5-4	1.5(13.3)	3.5	12
	FR-BU2-H55K	M5	5.5-5	2.5(22.1)	5.5	10
	FR-BU2-H75K	M6	14-6	4.4(38.9)	14	6

2) Control circuit terminal

POINT
・Undertightening can cause a cable disconnection or malfunction. Overtightening can cause a short circuit or malfunction due to damage to the screw or the brake unit.



Terminal block



Wire the stripped cable after twisting to prevent the cable from becoming loose. In addition, do not solder it.

Wire size: M3

Tightening torque: 0.5N・m to 0.6N・m

Wire size: 0.3mm^2 to 0.75 mm^2

Screw driver: Small flat-blade screwdriver

(Tip thickness: 0.4mm/Tip width 2.5mm)

(b) Cables for connecting the servo amplifier and a distribution terminal block when connecting two sets of the brake unit

Brake unit	Wire size	
	HIV wire [mm^2]	AWG
FR-BU2-15K	8	8

(5) Crimping terminals for P and N terminals of servo amplifier

(a) Recommended crimping terminals

POINT
・Always use recommended crimping terminals or equivalent since some crimping terminals cannot be installed depending on the size.

	Servo amplifier	Brake unit	Number of connected units	Crimping terminal (Manufacturer)	(Note 1) Applicable tool
200V class	MR-J3-500T	FR-BU2-15K	1	FVD5.5-S4(Japan Solderless Terminal)	c
			2	8-4NS(Japan Solderless Terminal) (Note 2)	d
		FR-BU2-30K	1	FVD5.5-S4(Japan Solderless Terminal)	c
	MR-J3-700T	FR-BU2-15K	2	8-4NS(Japan Solderless Terminal) (Note 2)	d
		FR-BU2-30K	1	FVD5.5-S4(Japan Solderless Terminal)	c
	MR-J3-11KT	FR-BU2-15K	2	FVD8-6(Japan Solderless Terminal)	a
		FR-BU2-30K	1	FVD5.5-6(Japan Solderless Terminal)	c
		FR-BU2-55K	1	FVD14-6(Japan Solderless Terminal)	b
	MR-J3-15KT	FR-BU2-15K	2	FVD8-6(Japan Solderless Terminal)	a
		FR-BU2-30K	1	FVD5.5-6(Japan Solderless Terminal)	c
		FR-BU2-55K	1	FVD14-6(Japan Solderless Terminal)	b
	MR-J3-22KT	FR-BU2-55K	1	FVD14-8(Japan Solderless Terminal)	b
400V class	MR-J3-500T4	FR-BU2-H30K	1	FVD5.5-S4(Japan Solderless Terminal)	c
	MR-J3-700T4	FR-BU2-H30K	1	FVD5.5-S4(Japan Solderless Terminal)	c
	MR-J3-11KT4	FR-BU2-H30K	1	FVD5.5-6(Japan Solderless Terminal)	c
		FR-BU2-H55K	1	FVD5.5-6(Japan Solderless Terminal)	c
	MR-J3-15KT4	FR-BU2-H55K	1	FVD5.5-6(Japan Solderless Terminal)	c
	MR-J3-22KT4	FR-BU2-H55K	1	FVD5.5-8(Japan Solderless Terminal)	c
		FR-BU2-H75K	1	FVD14-8(Japan Solderless Terminal)	b

Note 1. Symbols in the applicable tool field indicate applicable tools in (5)(b) in this section.

2. Coat the crimping part with an insulation tube.

(b) Applicable tool

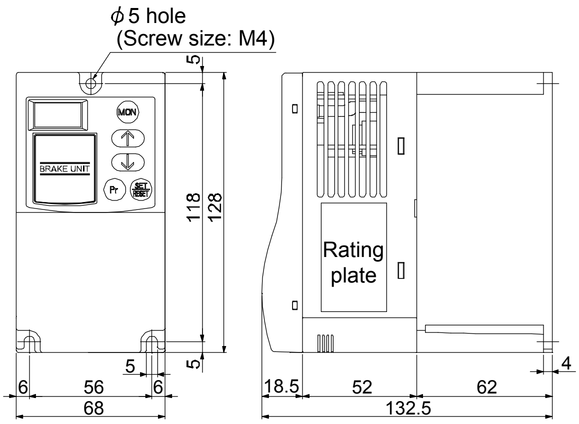
Symbol	Servo amplifier side crimping terminals				
	Crimping terminal	Applicable tool			Manufacturer
		Body	Head	Dice	
a	FVD8-6	YF-1・E-4	YNE-38	DH-111・DH121	Japan Solderless Terminal
b	FVD14-6 FVD14-8	YF-1・E-4	YNE-38	DH-112・DH122	
c	FDV5.5-S4 FDV5.5-6	YNT-1210S			
d	8-4NS	YHT-8S			

13.3.4 Outline dimension drawings

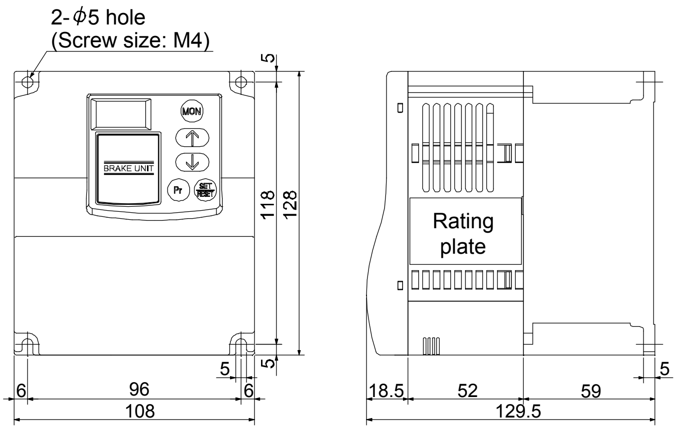
(1) FR-BU2- (H) brake unit

[Unit: mm]

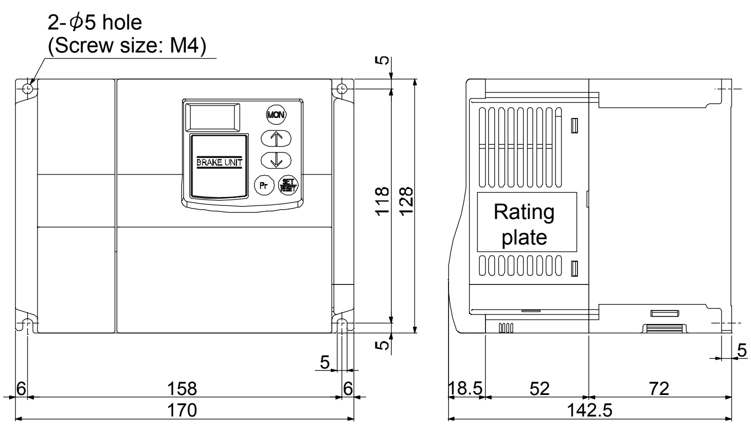
FR-BU2-15K



FR-BU2-30K
FR-BU2-H30K

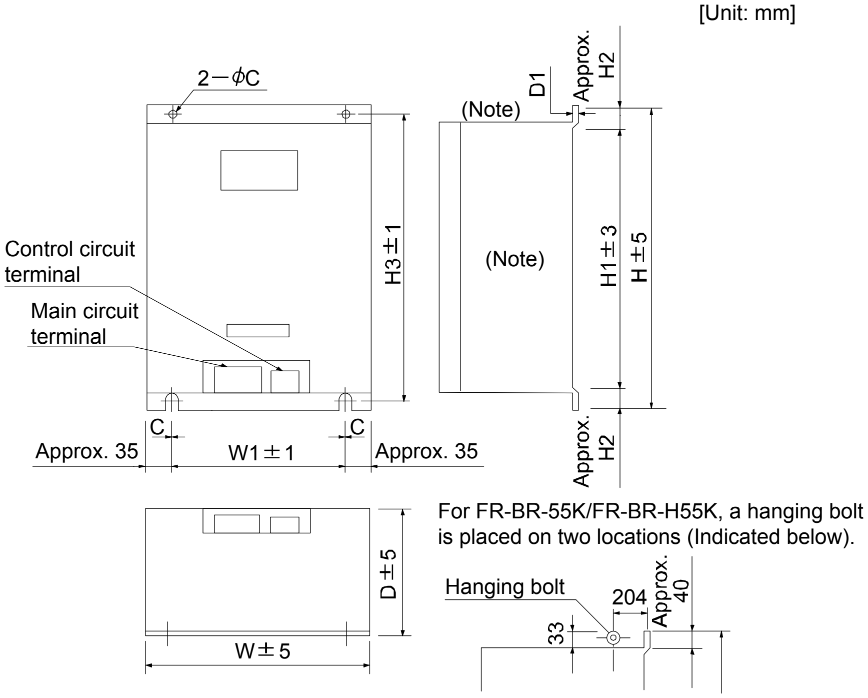


FR-BU2-55K
FR-BU2-H55K, H75K



(2) FR-BR- (H) resistor unit

[Unit: mm]

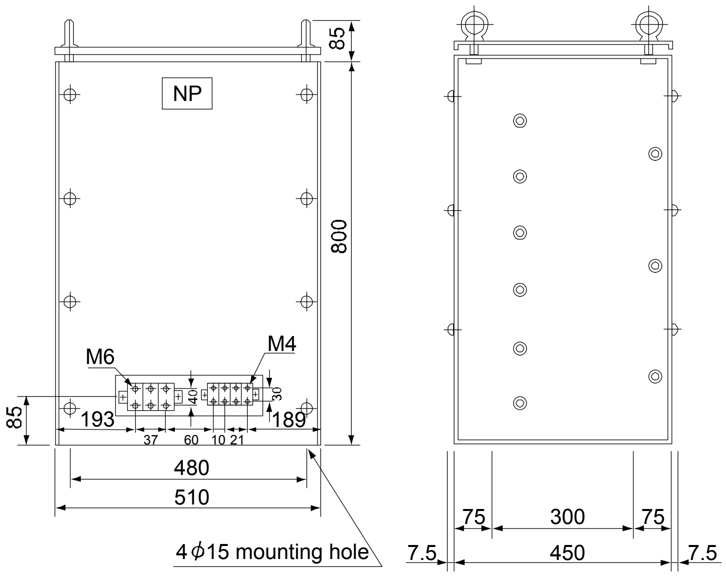


Note. Ventilation ports are provided on both sides and the top. The bottom is open.

Resistor unit		W	W1	H	H1	H2	H3	D	D1	C	Approximate mass [kg]([lb])
200V class	FR-BR-15K	170	100	450	410	20	432	220	3.2	6	15(33.1)
	FR-BR-30K	340	270	600	560	20	582	220	4	10	30(66.1)
	FR-BR-55K	480	410	700	620	40	670	450	3.2	12	70(154)
400V class	FR-BR-H30K	340	270	600	560	20	582	220	4	10	30(66.1)
	FR-BR-H55K	480	410	700	620	40	670	450	3.2	12	70(154)

(3) MT-BR5- (H) resistor unit

[Unit: mm]



Resistor unit		Resistance value	Approximate mass [kg]([lb])
200V class	MT-BR5-55K	2.0Ω	50(110)
400V class	MT-BR5-H75K	6.5Ω	70(154)

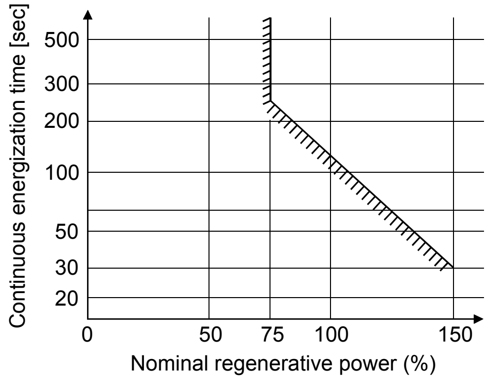
13.4 Power regeneration converter

When using the power regeneration converter, set "□□01" in parameter No.PA02.

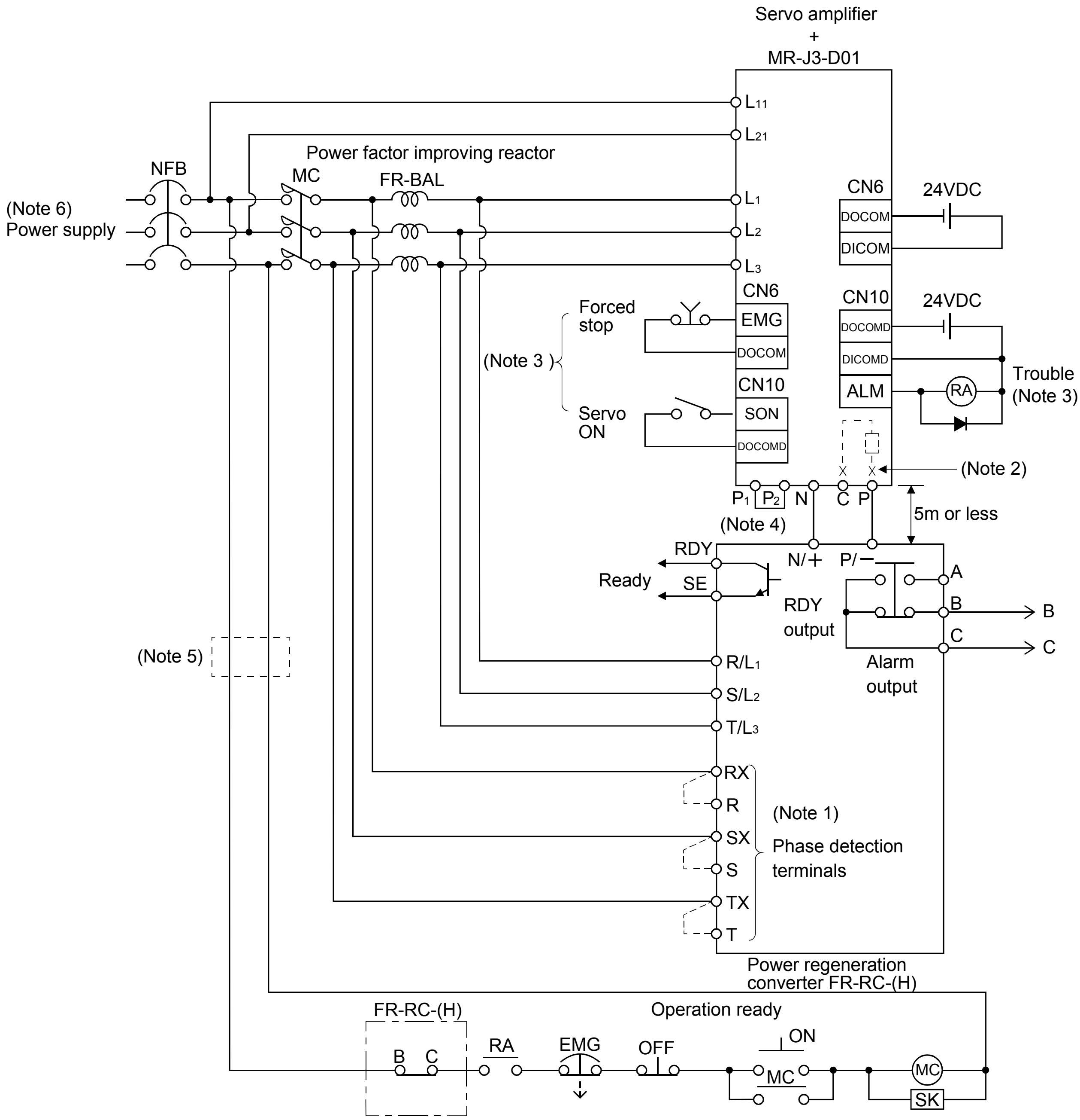
(1) Selection

The converters can continuously return 75% of the nominal regenerative power. They are applied to the servo amplifiers of the 5kW to 22kW.

<table>
<tr><th>Power regeneration converter</th><th>Nominal Regenerative Power (kW)</th><th>Servo Amplifier</th></tr>
<tr><td>FR-RC-15K</td><td>15</td><td rowspan="2">MR-J3-500T
MR-J3-700T
MR-J3-11KT
MR-J3-15KT</td></tr>
<tr><td>FR-RC-30K</td><td>30</td></tr>
<tr><td>FR-RC-55K</td><td>55</td><td>MR-J3-22KT</td></tr>
<tr><td>FR-RC-H15K</td><td>15</td><td>MR-J3-500T4
MR-J3-700T4</td></tr>
<tr><td>FR-RC-H30K</td><td>30</td><td>MR-J3-11KT4
MR-J3-15KT4</td></tr>
<tr><td>FR-RC-H55K</td><td>55</td><td>MR-J3-22KT4</td></tr>
</table>



(2) Connection example



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. When using servo amplifiers of 5kW and 7kW, always remove the lead of built-in regenerative resistor connected to P terminal and C terminal.

3. For sink input-output interface. Refer to section 3.8.3 for source input-output interface.

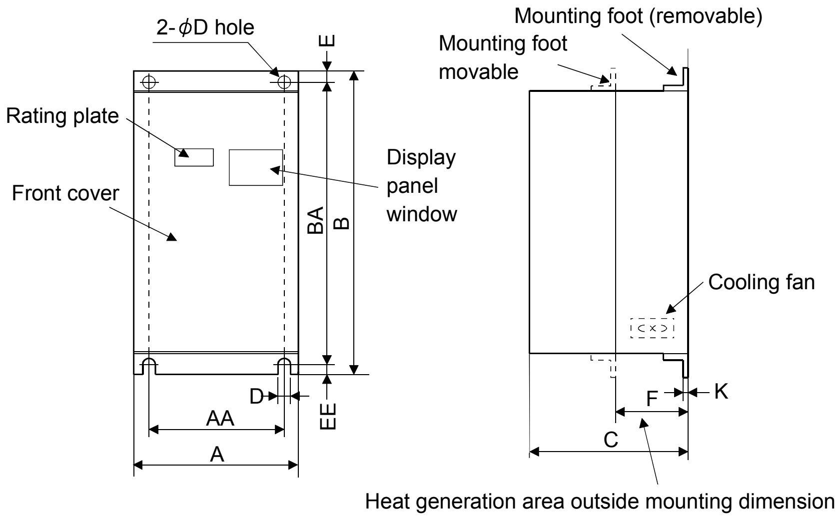
4. When using the servo amplifier of 11k to 22kW, always connect P_1 and P. (Factory-wired.) When using the power factor improving DC reactor, refer to section 13.11.

5. Stepdown transformer is required for coil voltage of magnetic contactor more than 200V class in 400V class servo amplifiers.

6. Refer to section 1.2 for the power supply specification.

(3) Outside dimensions of the power regeneration converters

[Unit : mm]

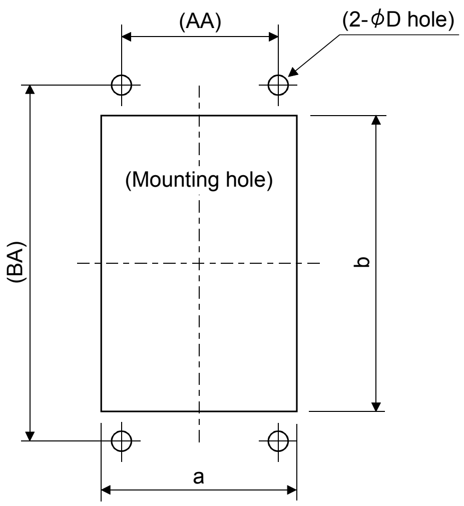


Power regeneration converter	A	AA	B	BA	C	D	E	EE	K	F	Approx. Mass [kg(lb)]
FR-RC-15K	270	200	450	432	195	10	10	8	3.2	87	19 (41.888)
FR-RC-H15K FR-RC-30K FR-RC-H30K	340	270	600	582	195	10	10	8	3.2	90	31 (68.343)
FR-RC-55K FR-RC-H55K	480	410	700	670	250	12	15	15	3.2	135	55 (121.3)

(4) Mounting hole machining dimensions

When the power regeneration converter is fitted to a totally enclosed type box, mount the heat generating area of the converter outside the box to provide heat generation measures. At this time, the mounting hole having the following dimensions is machined in the box.

[Unit : mm]



Model	a	b	D	AA	BA
FR-RC-15K	260	412	10	200	432
FR-RC-H15K FR-RC-30K FR-RC-H30K	330	562	10	270	582
FR-RC-55K FR-RC-H55K	470	642	12	410	670

13.5 Power regeneration common converter

POINT

- Use the FR-CV for the servo amplifier of 200V class and the FR-CV-H for that of 400V class.
- For details of the power regeneration common converter FR-CV-(H), refer to the FR-CV-(H) Installation Guide (IB(NA)0600075).
- Do not supply power to the main circuit power supply terminals (L_1, L_2, L_3) 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 the power regeneration common converter, set parameter No. PA02 to "□□01".

(1) Model

FR－CV－□□

Capacity

Symbol	Capacity [kW]
7.5K	7.5
11K	11
15K	15
22K	22
30K	30
37K	37
55K	55

Symbol	Voltage class
None	200V class
H	400V class

(2) Selection

The power regenerative common converter FR-CV can be used for the servo amplifier of 200V class with 3.5k to 22kW and that of 400V class with 11k to 22kW. The following shows the restrictions on using the FR-CV-(H).

(a) Up to six servo amplifiers can be connected to one FR-CV-(H).
(b) FR-CV-(H) capacity [W] Total of rated capacities [W] 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-□						
	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

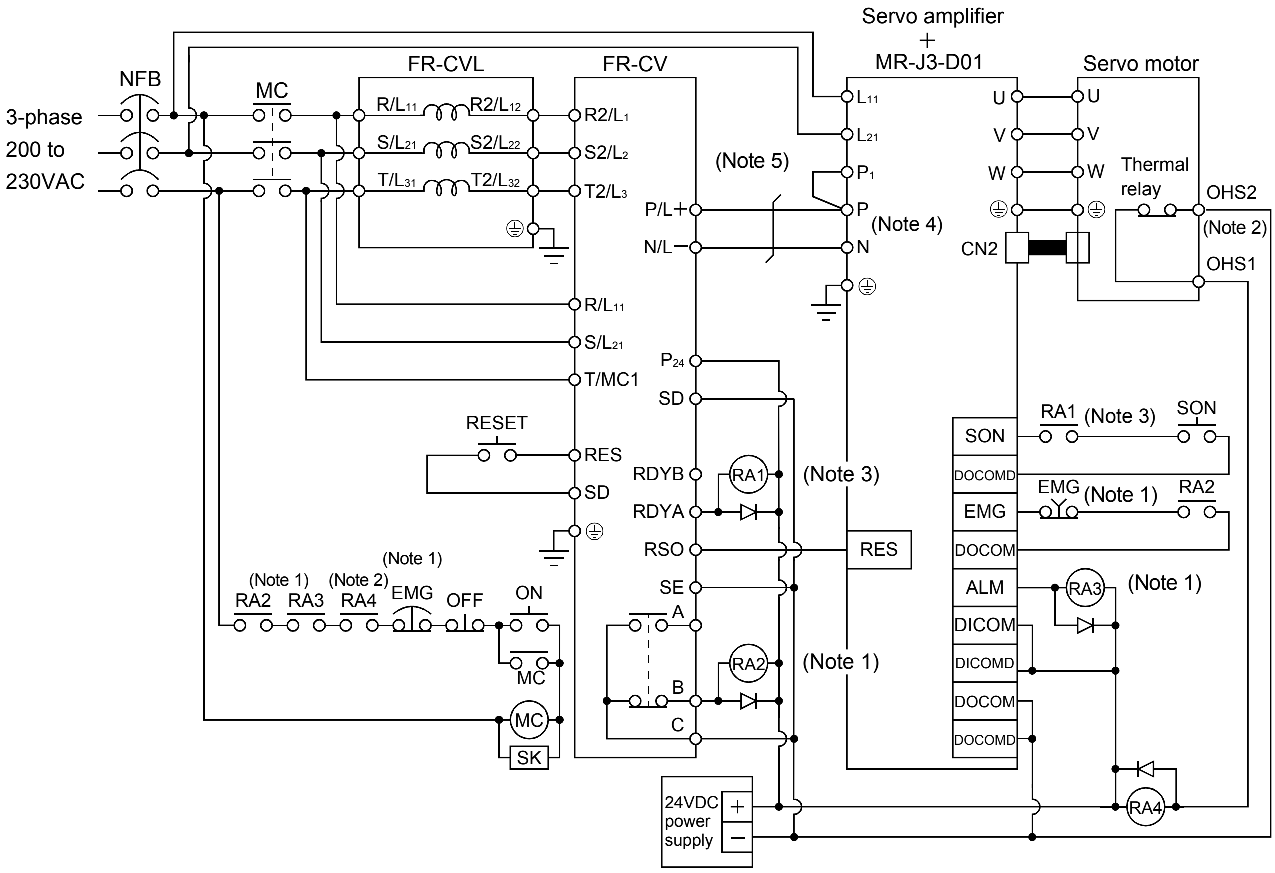
Item	FR-CV-H□			
	22K	30K	37K	55K
Maximum number of connected servo amplifiers	6			
Total of connectable servo amplifier capacities [kW]	11	15	18.5	27.5
Total of connectable servo motor rated currents [A]	90	115	145	215
Maximum servo amplifier capacity [kW]	11	15	15	22

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-7.5K(-AT)	FR-CVL-7.5K
FR-CV-11 K(-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
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

(a) 200V class



Note 1. Configure a sequence that will shut off main circuit power at an forced stop or at FR-CV or servo amplifier alarm occurrence.

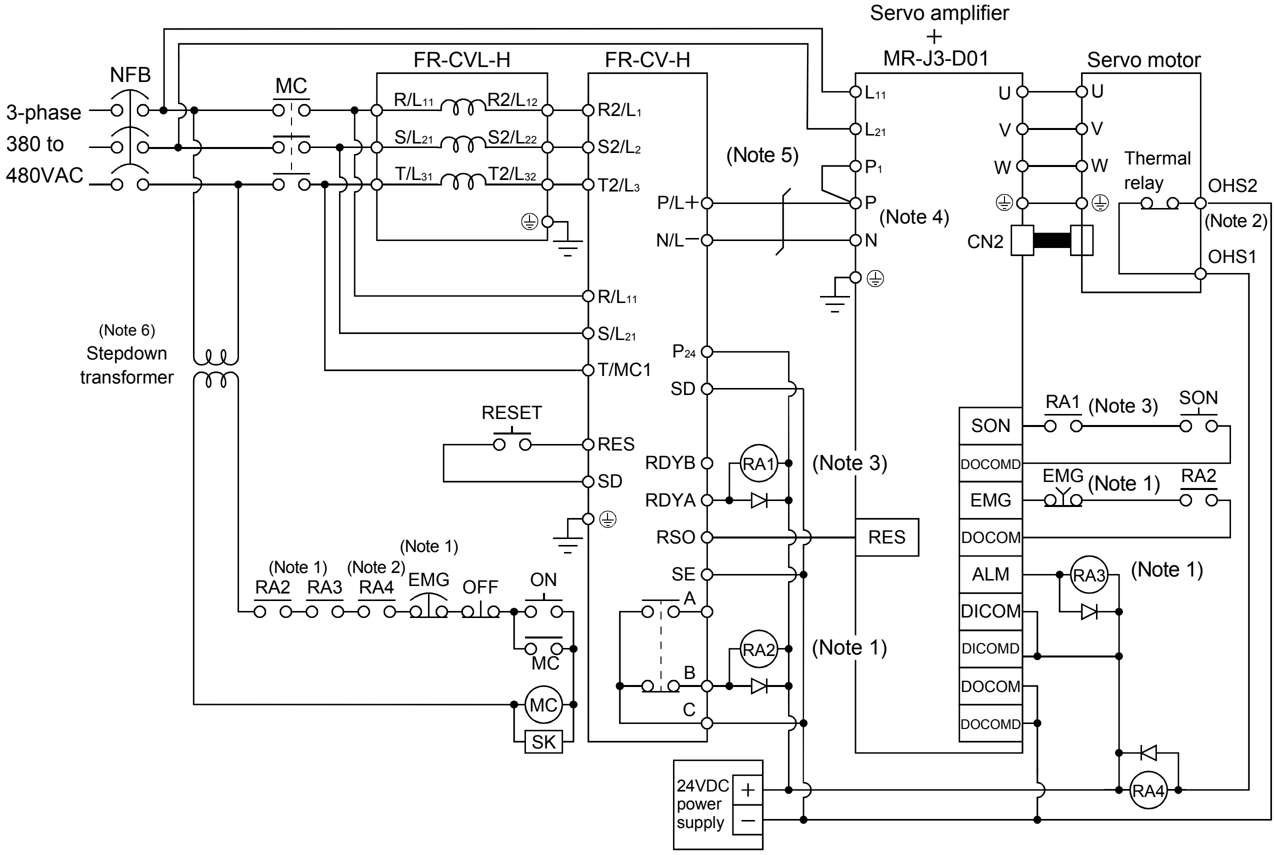
2. For the servo motor with thermal relay, configure a sequence that will shut off main circuit power when the thermal relay operates.

3. For the servo amplifier, configure a sequence that will switch the servo on after the FR-CV is ready.

4. When using the servo amplifier of 7kW or less, make sure to disconnect the wiring of built-in regeneration resistor (3.5kW or less: P-D, 5k/7kW: P-C).

5. When using the servo amplifier of 11k to 22kW, make sure to connect P_1 and P. (Factory-wired.)

(b) 400V class



Note 1. Configure a sequence that will shut off main circuit power at an forced stop or at FR-CV-H or servo amplifier alarm occurrence.

2. For the servo motor with thermal relay, configure a sequence that will shut off main circuit power when the thermal relay operates.
3. For the servo amplifier, configure a sequence that will switch the servo on after the FR-CV-H is ready.
4. When using the servo amplifier of 7kW or less, make sure to disconnect the wiring of built-in regeneration resistor (2kW or less: P+-D, 3.5k to 7kW: P-C).
5. When using the servo amplifier of 11k to 22kW, make sure to connect P_1 and P. (Factory-wired.)
6. Stepdown transformer is required for coil voltage of magnetic contactor more than 200V class servo amplifiers.

(4) Selection example of wires used for wiring

POINT

・Selection condition of wire size is as follows.

Wire type: 600V Polyvinyl chloride insulated wire (IV wire)

Construction condition: One wire is constructed in the air

(a) Wire sizes

1) Across P(＋)-P, N-N(－)

The following table indicates the connection wire sizes of the DC power supply (P, N terminals) between the FR-CV and servo amplifier.

Total of servo amplifier capacities [kW]	Wires [mm^2]
1 or less	2
2	3.5
5	5.5
7	8
11	14
15	22
22	50

The following table indicates the connection wire sizes of the DC power supply (P(＋), N(－) terminals) between the FR-CV-H and servo amplifier.

Total of servo amplifier capacities [kW]	Wires [mm^2]
1 or less	2
2	3.5
5	5.5
7	8
11	8
15	22
22	22

2) Grounding

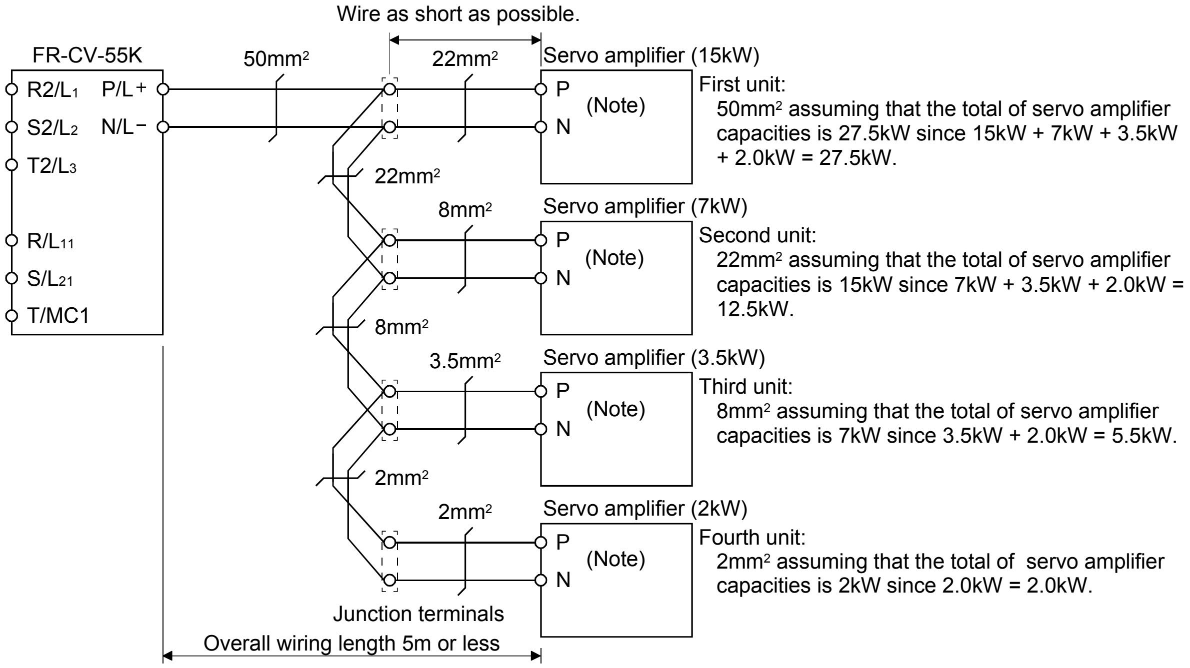
For grounding, use the wire of the size equal to or greater than that indicated in the following table, and make it as short as possible.

Power regeneration common converter	Grounding wire size [mm^2]
FR-CV-7.5K to FR-CV-15K	14
FR-CV-22K・FR-CV-30K	22
FR-CV-37K・FR-CV-55K	38
FR-CV-H22K・FR-CV-H30K	8
FR-CV-H37K・FR-CV-H55K	22

(b) Example of selecting the wire sizes

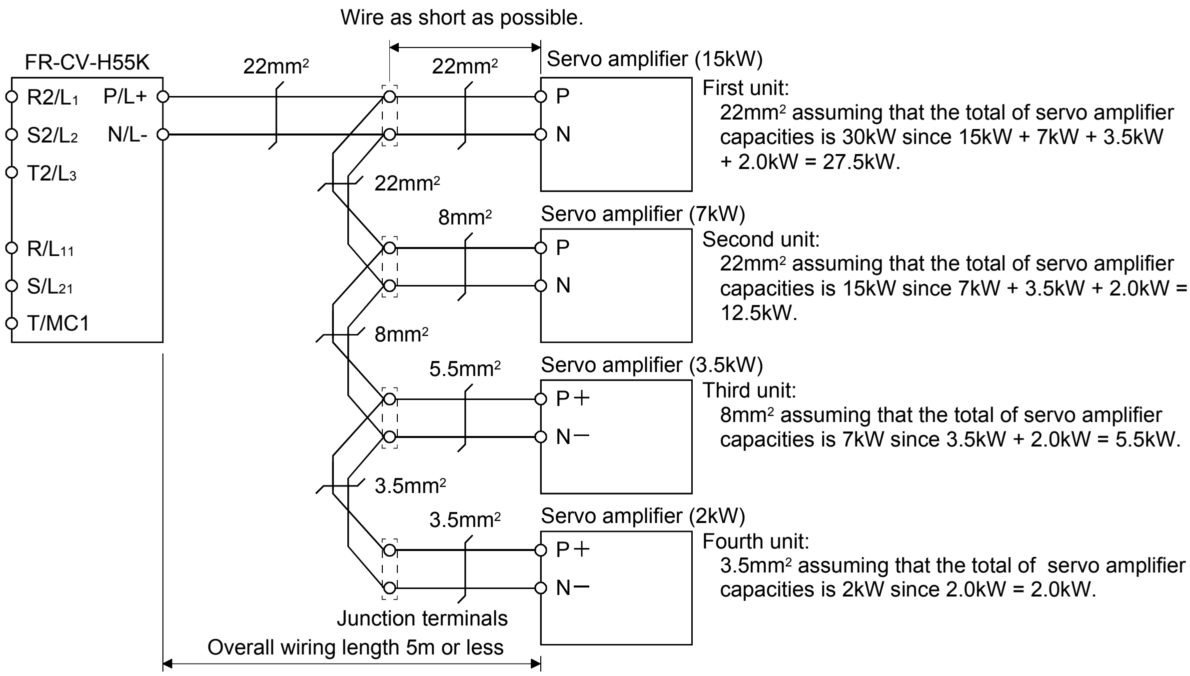
When connecting multiple servo amplifiers, always use junction terminals for wiring the servo amplifier terminals P, N. Also, connect the servo amplifiers in the order of larger to smaller capacities.

1) 200V class



Note. When using the servo amplifier of 7kW or less, make sure to disconnect the wiring of built-in regeneration resistor (3.5kW or less: P-D, 5k/7kW: P-C).

2) 400V class



(5) Other precautions

(a) Always use the FR-CVL-(H) as the power factor improving reactor. Do not use the FR-BAL or FR-BEL.

(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 5m or less, and the wiring must be twisted.

(6) Specifications

Item \ Power regeneration common converter FR-CV-□			7.5K	11K	15K	22K	30K	37K	55K
Total of connectable servo amplifier capacities [kW]			3.75	5.5	7.5	11	15	18.5	27.5
Maximum servo amplifier capacity [kW]			3.5	5	7	11	15	15	22
Output	Total of connectable servo motor rated currents [A]		33	46	61	90	115	145	215
	Regenerative braking torque	Short-time rating	Total capacity of applicable servo motors, 300% torque, 60s (Note 1)						
		Continuous rating	100% torque						
Power supply	Rated input AC voltage/frequency		Three-phase 200 to 220V 50Hz, 200 to 230V 60Hz						
	Permissible AC voltage fluctuation		Three-phase 170 to 242V 50Hz, 170 to 253V 60Hz						
	Permissible frequency fluctuation		±5%						
	Power supply capacity (Note 2) [kVA]		17	20	28	41	52	66	100
Protective structure (JEM 1030), cooling system			Open type (IP00), forced cooling						
Environment	Ambient temperature		-10℃ to +50℃ (14 to 122°F) (non-freezing)						
	Ambient humidity		90%RH or less (non-condensing)						
	Ambience		Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt)						
Altitude, vibration			1000m or less above sea level, 5.9m/s^2 or less						
No-fuse breaker or leakage current breaker			30AF 30A	50AF 50A	100AF 75A	100AF 100A	225AF 125A	225AF 125A	225AF 175A
Magnetic contactor			S-N20	S-N35	S-N50	S-N65	S-N95	S-N95	S-N125

Item \ Power regeneration common converter FR-CV-H□			22K	30K	37K	55K
Total of connectable servo amplifier capacities [kW]			11	15	18.5	27.5
Maximum servo amplifier capacity [kW]			11	15	15	22
Output	Total of connectable servo motor rated currents [A]		43	57	71	110
	Regenerative braking torque	Short-time rating	Total capacity of applicable servo motors, 300% torque, 60s (Note 1)			
		Continuous rating	100% torque			
Power supply	Rated input AC voltage/frequency		Three-phase 380 to 480V, 50Hz/60Hz			
	Permissible AC voltage fluctuation		Three-phase 323 to 528V, 50Hz/60Hz			
	Permissible frequency fluctuation		±5%			
	Power supply capacity [kVA]		41	52	66	100
Protective structure (JEM 1030), cooling system			Open type (IP00), forced cooling			
Environment	Ambient temperature		-10℃ to +50℃ (14 to 122°F) (non-freezing)			
	Ambient humidity		90%RH or less (non-condensing)			
	Ambience		Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt)			
Altitude, vibration			1000m or less above sea level, 5.9m/s^2 or less			
No-fuse breaker or leakage current breaker			60AF 60A	100AF 175A	100AF 175A	225AF 125A
Magnetic contactor			S-N25	S-N35	S-N35	S-N65

Note 1. This is the time when the protective function of the FR-CV is activated. The protective function of the servo amplifier is activated in the time indicated in section 12.1.

2. When connecting the capacity of connectable servo amplifier, specify the value of servo amplifier.

13.6 External dynamic brake

POINT

- Configure up a sequence which switches off the contact of the brake unit after (or as soon as) it has turned off the servo on signal at a power failure or failure.
- For the braking time taken when the dynamic brake is operated, refer to section 12.3.
- The brake unit is rated for a short duration. Do not use it for high duty.
- When the dynamic brake is used, the power supply voltage is restricted as indicated below.

  3-Phase 170 to 220VAC/50Hz

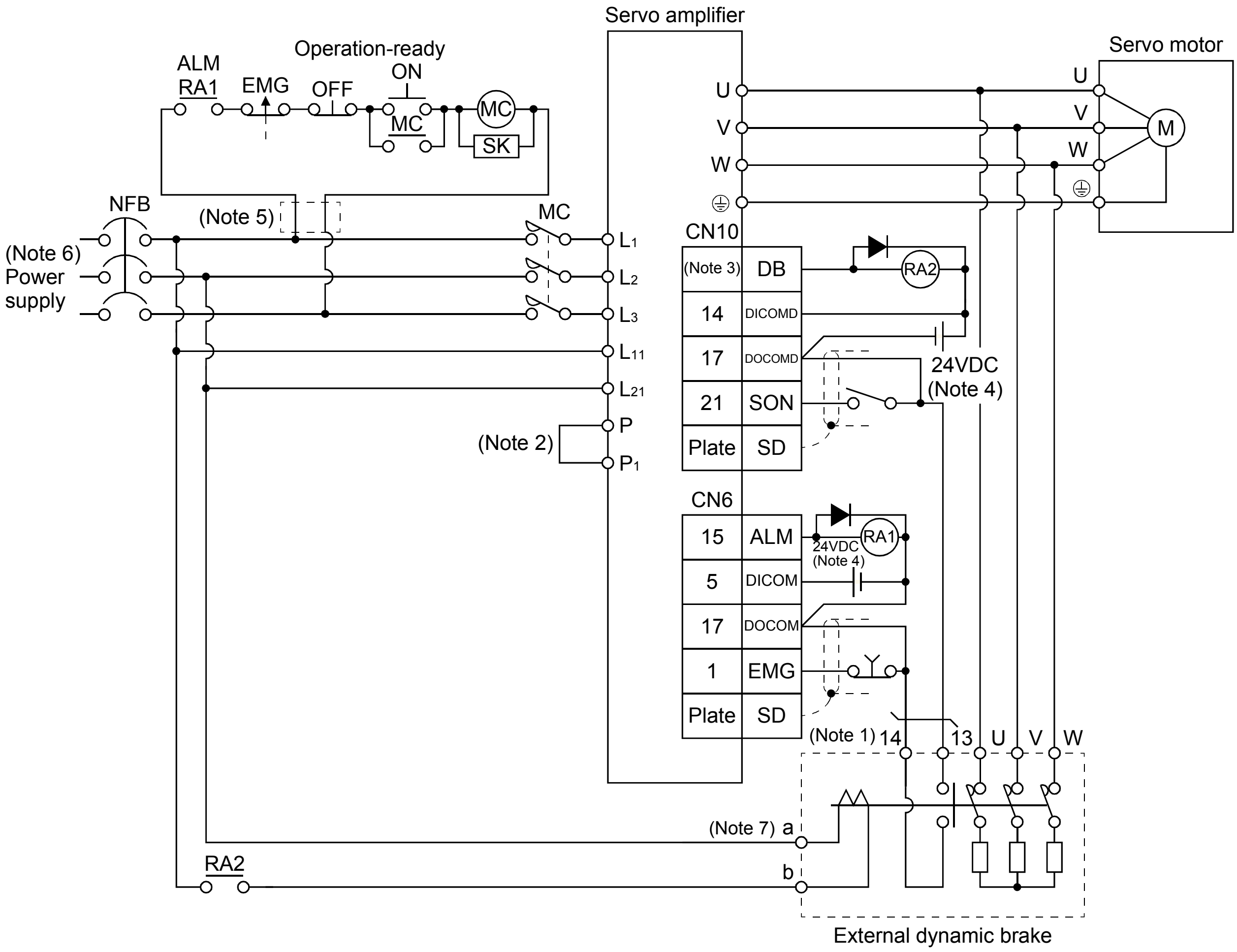
  3-Phase 170 to 242VAC/60Hz

(1) Selection of 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 7kW or less servo amplifier. Since it is not built in the 11kW or more servo amplifier, purchase it separately if required. Assign the dynamic brake sequence (DB) to any of the CN6-14 to CN6-16 pins in the parameters No.PD09 to PD11 or any of the C10-46 to CN10-49 pins in the parameters No.Po08 or Po09.

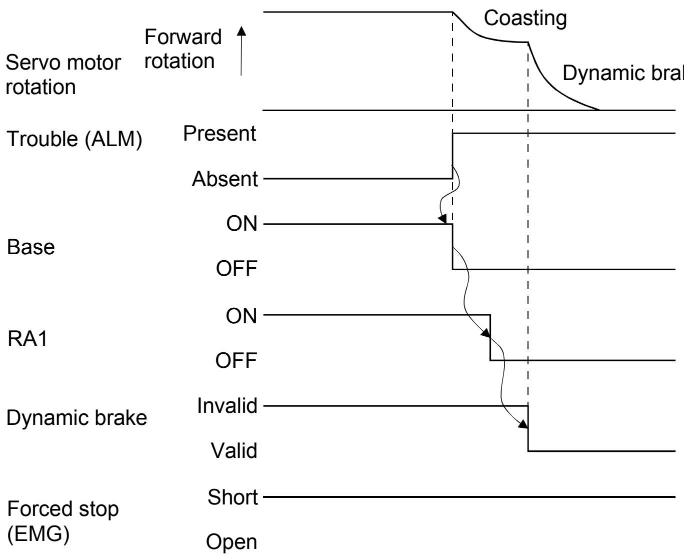
Servo amplifier	Dynamic brake
MR-J3-11KT	DBU-11K
MR-J3-15KT	DBU-15K
MR-J3-22KT	DBU-22K
MR-J3-11KT4	DBU-11K-4
MR-J3-15KT4	DBU-22K-4
MR-J3-22KT4	

(2) Connection example

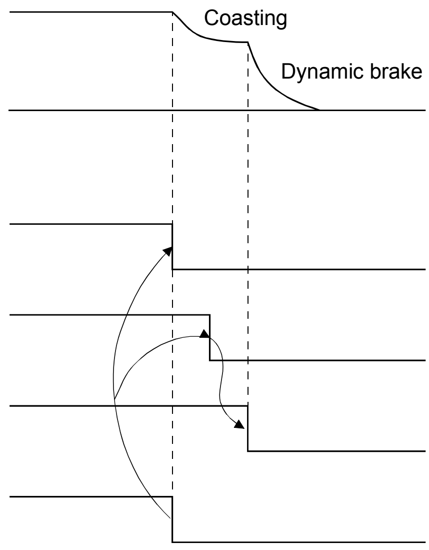


Note 1. Terminals 13, 14 are normally open contact outputs. If the dynamic brake is seized, terminals 13, 14 will open. Therefore, configure up an external sequence to prevent servo-on.
2. When using the servo amplifier of 11k to 22kW, make sure to connect P_1 and P. (Factory-wired.) When using the power factor DC reactor, refer to section 13.11.
3. Assign the dynamic brake sequence (DB) in the parameters No.PD09 ･ PD10 ･ Po08 ･ Po09.
4. 24VDC can be supplied from the same power supply.
5. Stepdown transformer is required for coil voltage of magnetic contactor more than 200V class in 400V class servo amplifiers.
6. Refer to section 1.2 for the power supply specification.
7. The power supply voltage of the inside magnet contactor for 400V class dynamic brake DBU-11K-4 and DBU-22K-4 is restricted as follows. When using these dynamic brakes, use them within the range of the power supply.

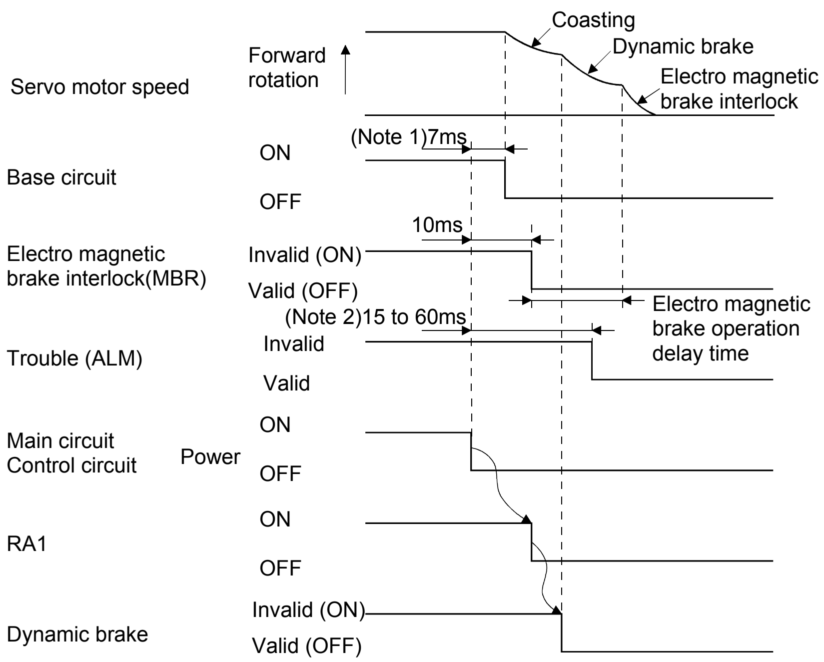
Dynamic brake	Power supply voltage
DBU-11K-4 DBU-22K-4	1-phase 380 to 463VAC 50Hz/60Hz



a. Timing chart at alarm occurrence



b. Timing chart at Forced stop (EMG) validity



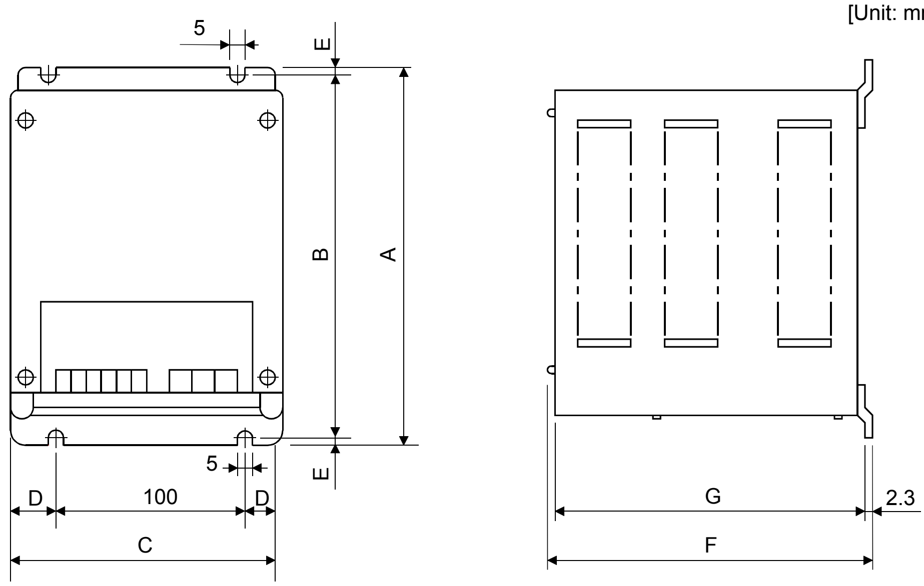
Note 1. When powering OFF,the RA1 of external dynamic brake circuit will be turned OFF, and the base circuit is turned OFF earlier than usual before an output shortage occurs.
(Only when assigning the DB as the output signal in the parameter No.PD09, PD10, Po08 and Po09.
2. Variable according to the operation status.

c. Timing chart when both of the main and control circuit power are OFF

(3) Outline dimension drawing

(a) DB-11K・DBU-15K・DBU-22K

[Unit: mm]



Terminal block

E (GND)		a	b	13	14

Screw : M3.5

Tightening torque: 0.8 [N•m](7 [lb•in])

U	V	W

Screw : M4

Tightening torque: 1.2 [N•m](10.6 [lb•in])

Dynamic brake	A	B	C	D	E	F	G	Mass [kg]([lb])	Connection wire [mm^2] (Note)
DBU-11K	200	190	140	20	5	170	163.5	2 (4.41)	5.5
DBU-15K, 22K	250	238	150	25	6	235	228	6 (13.23)	5.5

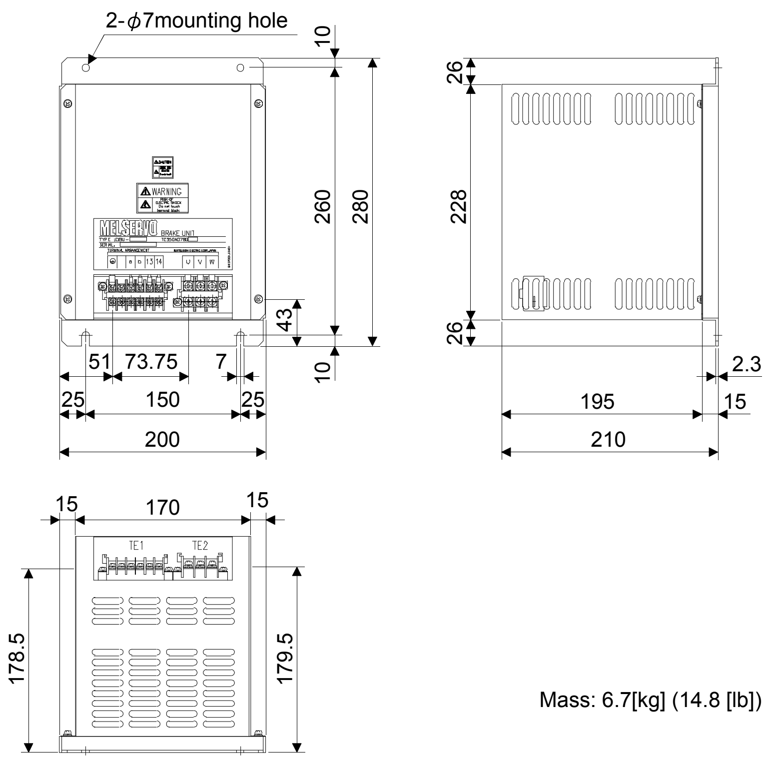
Note. Selection condition of wire size is as follows.

Wire type: 600V Polyvinyl chloride insulated wire (IV wire)

Construction condition: One wire is constructed in the air

(b) DBU-11K-4 · DBU-22K-4

[Unit: mm]



Mass: 6.7[kg] (14.8 [lb])

Terminal block
TE1

⏚		a	b	13	14

Screw: M3.5
Tightening torque: 0.8[N•m](7[lb•in])

TE2

U	V	W

Screw: M4
Tightening torque: 1.2 [N•m](10.6[lb•in])

Dynamic brake	Wire [mm^2] (Note)	
	a · b	U · V · W
DBU-11K	2	5.5
DBU-15K, 22K	2	5.5

Note. Selection condition of wire size is as follows.
Wire type: 600V Polyvinyl chloride insulated wire (IV wire)
Construction condition: One wire is constructed in the air

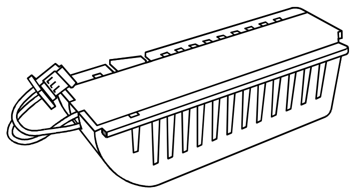
13.7 Battery MR-J3BAT

POINT

- The revision (Edition 44) of the Dangerous Goods Rule of the International Air Transport Association (IATA) went into effect on January 1, 2003 and was enforced immediately. In this rule, "provisions of the lithium and lithium ion batteries" were revised to tighten the restrictions on the air transportation of batteries. However, since this battery is non-dangerous goods (non-Class 9), air transportation of 24 or less batteries is outside the range of the restrictions. Air transportation of more than 24 batteries requires packing compliant with the Packing Standard 903. When a self-certificate is necessary for battery safety tests, contact our branch or representative. For more information, consult our branch or representative. (As of February, 2008).

(1) Purpose of use for MR-J3BAT

This battery is used to construct an absolute position detection system. Refer to section 14.3 for the fitting method, etc.

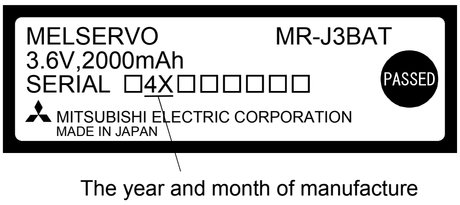


(2) Year and month when MR-J3BAT is manufactured

The year and month when MR-J3BAT is manufactured are written down in Serial No. on the rating plate of the battery back face.

The year and month of manufacture are indicated by the last one digit of the year and 1 to 9, X(10), Y(11), Z(12).

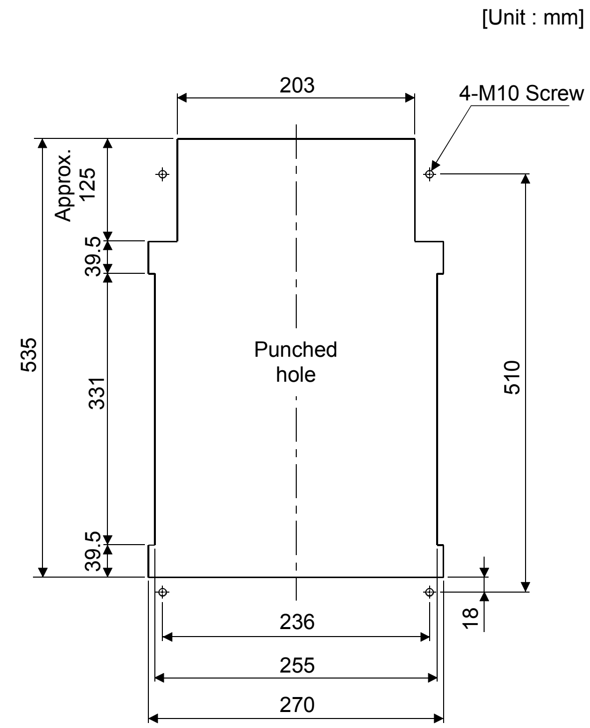
For October 2004, the Serial No. is like, "SERIAL □ 4X □□□□□□".



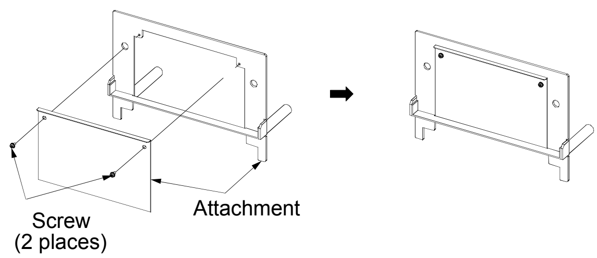
13.8 Heat sink outside mounting attachment (MR-J3ACN)

Use the heat sink outside mounting attachment to mount the heat generation area of the servo amplifier in the outside of the control box to dissipate servo amplifier-generated heat to the outside of the box and reduce the amount of heat generated in the box, thereby allowing a compact control box to be designed.
In the control box, machine a hole having the panel cut dimensions, fit the heat sink outside mounting attachment to the servo amplifier with the fitting screws (4 screws supplied), and install the servo amplifier to the control box.
The environment outside the control box when using the heat sink outside mounting attachment should be within the range of the servo amplifier operating environment conditions.
The heat sink outside mounting attachment of MR-J3ACN can be used for MR-J3-11KT(4) to MR-J3-22KT(4).

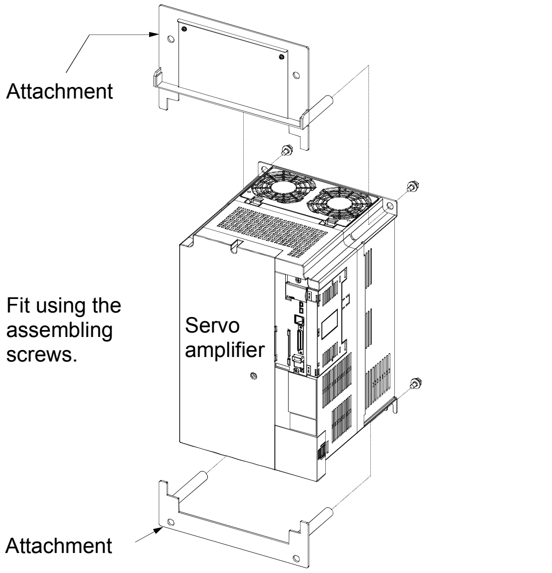
(1) Panel cut dimensions



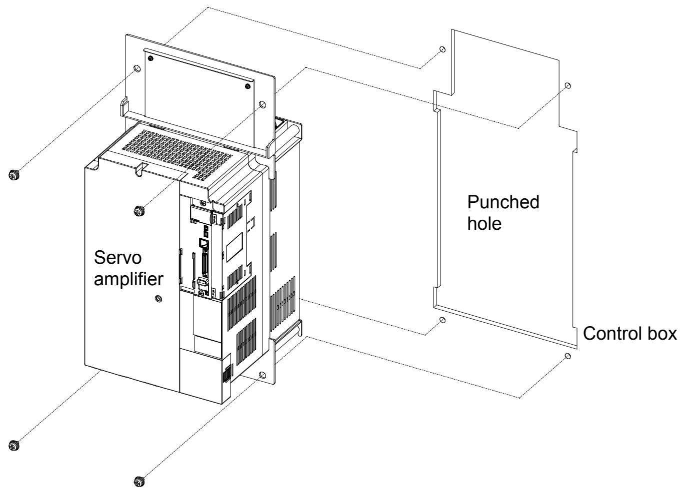
(2) How to assemble the attachment for a heat sink outside mounting attachment



(3) Fitting method



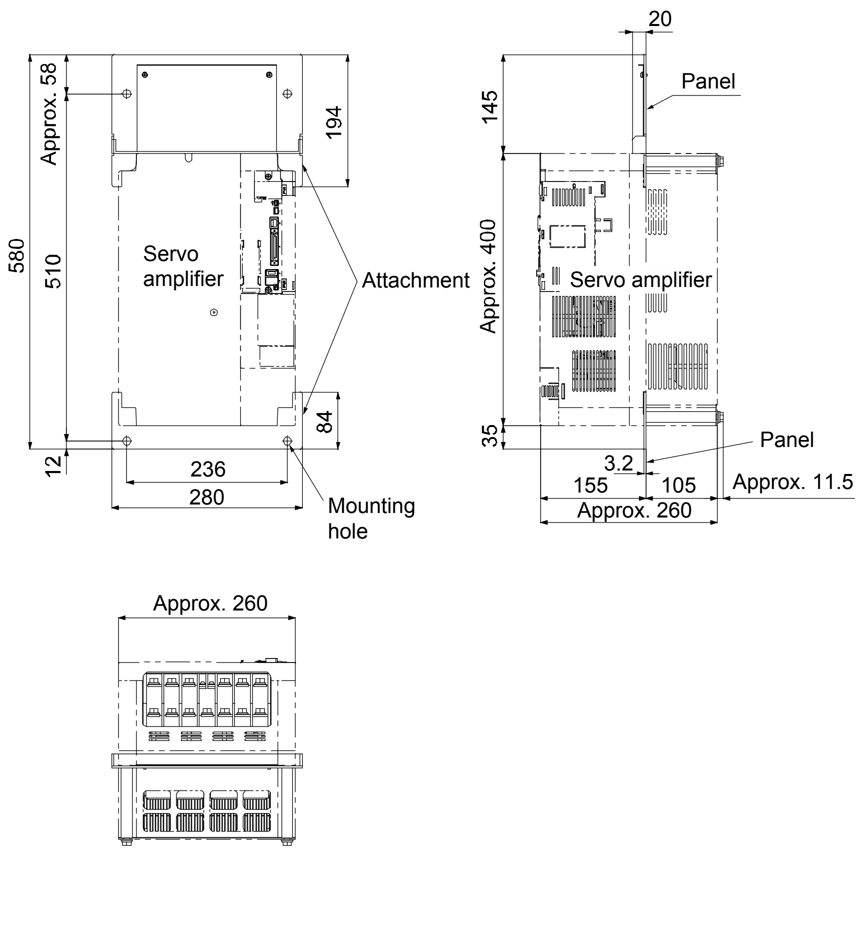
a. Assembling the heat sink outside mounting attachment



b. Installation to the control box

(4) Outline dimension drawing

[Unit: mm]

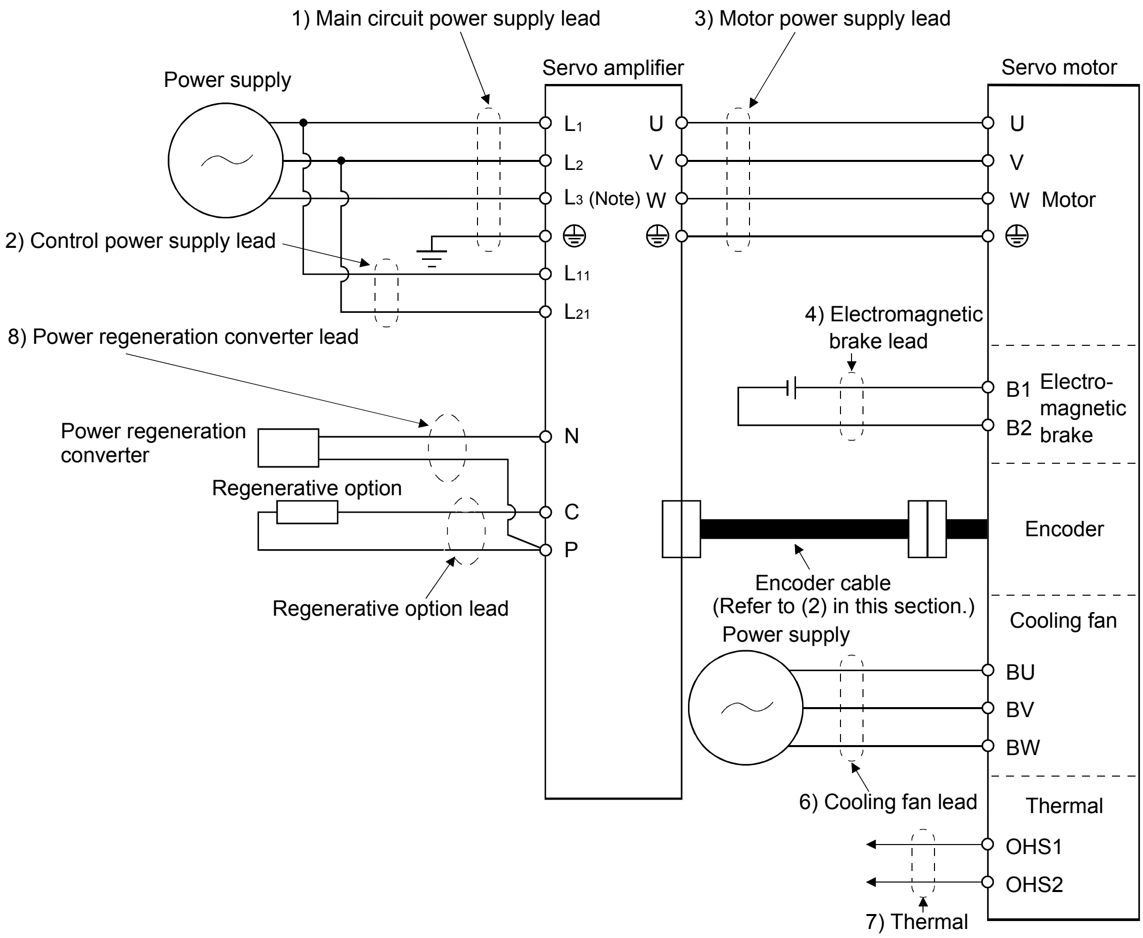


13.9 Selection example of wires

POINT
・Wires indicated in this section are separated wires. When using a cable for power line (U, V, and W) between the servo amplifier and servo motor, use a 600V grade EP rubber insulated chloroprene sheath cab-tire cable (2PNCT). For selection of cables, refer to appendix 5. ・To comply with the UL/C-UL (CSA) Standard, use UL-recognized copper wires rated at 60°C (140°F) or more for wiring. To comply with other standards, use a wire that is complied with each standard ・Selection condition of wire size is as follows. Construction condition: One wire is constructed in the air Wire length: 30m or less

(1) Wires for power supply wiring

The following diagram shows the wires used for wiring. Use the wires given in this section or equivalent.



Note. There is no L_3 for 1-phase 100 to 120VAC power supply.

(a) When using the 600V Polyvinyl chloride insulated wire (IV wire)
Selection example of wire size when using IV wires is indicated below.

Table 13.1 Wire size selection example 1 (IV wire)

<table>
<tr><th rowspan="2">Servo amplifier</th><th colspan="7">Wires [mm^2] (Note 1, 4)</th></tr>
<tr><th>1)
L_1 ・ L_2 ・ L_3 ・ ⏚</th><th>2) L_{11} ・ L_{21}</th><th>3)
U ・ V ・ W ・ ⏚</th><th>4) P ・ C</th><th>5) B1 ・ B2</th><th>6)
BU ・ BV ・ BW</th><th>7)
OHS1 ・ OHS2</th></tr>
<tr><td>MR-J3-10T(1)</td><td rowspan="7">2(AWG14)</td><td rowspan="8">1.25(AWG16)</td><td rowspan="5">1.25(AWG16)</td><td rowspan="8">2(AWG14)</td><td rowspan="22">1.25(AWG16)</td><td rowspan="9"></td><td rowspan="9"></td></tr>
<tr><td>MR-J3-20T(1)</td></tr>
<tr><td>MR-J3-40T(1)</td></tr>
<tr><td>MR-J3-60T</td></tr>
<tr><td>MR-J3-70T</td></tr>
<tr><td>MR-J3-100T</td><td rowspan="2">2(AWG14)</td></tr>
<tr><td>MR-J3-200T</td></tr>
<tr><td>MR-J3-350T</td><td>3.5(AWG12)</td><td>3.5(AWG12)</td></tr>
<tr><td>MR-J3-500T
(Note 2)</td><td>5.5(AWG10): a</td><td rowspan="2">1.25(AWG16): h</td><td>5.5(AWG10): a</td><td>2(AWG14): g</td></tr>
<tr><td>MR-J3-700T
(Note 2)</td><td>8(AWG8): b</td><td>8(AWG8): b</td><td>3.5(AWG12): a</td><td>2(AWG14)
(Note 3)</td><td>1.25(AWG16)
(Note 3)</td></tr>
<tr><td>MR-J3-11KT
(Note 2)</td><td>14(AWG6): c</td><td rowspan="3">1.25(AWG16): g</td><td>22(AWG4): d</td><td rowspan="2">5.5(AWG10): j</td><td rowspan="3">2(AWG14)</td><td rowspan="3">1.25(AWG16)</td></tr>
<tr><td>MR-J3-15KT
(Note 2)</td><td>22(AWG4): d</td><td>30(AWG2): e</td></tr>
<tr><td>MR-J3-22KT
(Note 2)</td><td>50(AWG1/0): f</td><td>60(AWG2/0): f</td><td>5.5(AWG10): k</td></tr>
<tr><td>MR-J3-60T4</td><td rowspan="3">2(AWG14)</td><td rowspan="3">1.25(AWG16)</td><td rowspan="2">1.25(AWG16)</td><td rowspan="3">2(AWG14)</td><td rowspan="5"></td><td rowspan="5"></td></tr>
<tr><td>MR-J3-100T4</td></tr>
<tr><td>MR-J3-200T4</td><td>2(AWG14)</td></tr>
<tr><td>MR-J3-350T4</td><td>2(AWG14): g</td><td rowspan="3">1.25(AWG16): h</td><td>2(AWG14): g</td><td rowspan="3">2(AWG14): g</td></tr>
<tr><td>MR-J3-500T4
(Note 2)</td><td rowspan="2">5.5(AWG10): a</td><td rowspan="2">5.5(AWG10): a</td></tr>
<tr><td>MR-J3-700T4
(Note 2)</td><td>2(AWG14)
(Note 3)</td><td>1.25(AWG16)
(Note 3)</td></tr>
<tr><td>MR-J3-11KT4
(Note 2)</td><td>8(AWG8): l</td><td rowspan="3">1.25(AWG16): g</td><td>8(AWG8): l</td><td>3.5(AWG12): j</td><td rowspan="3">2(AWG14)</td><td rowspan="3">1.25(AWG16)</td></tr>
<tr><td>MR-J3-15KT4
(Note 2)</td><td>14(AWG6): c</td><td>22(AWG4): d</td><td>5.5(AWG10): j</td></tr>
<tr><td>MR-J3-22KT4
(Note 2)</td><td>14(AWG6): m</td><td>22(AWG4): n</td><td>5.5(AWG10): k</td></tr>
</table>

Note 1. Alphabets in the table indicate crimping tools. For crimping terminals and applicable tools, refer to (1) (c) in this section.
2. When connecting to the terminal block, be sure to use the screws which are provided with the terminal block.
3. For the servo motor with a cooling fan.
4. Wires are selected based on the highest rated current among combining servo motors.

Use wires 8) of the following sizes with the power regeneration converter (FR-RC-(H)).

Model	Wires[mm^2]
FR-RC-15K	14(AWG6)
FR-RC-30K	14(AWG6)
FR-RC-55K	22(AWG4)
FR-RC-H15K	14(AWG6)
FR-RC-H30K	14(AWG6)
FR-RC-H55K	14(AWG6)

(b) When using the 600V Grade heat-resistant polyvinyl chloride insulated wire (HIV wire)

Selection example of wire size when using HIV wires is indicated below. For the wire (8)) for power regeneration converter (FR-RC-(H)), use the IV wire indicated in (1) (a) in this section.

Table 13.2 Wire size selection example 2 (HIV wire)

<table>
<tr><th rowspan="2">Servo amplifier</th><th colspan="7">Wires [mm²] (Note 1, 4)</th></tr>
<tr><th>1) L1 · L2 · L3 · ⏚</th><th>2) L11 · L21</th><th>3) U · V · W · ⏚</th><th>4) P · C</th><th>5) B1 · B2</th><th>6) BU · BV · BW</th><th>7) OHS1 · OHS2</th></tr>
<tr><td>MR-J3-10T(1)</td><td rowspan="7">2(AWG14)</td><td rowspan="8">1.25(AWG16)</td><td rowspan="5">1.25(AWG16)</td><td rowspan="8">2(AWG14)</td><td rowspan="22">1.25(AWG16)</td><td rowspan="9"></td><td rowspan="9"></td></tr>
<tr><td>MR-J3-20T(1)</td></tr>
<tr><td>MR-J3-40T(1)</td></tr>
<tr><td>MR-J3-60T</td></tr>
<tr><td>MR-J3-70T</td></tr>
<tr><td>MR-J3-100T</td><td>1.25(AWG16)</td></tr>
<tr><td>MR-J3-200T</td><td>2(AWG14)</td></tr>
<tr><td>MR-J3-350T</td><td>3.5(AWG12)</td><td>3.5(AWG12)</td></tr>
<tr><td>MR-J3-500T (Note 2)</td><td>5.5(AWG10): a</td><td rowspan="2">1.25(AWG16): h</td><td>5.5(AWG10): a</td><td>2(AWG14): g</td></tr>
<tr><td>MR-J3-700T (Note 2)</td><td>8(AWG8): b</td><td>8(AWG8): b</td><td>2(AWG14): g</td><td>1.25(AWG16) (Note 3)</td><td>1.25(AWG16) (Note 3)</td></tr>
<tr><td>MR-J3-11KT (Note 2)</td><td>14(AWG6): c</td><td rowspan="3">1.25(AWG16): g</td><td>14(AWG6): c</td><td rowspan="2">3.5(AWG12): j</td><td rowspan="3">1.25(AWG16)</td><td rowspan="3">1.25(AWG16)</td></tr>
<tr><td>MR-J3-15KT (Note 2)</td><td>22(AWG4): d</td><td>22(AWG4): d</td></tr>
<tr><td>MR-J3-22KT (Note 2)</td><td>38(AWG1): p</td><td>38(AWG1): p</td><td>5.5(AWG10): k</td></tr>
<tr><td>MR-J3-60T4</td><td rowspan="3">2(AWG14)</td><td rowspan="3">1.25(AWG16)</td><td rowspan="2">1.25(AWG16)</td><td rowspan="3">2(AWG14)</td><td rowspan="5"></td><td rowspan="5"></td></tr>
<tr><td>MR-J3-100T4</td></tr>
<tr><td>MR-J3-200T4</td><td>2(AWG14)</td></tr>
<tr><td>MR-J3-350T4</td><td>2(AWG14): g</td><td rowspan="3">1.25(AWG16): h</td><td>2(AWG14): g</td><td rowspan="3">2(AWG14): g</td></tr>
<tr><td>MR-J3-500T4 (Note 2)</td><td rowspan="2">3.5(AWG12): a</td><td>3.5(AWG12): a</td></tr>
<tr><td>MR-J3-700T4 (Note 2)</td><td>5.5(AWG10): a</td><td>1.25(AWG16) (Note 3)</td><td>1.25(AWG16) (Note 3)</td></tr>
<tr><td>MR-J3-11KT4 (Note 2)</td><td>5.5(AWG10): j</td><td rowspan="3">1.25(AWG16): g</td><td>8(AWG8): l</td><td>2(AWG14): q</td><td rowspan="3">1.25(AWG16)</td><td rowspan="3">1.25(AWG16)</td></tr>
<tr><td>MR-J3-15KT4 (Note 2)</td><td>8(AWG8): l</td><td>14(AWG6): c</td><td>3.5(AWG12): j</td></tr>
<tr><td>MR-J3-22KT4 (Note 2)</td><td>14(AWG6): m</td><td>14(AWG6): m</td><td>3.5(AWG12): k</td></tr>
</table>

Note 1. Alphabets in the table indicate crimping tools. For crimping terminals and applicable tools, refer to (1) (c) in this section.

2. When connecting to the terminal block, be sure to use the screws which are provided with the terminal block.

3. For the servo motor with a cooling fan.

4. Wires are selected based on the highest rated current among combining servo motors.

(c) Selection example of crimping terminals

Selection example of crimping terminals for the servo amplifier terminal box when using the wires mentioned in (1) (a) and (b) in this section is indicated below.

<table>
<tr><th rowspan="3">Symbol</th><th colspan="5">Servo amplifier side crimping terminals</th></tr>
<tr><th rowspan="2">(Note 2)
Crimping terminal</th><th colspan="3">Applicable tool</th><th rowspan="2">Manufacturer</th></tr>
<tr><th>Body</th><th>Head</th><th>Dice</th></tr>
<tr><td>a</td><td>FVD5.5-4</td><td>YNT-1210S</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="20">Japan Solderless Terminal</td></tr>
<tr><td>(Note 1)b</td><td>8-4NS</td><td>YHT-8S</td></tr>
<tr><td>c</td><td>FVD14-6</td><td rowspan="2">YF-1・E-4</td><td rowspan="2">YNE-38</td><td>DH-112・DH122</td></tr>
<tr><td>d</td><td>FVD22-6</td><td>DH-113・DH123</td></tr>
<tr><td rowspan="2">(Note 1)e</td><td rowspan="2">38-6</td><td>YPT-60-21</td><td></td><td rowspan="2">TD-112・TD-124</td></tr>
<tr><td>YF-1・E-4</td><td>YET-60-1</td></tr>
<tr><td rowspan="2">(Note 1)f</td><td rowspan="2">R60-8</td><td>YPT-60-21</td><td></td><td rowspan="2">TD-113・TD-125</td></tr>
<tr><td>YF-1・E-4</td><td>YET-60-1</td></tr>
<tr><td>g</td><td>FVD2-4</td><td rowspan="2">YNT-1614</td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>h</td><td>FVD2-M3</td></tr>
<tr><td>j</td><td>FVD5.5-6</td><td rowspan="2">YNT-1210S</td></tr>
<tr><td>k</td><td>FVD5.5-8</td></tr>
<tr><td>l</td><td>FVD8-6</td><td rowspan="3">YF-1・E-4</td><td rowspan="3">YNE-38</td><td>DH-111・DH121</td></tr>
<tr><td>m</td><td>FVD14-8</td><td>DH-112・DH122</td></tr>
<tr><td>n</td><td>FVD22-8</td><td>DH-113・DH123</td></tr>
<tr><td rowspan="2">(Note 1)p</td><td rowspan="2">R38-8</td><td>YPT-60-21</td><td></td><td rowspan="2">TD-112・TD-124</td></tr>
<tr><td>YF-1・E-4</td><td>YET-60-1</td></tr>
<tr><td>q</td><td>FVD2-6</td><td>YNT-1614</td><td></td><td></td></tr>
</table>

Note 1. Coat the part of crimping with the insulation tube.

2. Some crimping terminals may not be mounted depending on the size. Make sure to use the recommended ones or equivalent ones.

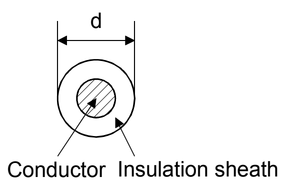
(2) Wires for cables

When fabricating a cable, use the wire models given in the following table or equivalent.

Table 13.3 Wires for option cables

Type	Model	Length [m(ft)]	Core size [mm^2]	Number of Cores	Characteristics of one core: Structure [Wires/mm]	Characteristics of one core: Conductor resistance [Ω/mm]	Characteristics of one core: Insulation coating ODd [mm] (Note 1)	(Note 3) Finishing OD [mm]	Wire model
Encoder cable	MR-J3ENCBL☐M-A1-L MR-J3ENCBL☐M-A2-L	2 to 10	AWG22	6 (3 pairs)	7/0.26	53 or less	1.2	7.1±0.3	(Note 3) VSVP 7/0.26 (AWG#22 or equivalent)-3P Ban-gi-shi-16823
	MR-J3ENCBL☐M-A1-H MR-J3ENCBL☐M-A2-H	2 to 10	AWG22	6 (3 pairs)	70/0.08	56 or less	1.2	7.1±0.3	(Note 3) ETFE SVP 70/0.08 (AWG#22 or equivalent)-3P Ban-gi-shi-16824
	MR-J3JCBL03M-A1-L MR-J3JCBL03M-A2-L	0.3	AWG26	8 (4 pairs)	30/0.08	233 or less	1.2	7.1±0.3	(Note 5) T/2464-1061/II A-SB 4P×26AWG
	MR-EKCBL☐M-L	2 to 10	0.3mm^2	4 (2 pairs)	12/0.18	65.7 or less	1.3	7.3	(Note 3) 20276 composite 4-pair shielded cable (A-TYPE)
			0.08mm^2	4 (2 pairs)	7/0.127	234 or less	0.67		
		20・30	0.3mm^2	12 (6 pairs)	12/0.18	63.6 or less	1.2	8.2	UL20276 AWG#23 6pair(BLACK)
	MR-EKCBL☐M-H	20	0.2mm^2	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	(Note 3) A14B2343 6P
		30 to 50	0.2mm^2	14 (7 pairs)	40/0.08	105 or less	0.88	8.0	(Note 3) J14B0238(0.2*7P)
	MR-J3ENSCBL☐M-L	2 to 10	AWG22	6 (3 pairs)	7/0.26	53 or less	1.2	7.1±0.3	(Note 3) VSVP 7/0.26 (Equivalent to AWG#22)-3P Ban-gi-shi-16823
		20・30	AWG23	12 (6 pairs)	12/0.18	63.3 or less	1.2	8.2±0.3	(Note 3) 20276 VSVCAWG#23×6P Ban-gi-shi-15038
	MR-J3ENSCBL☐M-H	2 to 10	AWG22	6 (3 pairs)	70/0.08	56 or less	1.2	7.1±0.3	(Note 3) ETFE SVP 70/0.08 (Equivalent to AWG#22)-3P Ban-gi-shi-16824
		20 to 50	AWG24	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	(Note 3) ETRE・SVP 40/0.08mm×6P Ban-gi-shi-15266
Motor power supply cable	MR-PWS1CBL☐M-A1-L	2 to 10	(Note 6) AWG19	4	50/0.08	25.40 or less	1.8	5.7±0.3	(Note 4) UL Style 2103 AWG19 4 cores
	MR-PWS1CBL☐M-A2-L	2 to 10							
	MR-PWS1CBL☐M-A1-H	2 to 10							
	MR-PWS1CBL☐M-A2-H	2 to 10							
	MR-PWS2CBL03M-A1-L	0.3							
	MR-PWS2CBL03M-A2-L	0.3							
Motor brake cable	MR-BKS1CBL☐M-A1-L	2 to 10	(Note 6) AWG20	2	100/0.08	38.14 or less	1.3	4.0±0.3	(Note 4) UL Style 2103 AWG20 2 cores
	MR-BKS1CBL☐M-A2-L	2 to 10							
	MR-BKS1CBL☐M-A1-H	2 to 10							
	MR-BKS1CBL☐M-A2-H	2 to 10							
	MR-BKS2CBL03M-A1-L	0.3							
	MR-BKS2CBL03M-A2-L	0.3							

Note 1. d is as shown below.



2. Purchased from Toa Electric Industry
3. Standard OD. Max. OD is about 10% greater.
4. Kurabe
5. Taiyo Electric Wire and Cable
6. These wire sizes assume that the UL-compliant wires are used at the wiring length of 10m.

13.10 No-fuse breakers, fuses, magnetic contactors

Always use one no-fuse breaker and one magnetic contactor with one servo amplifier. When using a fuse instead of the no-fuse breaker, use the one having the specifications given in this section.

Servo amplifier	No-fuse breaker		Fuse			Magnetic contactor
	Not using power factor improving reactor	Using power factor improving reactor	(Note) Class	Current [A]	Voltage AC [V]	
MR-J3-10T (1)	30A frame 5A	30A frame 5A	T	10	250	S-N10
MR-J3-20T	30A frame 5A	30A frame 5A		10		
MR-J3-20T1	30A frame 10A	30A frame 10A		15		
MR-J3-40T	30A frame 10A	30A frame 5A		15		
MR-J3-60T・70T・100T・40T1	30A frame 15A	30A frame 10A		20		
MR-J3-200T	30A frame 20A	30A frame 15A		40		S-N18
MR-J3-350T	30A frame 30A	30A frame 30A		70		S-N20
MR-J3-500T	50A frame 50A	50A frame 40A		125		S-N35
MR-J3-700T	100A frame 75A	50A frame 50A		150		S-N50
MR-J3-11KT	100A frame 100A	100A frame 75A		200		S-N65
MR-J3-15KT	225A frame 125A	100A frame 100A		250		S-N95
MR-J3-22KT	225A frame 175A	225A frame 150A		350		S-N125
MR-J3-60T4	30A frame 5A	30A frame 5A		10	600	S-N10
MR-J3-100T4	30A frame 10A	30A frame 10A		15		
MR-J3-200T4	30A frame 15A	30A frame 15A		25		
MR-J3-350T4	30A frame 20A	30A frame 20A		35		
MR-J3-500T4	30A frame 30A	30A frame 30A		50		S-N18
MR-J3-700T4	50A frame 40A	50A frame 30A		65		S-N20
MR-J3-11KT4	60A frame 60A	50A frame 50A		100		S-N25
MR-J3-15KT4	100A frame 75A	60A frame 60A		150		S-N35
MR-J3-22KT4	225A frame 125A	100A frame 100A		175		S-N65

Note. When not using the servo amplifier as a UL/C-UL Standard compliant product, K5 class fuse can be used.

13.11 Power factor improving DC reactor

POINT
・For the 100V power supply type (MR-J3-□T1), the power factor improving DC reactor cannot be used.

The power factor improving DC reactor increases the form factor of the servo amplifier's input current to improve the power factor. It can decrease the power supply capacity. As compared to the power factor improving AC reactor (FR-BAL), it can decrease the loss. The input power factor is improved to about 95%.
It is also effective to reduce the input side harmonics.
When connecting the power factor improving DC reactor to the servo amplifier, always disconnect P_1 and P_2 (For 11kW or more, disconnect P_1 and P). 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 10cm or more clearance at each of the top and bottom, and a 5cm or more clearance on each side.

[Unit: mm]

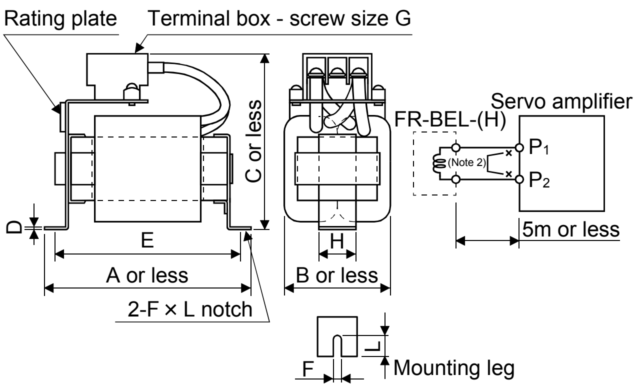


Fig. 13.1

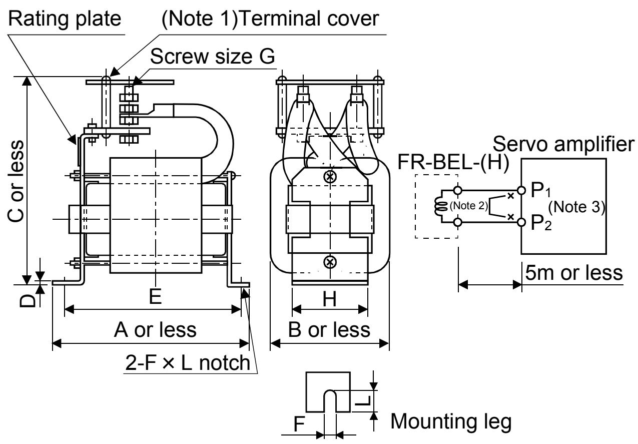


Fig. 13.2

Note 1. Since the terminal cover is supplied, attach it after connecting a wire.
2. When using DC reactor, disconnect P_1 and P_2.
3. When over 11kW, "P_2" becomes "P" respectively.

Servo amplifier	Power factor improving DC reactor	Outline drawing	Dimensions [mm]									Mounting screw size	Mass [kg(lb)]	Wire [mm²] (Note)
			A	B	C	D	E	F	L	G	H			
MR-J3-10T・20T	FR-BEL-0.4K	Fug. 13.1	110	50	94	1.6	95	6	12	M3.5	25	M5	0.5(1.10)	2(AWG14)
MR-J3-40T	FR-BEL-0.75K		120	53	102	1.6	105	6	12	M4	25	M5	0.7(1.54)	
MR-J3-60T・70T	FR-BEL-1.5K		130	65	110	1.6	115	6	12	M4	30	M5	1.1(2.43)	
MR-J3-100T	FR-BEL-2.2K		130	65	110	1.6	115	6	12	M4	30	M5	1.2(2.65)	
MR-J3-200T	FR-BEL-3.7K		150	75	102	2.0	135	6	12	M4	40	M5	1.7(3.75)	
MR-J3-350T	FR-BEL-7.5K		150	75	126	2.0	135	6	12	M5	40	M5	2.3(5.07)	3.5(AWG12)
MR-J3-500T	FR-BEL-11K		170	93	132	2.3	155	6	14	M5	50	M5	3.1(6.83)	5.5(AWG10)
MR-J3-700T	FR-BEL-15K	Fig. 13.2	170	93	170	2.3	155	6	14	M8	56	M5	3.8(8.38)	8(AWG8)
MR-J3-11KT														22(AWG4)
MR-J3-15KT	FR-BEL-22K		185	119	182	2.6	165	7	15	M8	70	M6	5.4(11.91)	30(AWG2)
MR-J3-22KT	FR-BEL-30K		185	119	201	2.6	165	7	15	M8	70	M6	6.7(14.77)	60(AWG2/0)
MR-J3-60T4	FR-BEL-H1.5K	Fig. 13.1	130	63	89	1.6	115	6	12	M3.5	32	M5	0.9(1.98)	2(AWG14)
MR-J3-100T4	FR-BEL-H2.2K		130	63	101	1.6	115	6	12	M3.5	32	M5	1.1(2.43)	
MR-J3-200T4	FR-BEL-H3.7K		150	75	102	2	135	6	12	M4	40	M5	1.7(3.75)	
MR-J3-350T4	FR-BEL-H7.5K		150	75	124	2	135	6	12	M4	40	M5	2.3(5.07)	
MR-J3-500T4	FR-BEL-H11K		170	93	132	2.3	155	6	14	M5	50	M5	3.1(6.83)	5.5(AWG10)
MR-J3-700T4	FR-BEL-H15K	Fig. 13.2	170	93	160	2.3	155	6	14	M6	56	M5	3.7(8.16)	8(AWG8)
MR-J3-11KT4														
MR-J3-15KT4	FR-BEL-H22K		185	119	171	2.6	165	7	15	M6	70	M6	5.0(11.02)	22(AWG4)
MR-J3-22KT4	FR-BEL-H30K		185	119	189	2.6	165	7	15	M6	70	M6	6.7(14.77)	

Note. Selection condition of wire size is as follows.

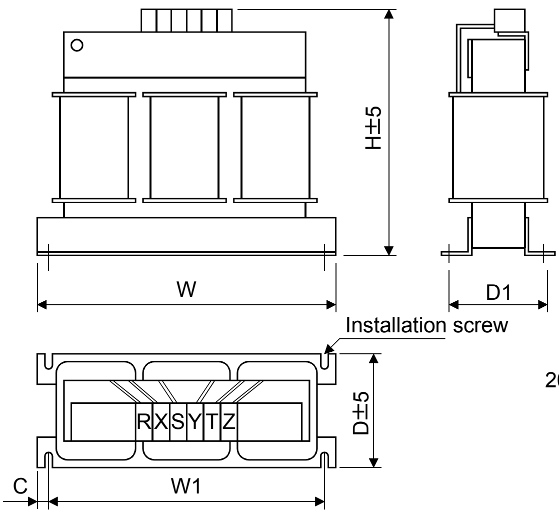
Wire type: 600V Polyvinyl chloride insulated wire (IV wire)

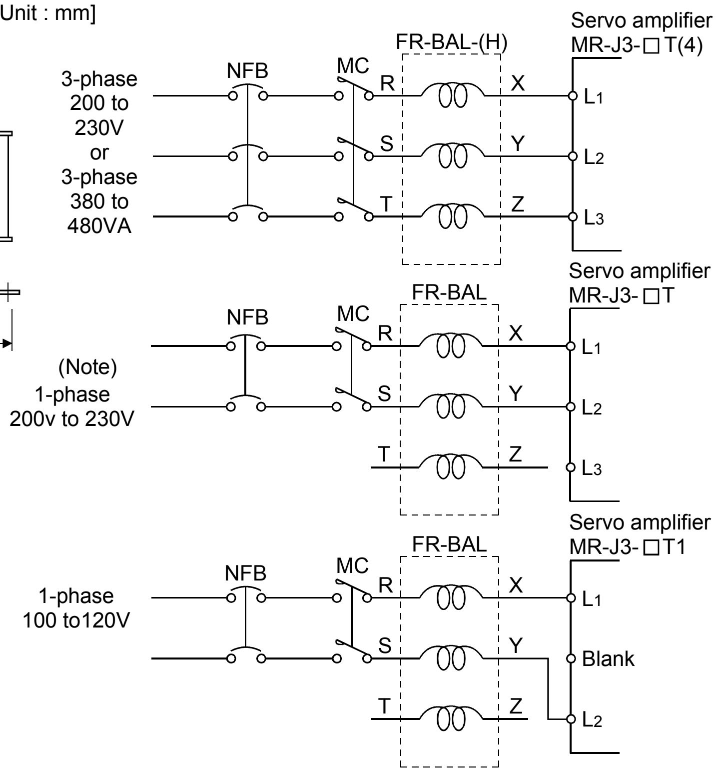
Construction condition: One wire is constructed in the air

13.12 Power factor improving reactors

The power factor improving reactors improve the phase factor by increasing the form factor of servo amplifier's input current.
It can reduce the power capacity.
The input power factor is improved to be about 90%. For use with a 1-phase power supply, it may be slightly lower than 90%.
In addition, it reduces the higher harmonic of input side.
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.

[Unit : mm]





Note. For the 1-phase 200V to 230V power supply, Connect the power supply to L_1, L_2 and leave L_3 open.

Servo amplifier	Model	Dimensions [mm]						Mounting screw size	Terminal screw size	Mass [kg (lb)]
		W	W1	H	D	D1	C			
MR-J3-10T・20T・10T1	FR-BAL-0.4K	135	120	115	59	$45^{0}_{-2.5}$	7.5	M4	M3.5	2.0 (4.41)
MR-J3-40T・20T1	FR-BAL-0.75K	135	120	115	69	$57^{0}_{-2.5}$	7.5	M4	M3.5	2.8 (6.17)
MR-J3-60T・70T・40T1	FR-BAL-1.5K	160	145	140	71	$55^{0}_{-2.5}$	7.5	M4	M3.5	3.7 (8.16)
MR-J3-100T	FR-BAL-2.2K	160	145	140	91	$75^{0}_{-2.5}$	7.5	M4	M3.5	5.6 (12.35)
MR-J3-200T	FR-BAL-3.7K	220	200	192	90	$70^{0}_{-2.5}$	10	M5	M4	8.5 (18.74)
MR-J3-350T	FR-BAL-7.5K	220	200	194	120	$100^{0}_{-2.5}$	10	M5	M5	14.5 (31.97)
MR-J3-500T	FR-BAL-11K	280	255	220	135	$100^{0}_{-2.5}$	12.5	M6	M6	19 (41.89)
MR-J3-700T MR-J3-11KT	FR-BAL-15K	295	270	275	133	$110^{0}_{-2.5}$	12.5	M6	M6	27 (59.53)
MR-J3-15KT	FR-BAL-22K	290	240	301	199	170±5	25	M8	M8	35 (77.16)
MR-J3-22KT	FR-BAL-30K	290	240	301	219	190±5	25	M8	M8	43 (94.80)
MR-J3-60T4	FR-BAL-H1.5K	160	145	140	87	$70^{0}_{-2.5}$	7.5	M4	M3.5	5.3 (11.68)
MR-J3-100T4	FR-BAL-H2.2K	160	145	140	91	$75^{0}_{-2.5}$	7.5	M4	M3.5	5.9 (13.01)
MR-J3-200T4	FR-BAL-H3.7K	220	200	190	90	$70^{0}_{-2.5}$	10	M5	M3.5	8.5 (18.74)
MR-J3-350T4	FR-BAL-H7.5K	220	200	192	120	100±5	10	M5	M4	14 (30.87)
MR-J3-500T4	FR-BAL-H11K	280	255	226	130	100±5	12.5	M6	M5	18.5 (40.79)
MR-J3-700T4 MR-J3-11KT4	FR-BAL-H15K	295	270	244	130	110±5	12.5	M6	M5	27 (59.53)
MR-J3-15KT4	FR-BAL-H22K	290	240	269	199	170±5	25	M8	M8	Approx.35 (Approx.77.16)
MR-J3-22KT4	FR-BAL-H30K	290	240	290	219	190±5	25	M8	M8	Approx.43 (Approx.94.80)

13.13 Relays (recommended)

The following relays should be used with the interfaces.

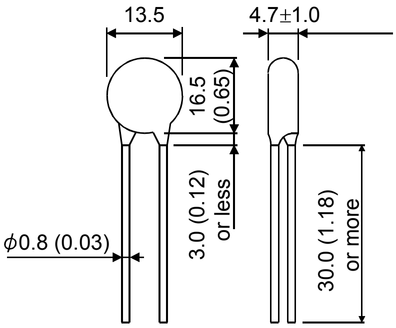
Interface	Selection example
Relay used for digital input command signals (interface DI-1)	To prevent defective contacts , use a relay for small signal (twin contacts). (Ex.) Omron : type G2A , MY
Relay used for digital output signals (interface DO-1)	Small relay with 12VDC or 24VDC of 40mA or less (Ex.) Omron : type MY

13.14 Surge absorbers (recommended)

A surge absorber is required for the electromagnetic brake. Use the following surge absorber or equivalent. When using the surge absorber, perform insulation beforehand to prevent short-circuit.

Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1mA
Permissible circuit voltage		Surge immunity	Energy immunity	Rated power				
AC [Vma]	DC [V]	[A]	[J]	[W]	[A]	[V]	[pF]	[V]
140	180	(Note) 500/time	5	0.4	25	360	300	220 (198 to 242)

Note. 1 time = 8 × 20μs



[Unit: mm]

(Example) ERZV10D221 (Matsushita Electric Industry)
TNR-10V221K (Nippon chemi-con)
Outline drawing [mm] (ERZ-C10DK221)

13.15 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 malfunction 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

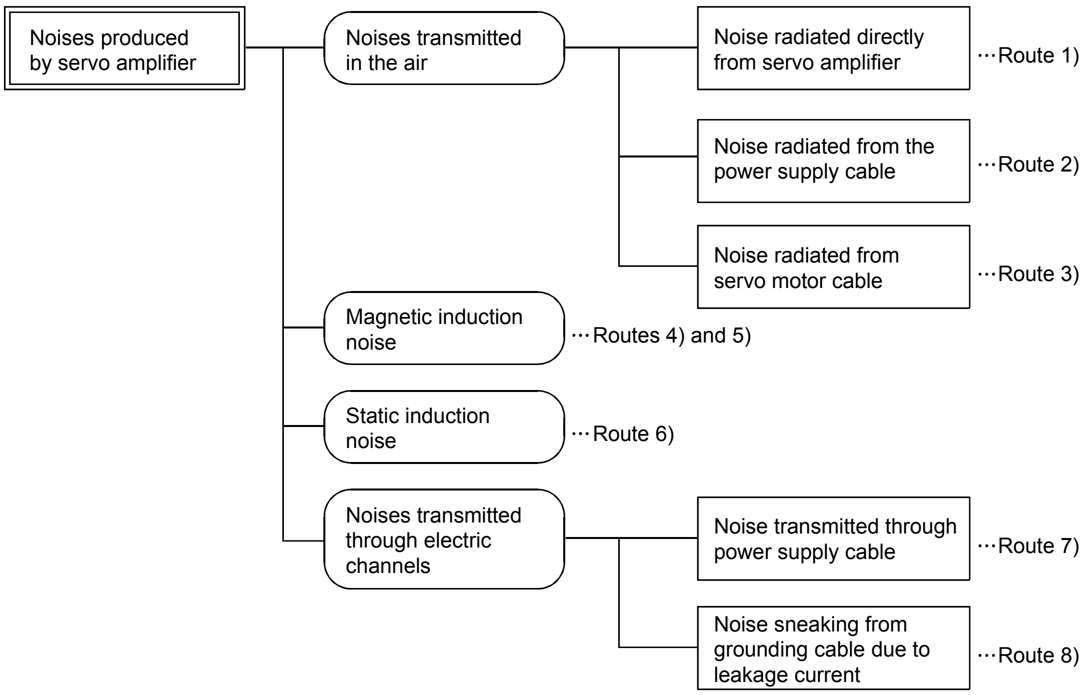
- Avoid laying power lines (input and output cables) and signal cables side by side or do not bundle them together. Separate power lines from signal cables.
- Use shielded, twisted pair cables for connection with the encoder and for control signal transmission, and connect the shield to the SD terminal.
- Ground the servo amplifier, servo motor, etc. together at one point (refer to section 3.12).

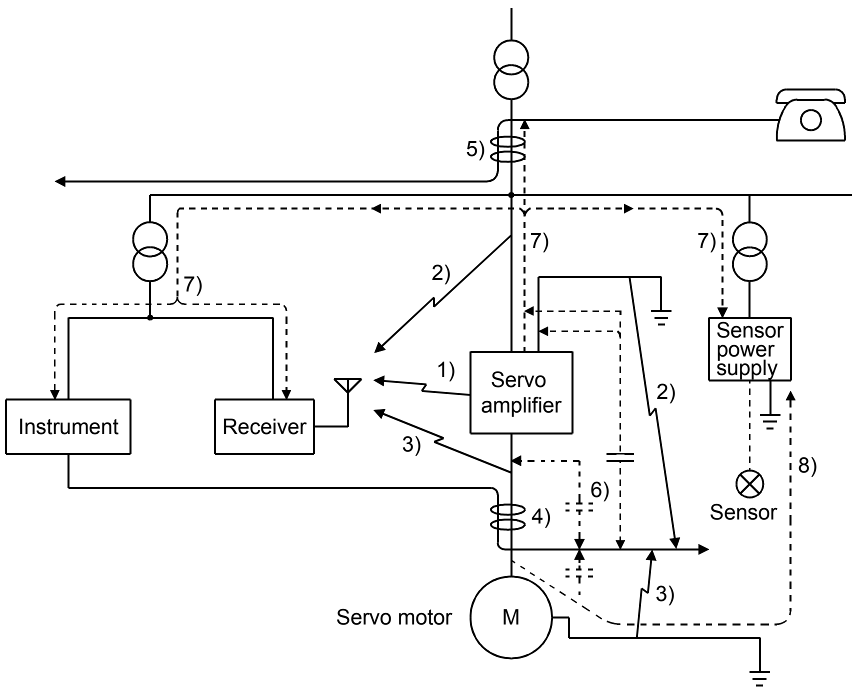
(b) Reduction techniques for external noises that cause the servo amplifier to malfunction

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
1) 2) 3)	When measuring instruments, receivers, sensors, etc. which handle weak signals and may malfunction due to noise and/or their signal cables are contained in a control box together with the servo amplifier or run near the servo amplifier, such devices may malfunction due to noises transmitted through the air. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the servo amplifier. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. 3. Avoid laying the power lines (Input cables of the servo amplifier) and signal cables 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 signal and power cables or put cables in separate metal conduits.
4) 5) 6)	When the power lines and the signal cables are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the servo amplifier. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. 3. Avoid laying the power lines (I/O cables of the servo amplifier) and signal cables side by side or bundling them together. 4. Use shielded wires for signal and power cables or put the cables in separate metal conduits.
7)	When the power supply of peripheral devices is connected to the power supply of the servo amplifier system, noises produced by the servo amplifier may be transmitted back through the power supply cable and the devices may malfunction. The following techniques are required. 1. Insert the radio noise filter (FR-BIF-(H)) on the power cables (Input cables) of the servo amplifier. 2. Insert the line noise filter (FR-BSF01・FR-BLF) on the power cables of the servo amplifier.
8)	When the cables of peripheral devices are connected to the servo amplifier to make a closed loop circuit, leakage current may flow to malfunction the peripheral devices. If so, malfunction may be prevented by disconnecting the grounding cable of the peripheral device.

(2) Noise reduction products

(a) Data line filter (Recommended)

Noise can be prevented by installing a data line filter onto the encoder cable, etc.

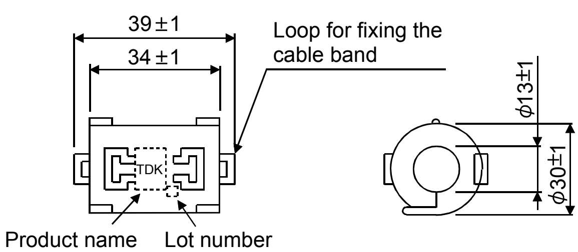
For example, the ZCAT3035-1330 of TDK and the ESD-SR-25 of NEC TOKIN make are available as data line filters.

As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below.

This impedances are reference values and not guaranteed values.

Impedance[Ω]	
10 to 100MHz	100 to 500MHz
80	150

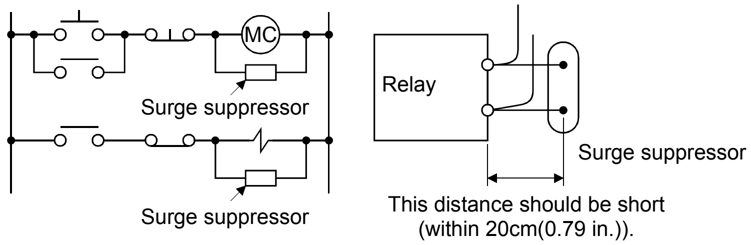
[Unit: mm]



Outline drawing (ZCAT3035-1330)

(b) Surge suppressor

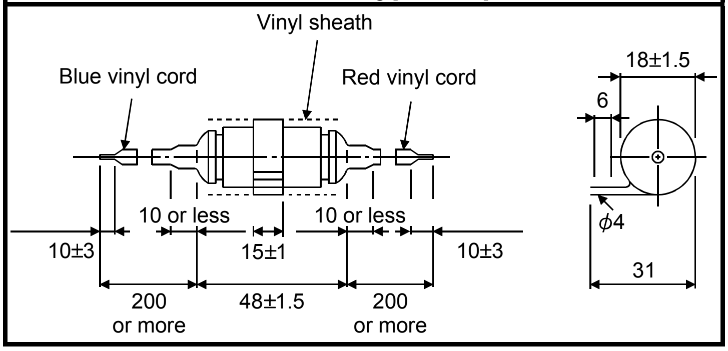
The recommended surge suppressor for installation to an AC relay, AC valve, AC electromagnetic brake or the like near the servo amplifier is shown below. Use this product or equivalent.



(Ex.) 972A.2003 50411
(Matsuo Electric Co.,Ltd.—200VAC rating)

Rated voltage AC[V]	C [μF]	R [Ω]	Test voltage AC[V]
200	0.5	50 (1W)	Across T-C 1000(1 to 5s)

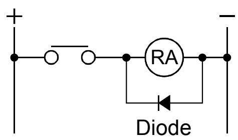
Outline drawing [Unit: mm]



Note that a diode should be installed to a DC relay, DC valve or the like.

Maximum voltage: Not less than 4 times the drive voltage of the relay or the like

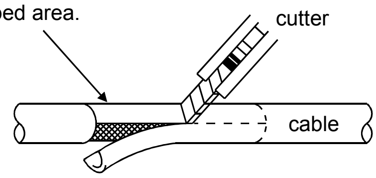
Maximum current: Not less than twice the drive current of the relay or the like

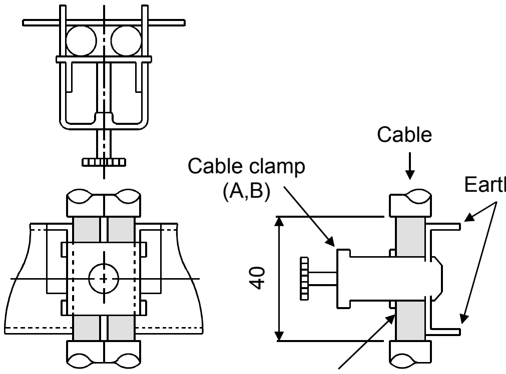


(c) Cable clamp fitting AERSBAN-□SET

Generally, the earth of the shielded cable may only be connected to the connector's SD terminal. However, the effect can be increased by directly connecting the cable to an earth plate as shown below. Install the earth 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 earth plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The clamp comes as a set with the earth plate.



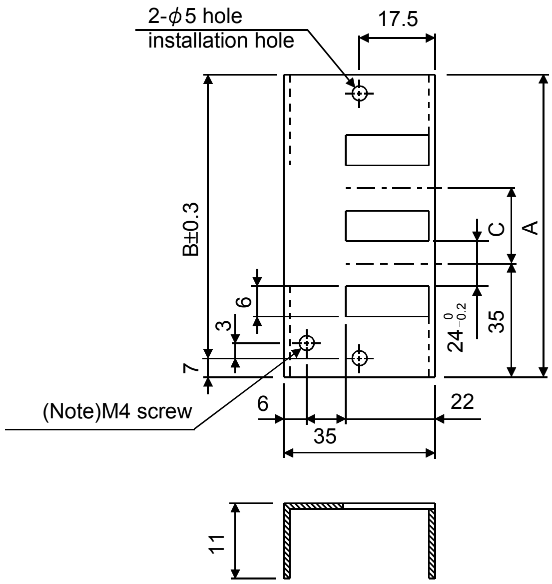


Clamp section diagram

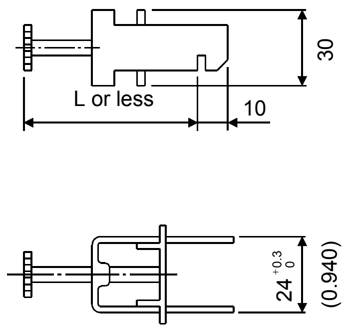
・Outline drawing

[Unit: mm]

Earth plate



Clamp section diagram



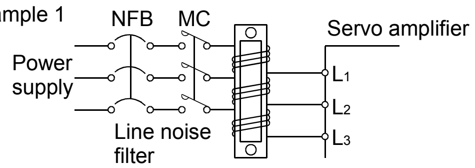
Note. Screw hole for grounding. Connect it to the earth plate of the control box.

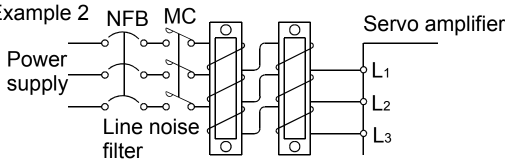
Type	A	B	C	Accessory fittings
AERSBAN-DSET	100	86	30	clamp A: 2pcs.
AERSBAN-ESET	70	56		clamp B: 1pc.

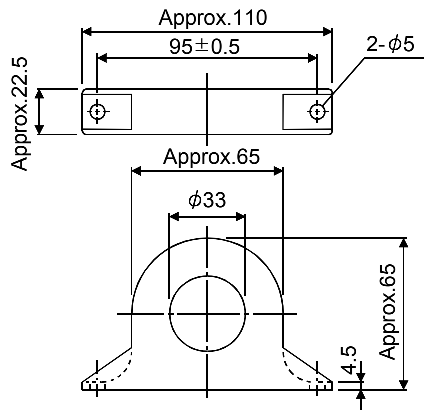
Clamp fitting	L
A	70
B	45

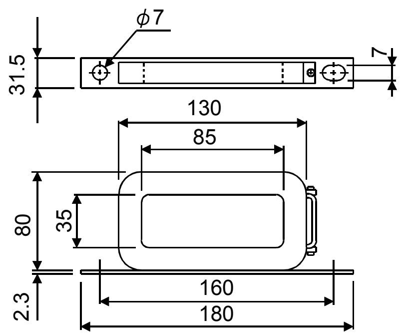
(d) Line noise filter (FR-BSF01, FR-BLF)

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 (zero-phase current) especially within 0.5MHz to 5MHz band.

<table>
<tr><th>Connection diagram</th><th>Outline drawing [Unit: mm]</th></tr>
<tr><td rowspan="2">
Use the line noise filters for wires of the main power supply (L_1 ・ L_2 ・ L_3) and of the motor power supply (U ・ V ・ W). Pass each of the 3-phase wires through the line noise filter an equal number of times in the same direction. For 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 motor power supply, passes must be four times or less. Do not pass the grounding (earth) wire through the filter, or the effect of the filter will drop. Wind the wires by passing through the filter to satisfy the required number of passes as shown in Example 1. If the wires are too thick to wind, use two or more filters to have the required number of passes as shown in Example 2. Place the line noise filters as close to the servo amplifier as possible for their best performance.
Example 1


(Number of turns: 4)
Example 2


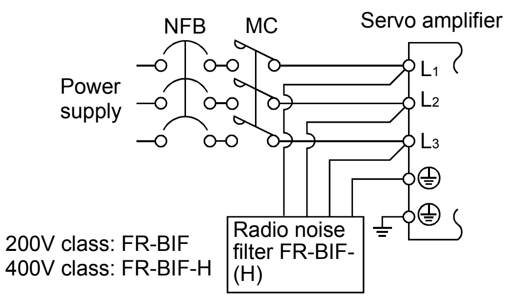
Two filters are used
(Total number of turns: 4)
</td>
<td>
FR-BSF01 (for wire size 3.5mm^2 (AWG12) or less)


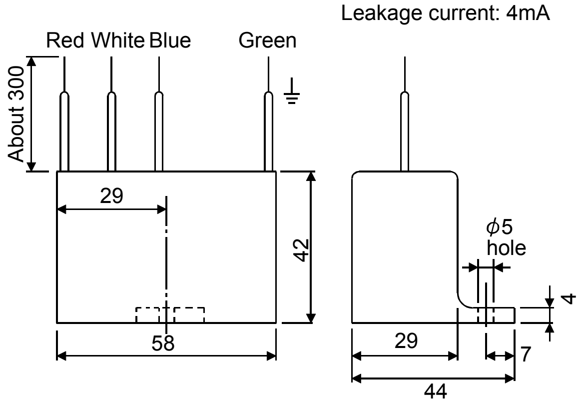
</td></tr>
<tr><td>
FR-BLF (for wire size 5.5mm^2 (AWG10) or more)


</td></tr>
</table>

(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 10MHz and lower radio frequency bands. The FR-BIF-(H) is designed for the input only.

<table>
<tr><th>Connection diagram</th><th>Outline drawing (Unit: mm)</th></tr>
<tr><td>
Make the connection cables as short as possible.
Grounding is always required.
When using the FR-BIF with a single-phase power supply, always insulate the wires that are not used for wiring.


</td>
<td>
Leakage current: 4mA


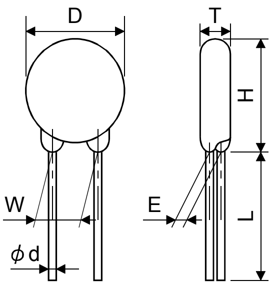
</td></tr>
</table>

(f) Varistors 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 supply voltage	Varistor	Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1mA
		Permissible circuit voltage		Surge current immunity	Energy immunity	Rated pulse power				
		AC[V_{rms}]	DC[V]	8/20μs[A]	2ms[J]	[W]	[A]	[V]	[pF]	[V]
100V class	TND20V-431K	275	350	10000/1 time	195	1.0	100	710	1300	430(387 to 473)
200V class	TND20V-471K	300	385	7000/2 time	215			775	1200	470(423 to 517)
400V class	TND20V-102K	625	825	7500/1 time 6500/2 time	400			1650	500	1000(900 to 1100)

[Unit: mm]



Model	D Max.	H Max.	T Max.	E ±1.0	(Note)L min.	ϕd ±0.05	W ±1.0
TND20V-431K	21.5	24.5	6.4	3.3	20	0.8	10.0
TND20V-471K			6.6	3.5			
TND20V-102K	22.5	25.5	9.5	6.4			

Note. For special purpose items for lead length (L), contact the manufacturer.

13.16 Leakage current breaker

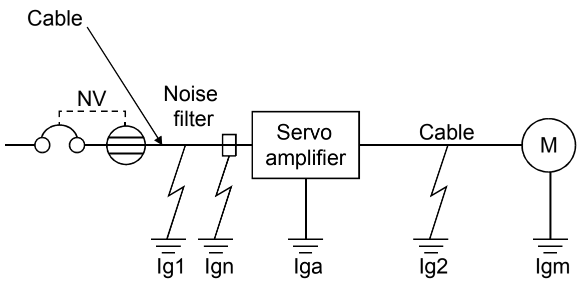
(1) Selection method

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 a leakage current breaker according to the following formula, and ground the servo amplifier, servo motor, etc. securely.

Make the input and output cables as short as possible, and also make the grounding cable as long as possible (about 30cm) to minimize leakage currents.

Rated sensitivity current $\geq 10 \cdot \{Ig1+Ign+Iga+K \cdot (Ig2+Igm)\}$ [mA]   (13.1)



K: Constant considering the harmonic contents

Leakage current breaker		K
Type	Mitsubishi products	
Models provided with harmonic and surge reduction techniques	NV-SP NV-SW NV-CP NV-CW NV-L	1
General models	BV-C1 NFB NV-L	3

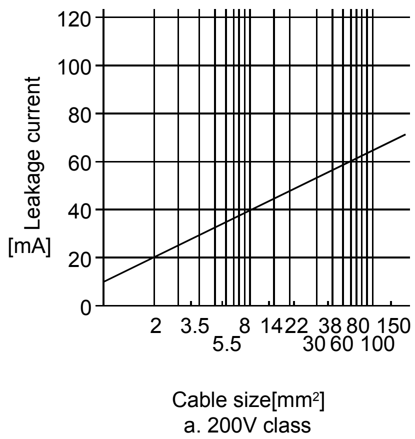
Ig1: Leakage current on the electric channel from the leakage current breaker to the input terminals of the servo amplifier (Found from Fig. 13.4.)

Ig2: Leakage current on the electric channel from the output terminals of the servo amplifier to the servo motor (Found from Fig. 13.4.)

Ign: Leakage current when a filter is connected to the input side (4.4mA per one FR-BIF-(H))

Iga: Leakage current of the servo amplifier (Found from Table 13.5.)

Igm: Leakage current of the servo motor (Found from Table 13.4.)



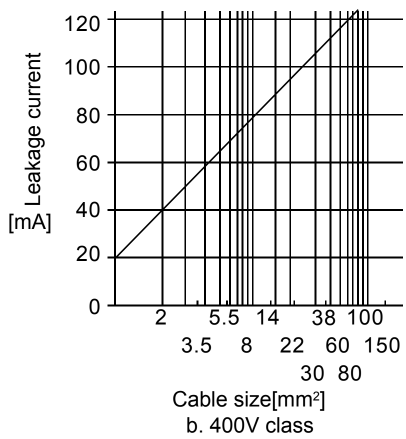


Fig. 13.3 Leakage current example (Ig1, Ig2) for CV cable run in metal conduit

Table 13.4 Servo motor's leakage current example (Igm)

Servo motor output [kW]	Leakage current [mA]
0.05 to 1	0.1
2	0.2
3.5	0.3
5	0.5
7	0.7
11	1.0
15	1.3
22	2.3

Table 13.5 Servo amplifier's leakage current example (Iga)

Servo amplifier capacity [kW]	Leakage current [mA]
0.1 to 0.6	0.1
0.75 to 3.5 (Note)	0.15
5・7	2
11・15	5.5
22	7

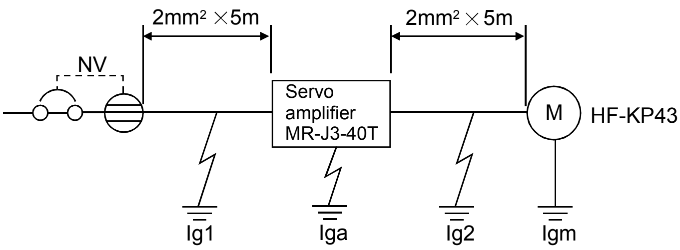
Note. For the 3.5kW of 400V class, leakage current is 2mA, which is the same as for 5kW and 7kW.

Table 13.6 Leakage circuit breaker selection example

Servo amplifier	Rated sensitivity current of leakage circuit breaker [mA]
MR-J3-10T to MR-J3-350T MR-J3-10T1 to MR-J3-40T1 MR-J3-60T4 to MR-J3-350T4	15
MR-J3-500T(4)	30
MR-J3-700T(4)	50
MR-J3-11KT(4) to MR-J3-22KT(4)	100

(2) Selection example

Indicated below is an example of selecting a leakage current breaker under the following conditions.



Use a leakage current breaker generally available.

Find the terms of Equation (13.1) 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 (13.1).

$$Ig \geq 10 \cdot \{0.1+0+0.1+1 \cdot (0.1+0.1)\}$$

$$\geq 4.0 \text{ [mA]}$$

According to the result of calculation, use a leakage current breaker having the rated sensitivity current (Ig) of 4.0[mA] or more. A leakage current breaker having Ig of 15[mA] is used with the NV-SP/SW/CP/CW/HW series.

13.17 EMC filter (recommended)

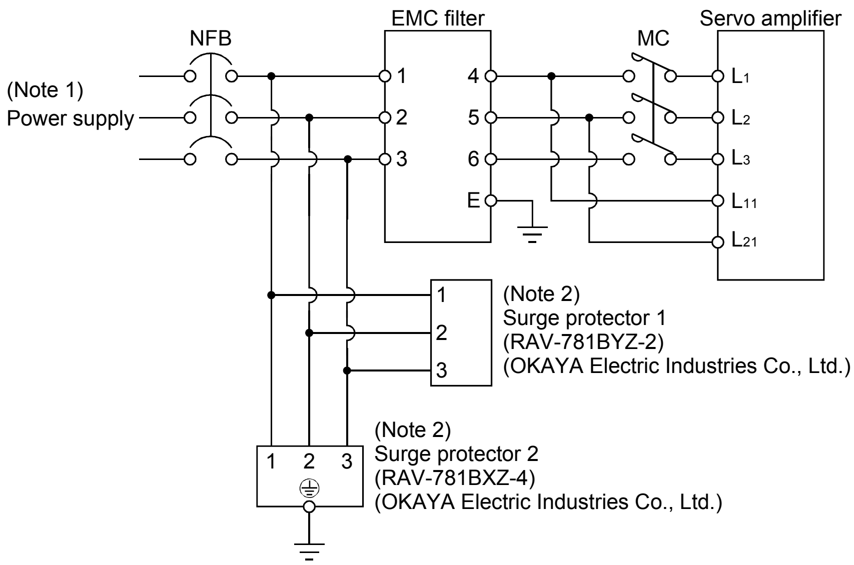
For compliance with the EMC directive of the EN Standard, it is recommended to use the following filter. Some EMC filters are large in leakage current.

(1) Combination with the servo amplifier

Servo amplifier	Recommended filter (Soshin Electric)		Mass [kg]([lb])
	Model	Leakage current [mA]	
MR-J3-10T to MR-J3-100T MR-J3-10T1 to MR-J3-40T1	(Note) HF3010A-UN	5	3 (6.61)
MR-J3-250T・MR-J3-350T	(Note) HF3030A-UN		5.5 (12.13)
MR-J3-500T・MR-J3-700T	(Note) HF3040A-UN	1.5	6.0 (13.23)
MR-J3-11KT to MR-J3-22KT	(Note) HF3100A-UN	6.5	15 (33.07)
MR-J3-60T4 to MR-J3-100T4	TF3005C-TX	5.5	6(13.23)
MR-J3-200T4 to MR-J3-700T4	TF3020C-TX		
MR-J3-11KT4	TF3030C-TX		7.5(16.54)
MR-J3-15KT4	TF3040C-TX		12.5(27.56)
MR-J3-22KT4	TF3060C-TX		

Note. A surge protector is separately required to use any of these EMC filters.

(2) Connection example



Note 1. For 1-phase 200V to 230VAC power supply, connect the power supply to L_1,L_2 and leave L_3 open. There is no L_3 for 1-phase 100 to 120VAC power supply. Refer to section 1.2 for the power supply specification.

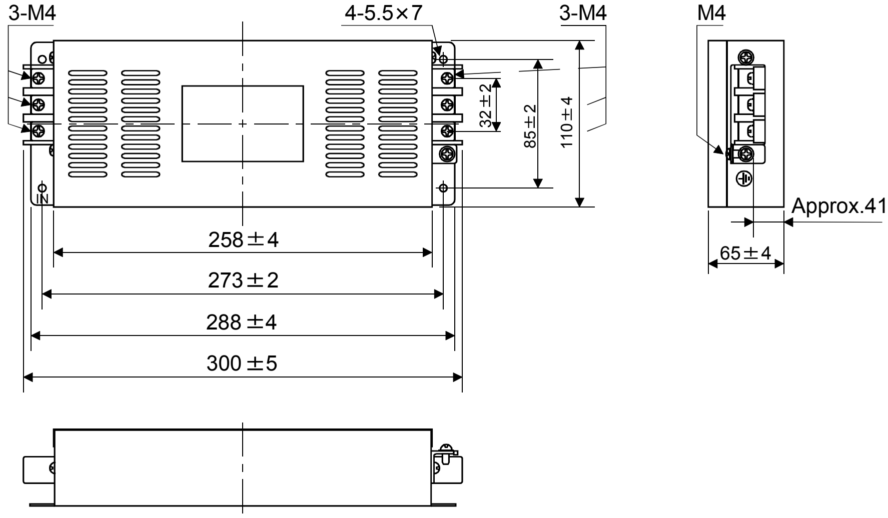
2. The example is when a surge protector is connected.

(3) Outline drawing

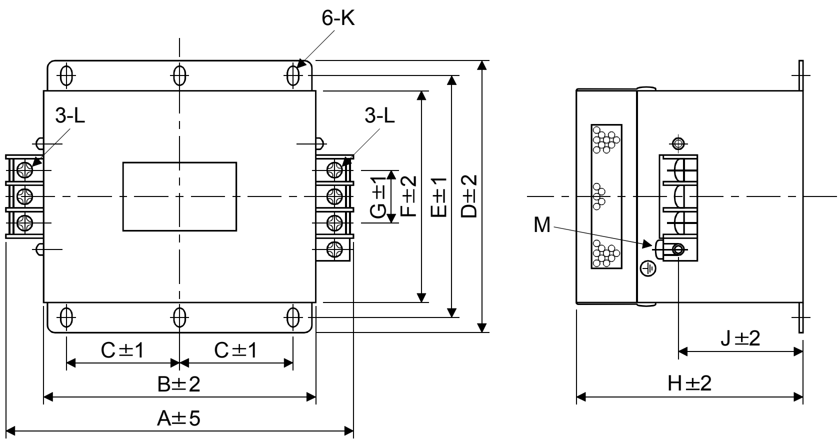
(a) EMC filter

HF3010A-UN

[Unit: mm]

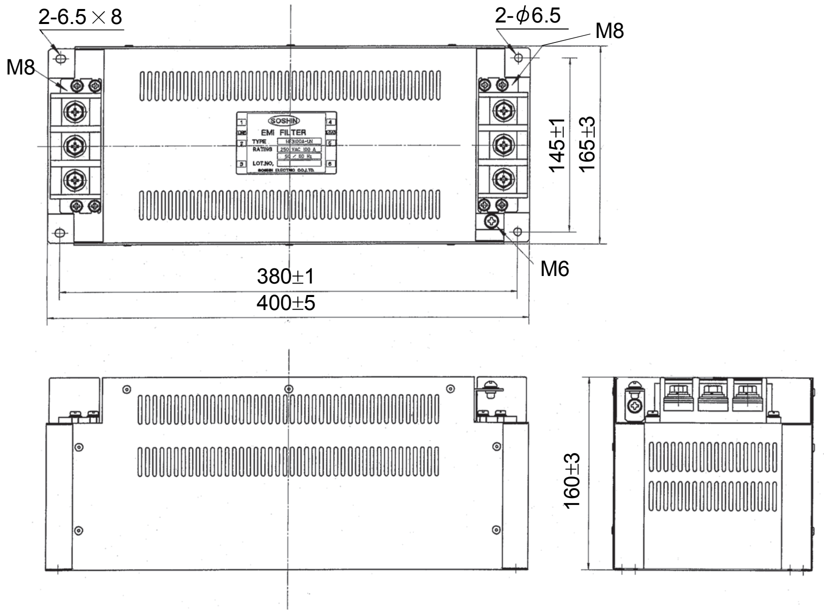


HF3030A-UN・HF-3040A-UN



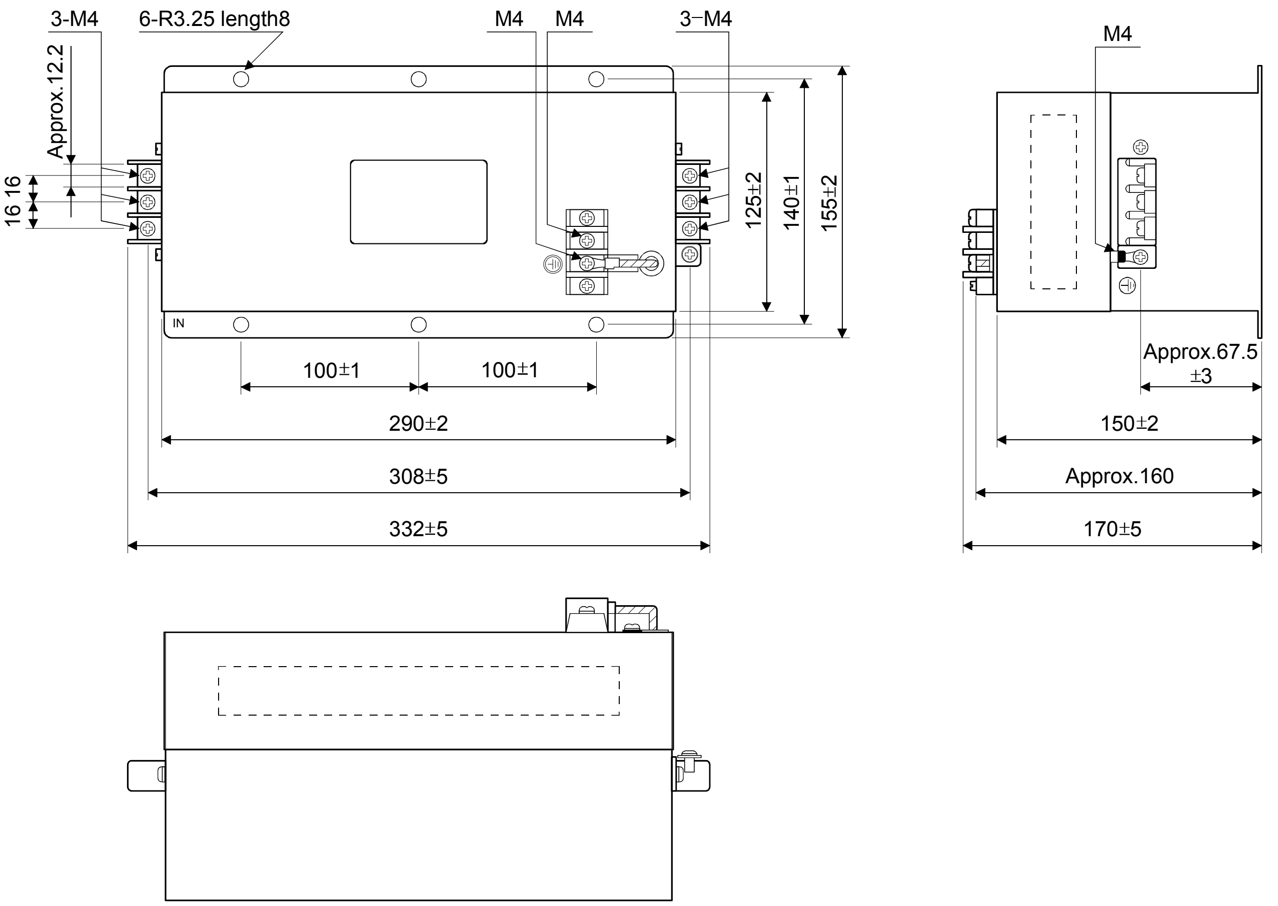
Model	Dimensions [mm]											
	A	B	C	D	E	F	G	H	J	K	L	M
HF3030A-UN	260	210	85	155	140	125	44	140	70	R3.25, length 8	M5	M4
HF3040A-UN	260	210	85	155	140	125	44	140	70		M5	M4

HF3100A-UN



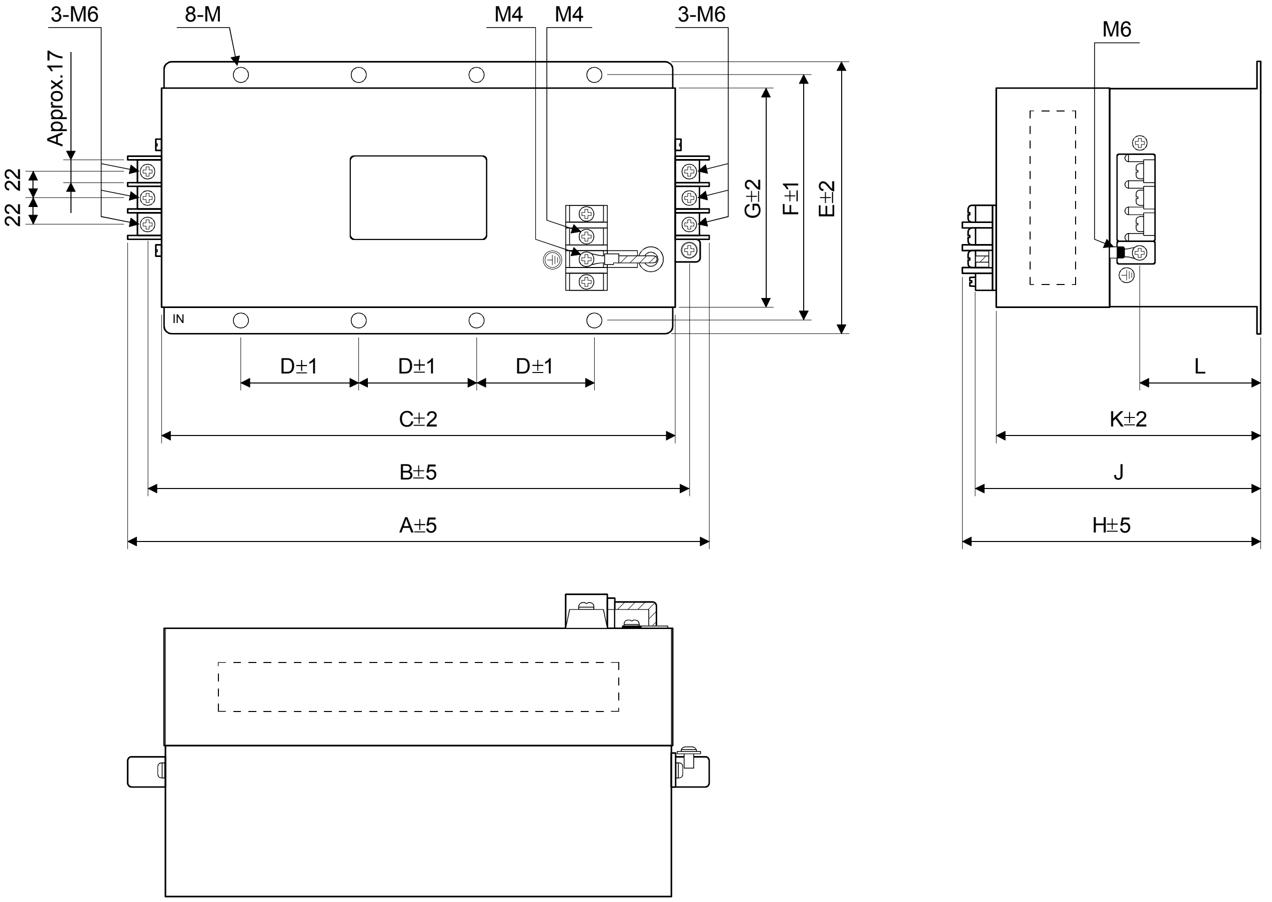
TF3005C-TX・TX3020C-TX・TF3030C-TX

[Unit: mm]



TF3040C-TX・TF3060C-TX

[Unit: mm]

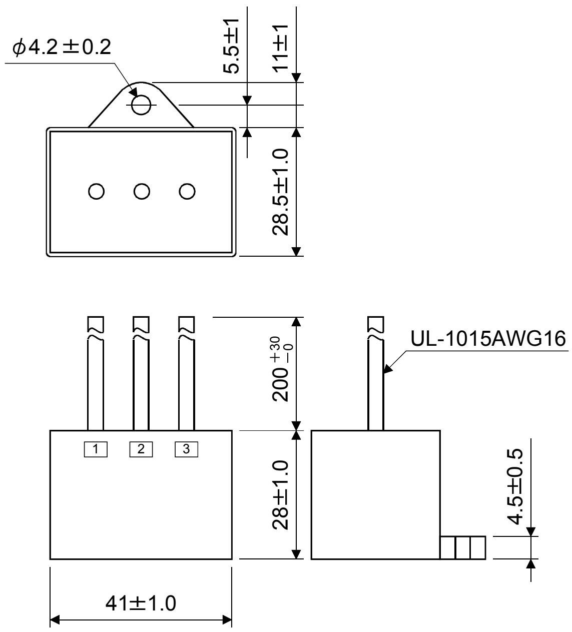


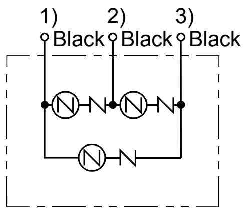
Model	Dimensions [mm]											
	A	B	C	D	E	F	G	H	J	K	L	M
TF3040C-TX TF3060C-TX	438	412	390	100	175	160	145	200	Approx.190	180	Approx.91.5	R3.25 length 8 (M6)

(b) Surge protector

RAV-781BYZ-2

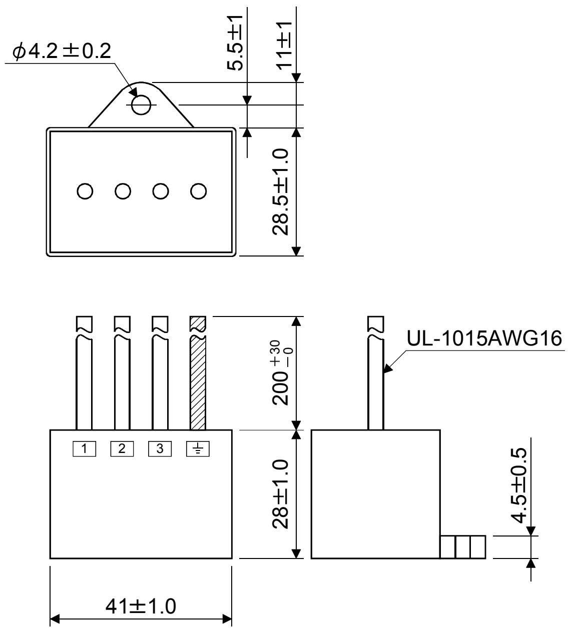
[Unit: mm]

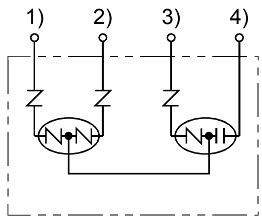




RAV-781BXZ-4

[Unit: mm]





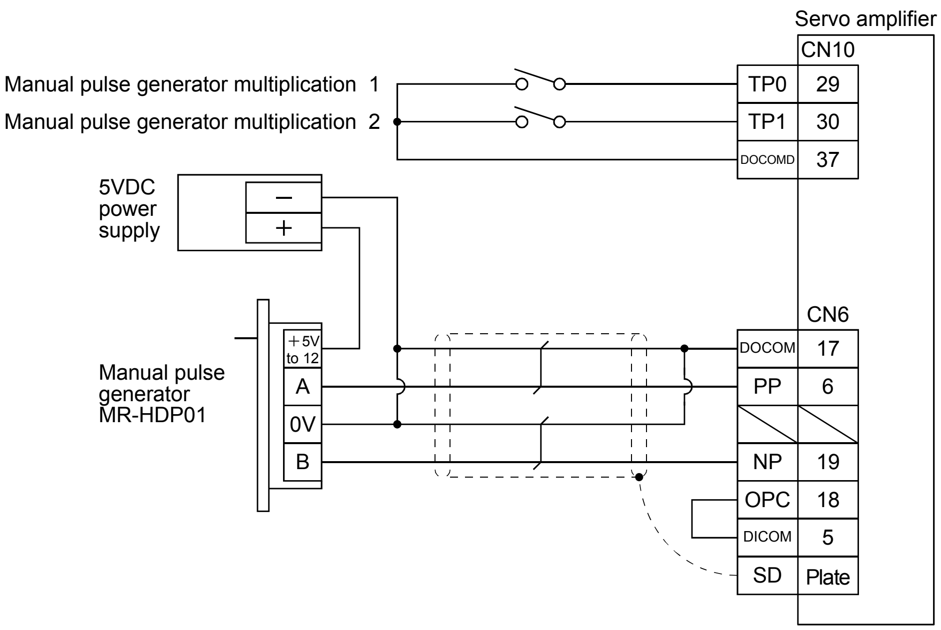
13.18 MR-HDP01 manual pulse generator

Use the MR-HDP01 manual pulse generator to rotate the servo motor. The travel of the servo motor to the pulse signal generated by MR-HDP01 with an external input signal can be changed with the manual pulse generator multiplication 1 (TP0) and 2 (TP1).

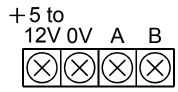
(1) Specifications

Item		Specifications
Power supply	Voltage	4.5 to 13.2VDC
	Current consumption	60mA or less
interface		Output current max. 20mA for open collector output
Pulse signal form		A-phase, B-phase, 2 signals of 90° phase difference
Pulse resolution		100pulse/rev
Max. speed		Max. 600r/min instaneously, 200r/min normally
Operating temperature range		−10℃ to +60℃ (14 to 140°F)
Storage temperature range		−30℃ to + 80℃ (−22 to 176°F)

(2) Connection example

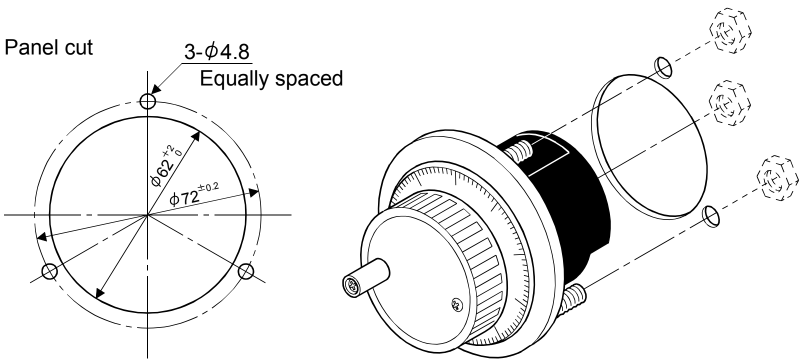


(3) Terminal layout

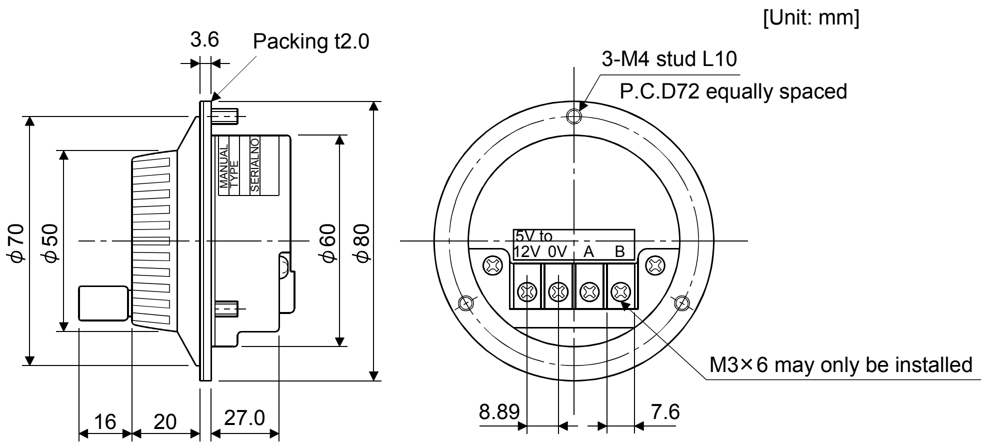


Signal	Description
+5 to 12V	Power input
0V	Common for power and signal
A	A-phase pulse output
B	B-phase pulse output

(4) Installation



(5) Outline drawing



13.19 MR-DS60 6-digit digital switch

Using the MR-DS60 6-digit digital switch can send the position data in the BCD signal. For the connection of MR-DS60 and MR-J3-D01, refer to section 3.2.2.

(1) Parameter setting

When using MR-DS60, set the parameter as shown below.

Parameter No. Po10

2		0	2

- Last digit (2): Positioning operation by BCD input.
- Third digit from right: Symbol (+/−) of the positioning data in the BCD positioning
  - 0: Invalid
    +/− symbol is not used
  - 1: Valid
    +/− symbols is used
- First digit (2): Strobe signal invalid

(2) Specifications of MR-DS60

Item	Specifications
Type	MR-DS60A
Number of digits	Signal 6-digit BCD
Electrical characteristic	28VDC (0.5A)
Dielectric withstand voltage	500Vr.m.s
Contact resistance	100mΩ or less
Life	1,000,000 times
Operating temperature range	0℃ to 60℃ (32 to 140°F)
Storage temperature range	−5℃ to 70℃ (23 to 158°F)

(3) Digital switch cable

Connect MR-DS60 to MR-J3-D01 with the digital switch cable indicated below.

Cable Model	Cable Length					Application
	25cm	1m	3m	5m	10m	
MS-DSCBL□M-G			3	5	10	For between MR-DS60 and MR-J3B-D01
MR-DSCBL□	25	100				For between MR-DS60s

(4) Terminal layout

CON1,CON2

10B			10A
	DO04	DO05	
	DI03	DI02	
	DI01	DI00	
	DI07	DI06	
	DI05	DI04	
	DI11	DI10	
	DI09	DI08	
1B	DI13	DI12	1A

Signal	Pin No.	Description
DO04	9A	Common output 1, sign, ×1000, ×10000, ×100000 side common output
DO05	9B	Common output 2, ×1, ×10, ×100 side common output
DI00	6A	×1, ×1000 bit 0
DI01	6B	×1, ×1000 bit 1
DI02	7A	×1, ×1000 bit 2
DI03	7B	×1, ×1000 bit 3
DI04	4A	×10, ×10000 bit 0
DI05	4B	×10, ×10000 bit 1
DI06	5A	×10, ×10000 bit 2
DI07	5B	×10, ×10000 bit 3
DI08	2A	×100, ×100000 bit 0
DI09	2B	×100, ×100000 bit 1
DI10	3A	×100, ×100000 bit 2
DI11	3B	×100, ×100000 bit 3
DI12	1A	Sign bit 0
DI13	1B	Sign bit 1

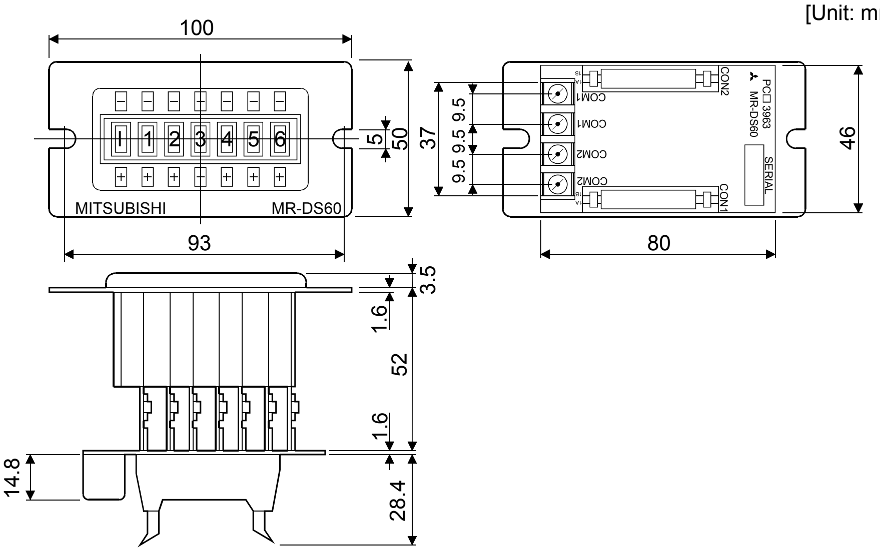
TB

DCM2
COM2
DCM1
COM1

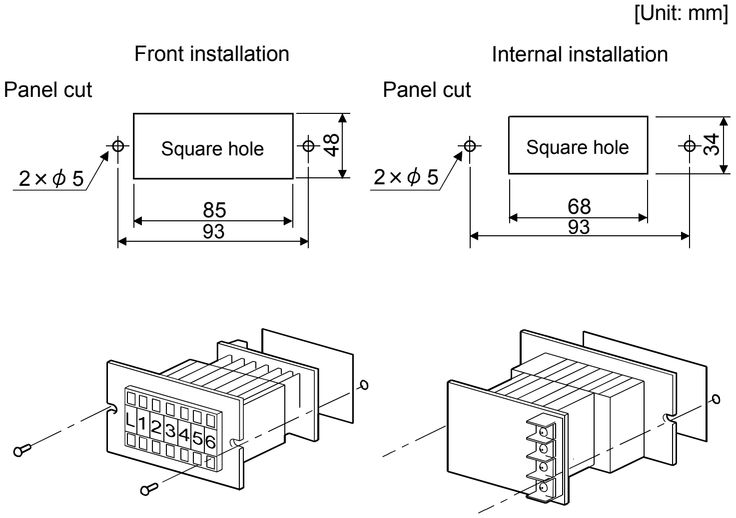
Signal	Description
DCM2	Common input 2. Connect with COM2 when selecting a block.
COM2	Common output 2. Common 2 used for switch selection when two or more digital switches are used.
DCM1	Common input 1. Connect with COM1 selecting a block.
COM1	Common output 1. Common 1 used for switch selection when two or more digital switches are used.

(5) Outline drawing

[Unit: mm]



(6) Installation

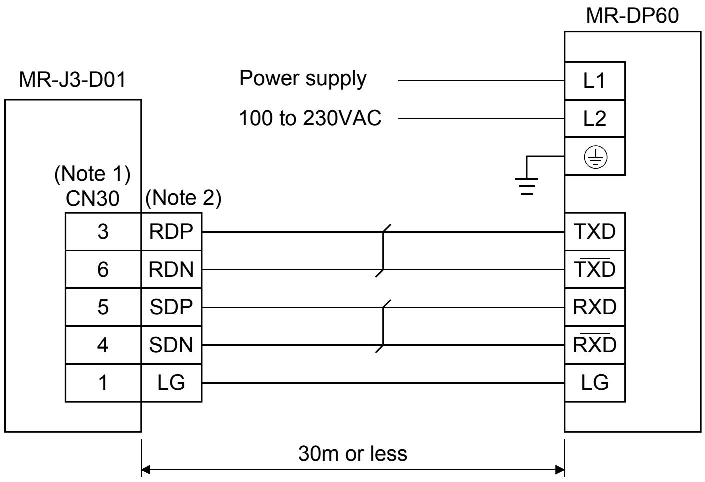


13.20 External digital display (MR-DP60)

(1) Specifications

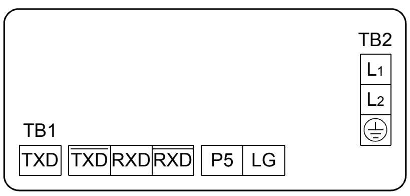
Item		Specifications
Display		Red seven-segment LED, signed, six digits
Power supply	Permissible voltage fluctuation	Single-phase, 85 to 253VAC, 50/60Hz
	Current consumption	Within 200mA
Communication	Interface	Conforms to RS-422A.
	Baud rate	4800bps, asynchronous
	Bit length	Start bit=1, date bit=8, parity bit=1, stop bit=1
	Protocol	MELSERVO protocol
	Communication commands	Commands dedicated to MELSERVO
Operating temperature / humidity range		0℃to＋60℃ (32 to 140°F), 90%RH or less, non-condensing
Storage temperature range		−5℃ to＋70℃ (23 to 158°F)

(2) Connection example



Note 1. CN30 is a connector designed exclusively for MR-DP60.
2. Recommended connector (HIROSE)
Plug: TM10P-88P
Connection tool: CL250-0228-1

(3) Terminal arrangement

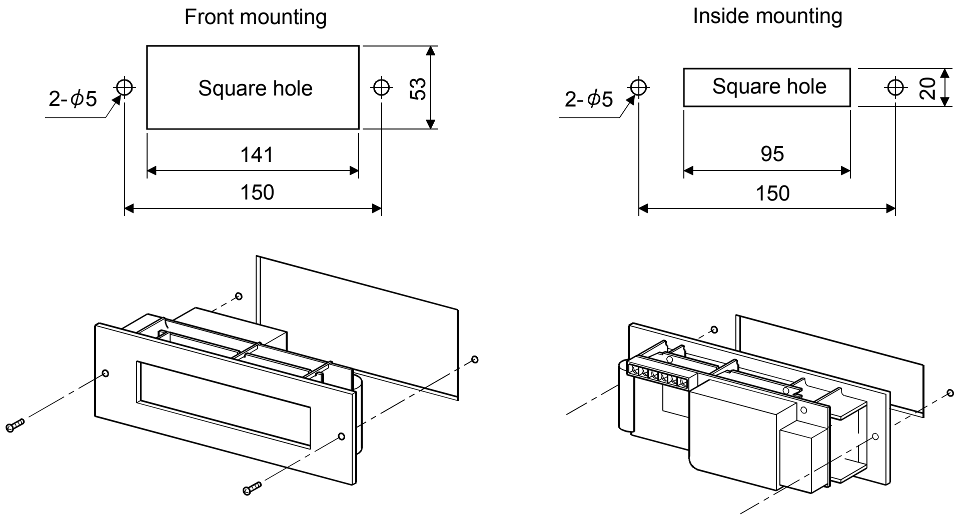


Signal	Description
L1	100 to 230VAC power input
L2	
⏚	Ground
RXD	Receive signal input
$\overline{RXD}$	Inverse receive signal input
$\overline{TXD}$	Inverse transmission signal output
TXD	Transmission signal output
P5	5VDC output (Note)
LG	Control common

Note. Do not use this terminal.

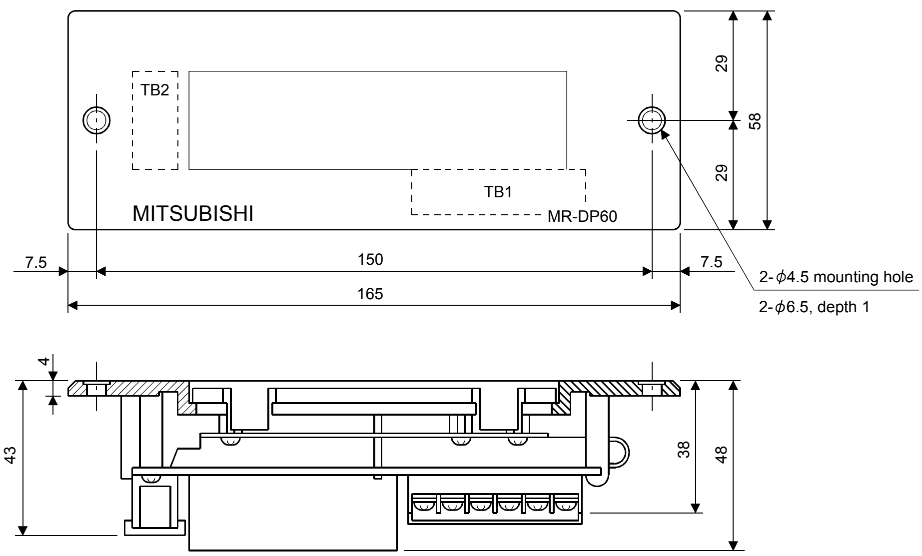
(4) Mounting

[Unit: mm]



(5) Outline dimension drawing

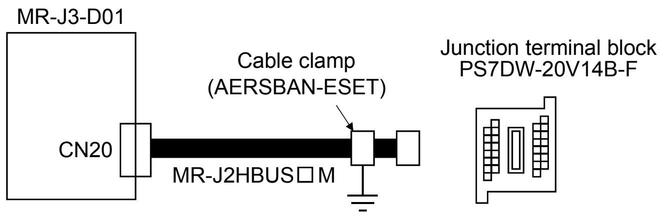
[Unit: mm]



13.21 Junction terminal block PS7DW-20V14B-F (recommended)

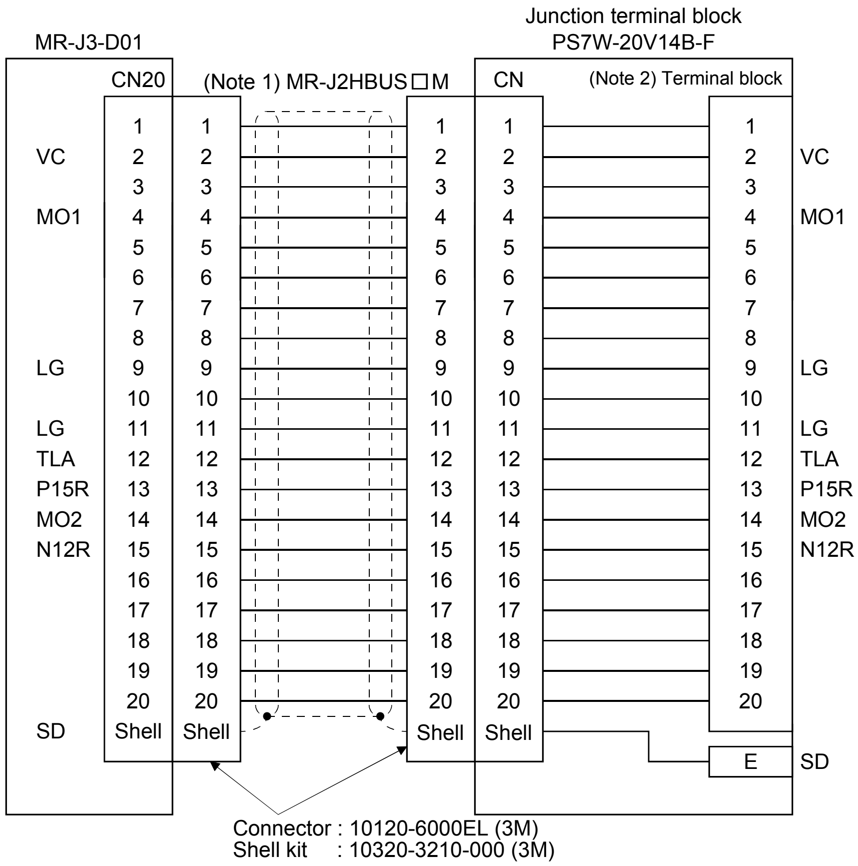
(1) How to use the junction terminal block

Always use the junction terminal block (PS7DW-20V14B-F(YOSHIDA)) 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 the cable clamp fitting (AERSBAN-ESET). For the use of the cable clamp fitting, refer to section 13.15 (2)(c).

(2) Connection of MR-J2HBUS □ M cable and junction terminal block



Note 1. Symbol indicating cable length is put in □.

05: 0.5m

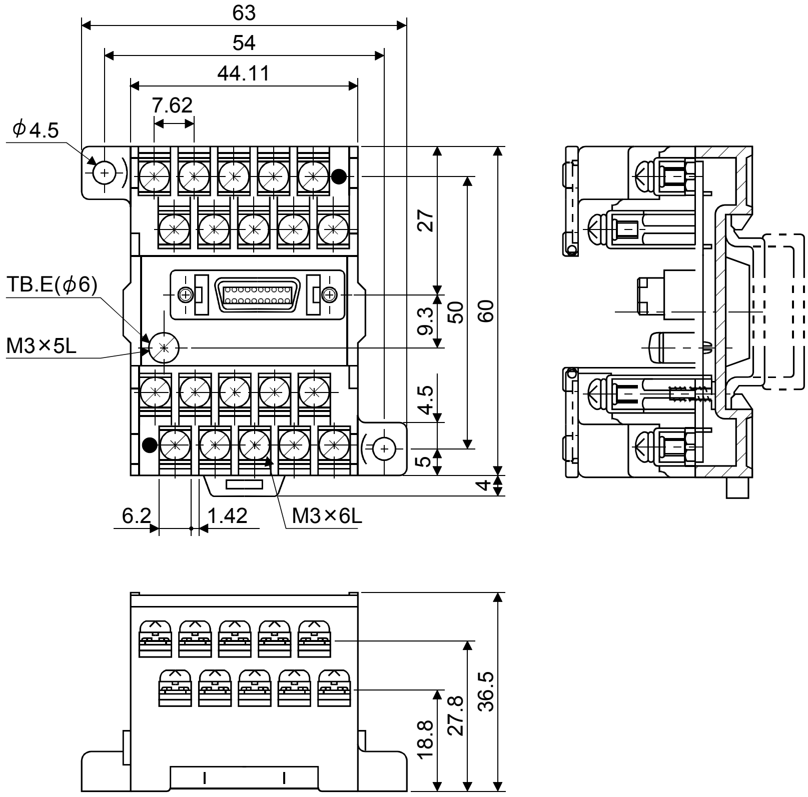
1: 1m

5: 5m

2. Keep open the terminals to which no signal is assigned.

(3) Outline drawings of junction terminal block

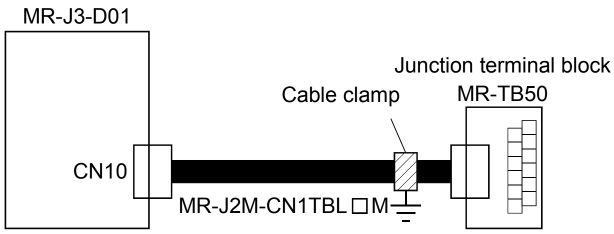
[Unit: mm]



13.22 Junction terminal block MR-TB50

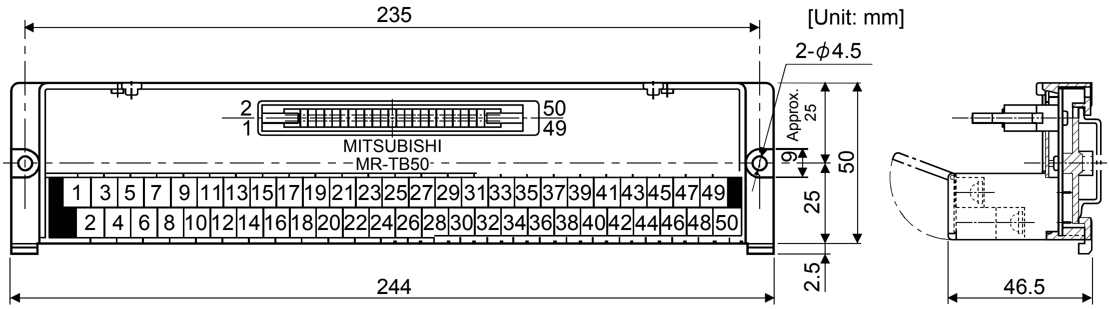
(1) How to use the junction terminal block

Always use the junction terminal block (MR-TB50) with the junction terminal block cable (MR-J2M-CN1TBL □ M) as a set. A connection example is shown below.



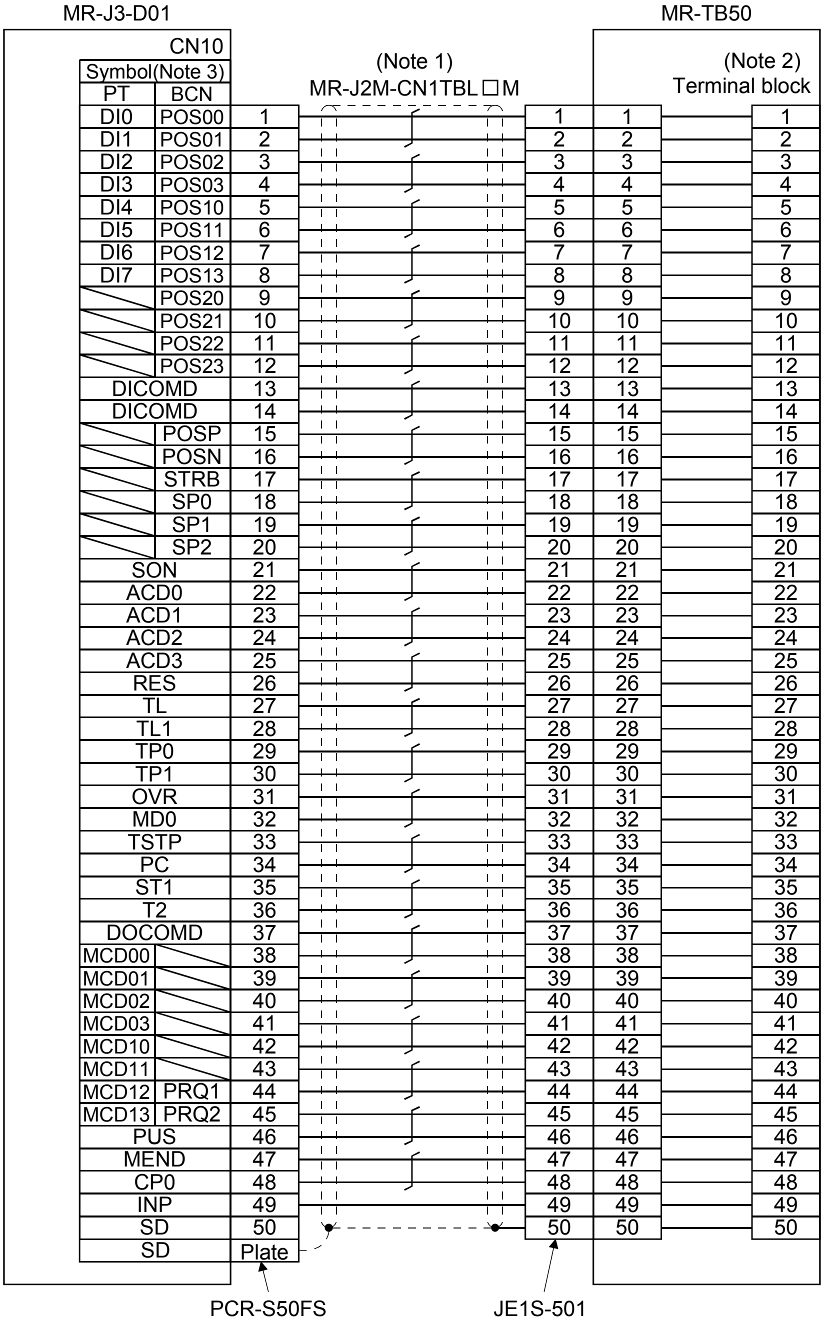
Ground the junction terminal block cable on the junction terminal block side with the standard accessory cable clamp fitting (AERSBAN-ESET). For the use of the cable clamp fitting, refer to section 13.15 (2)(c).

(2) Outline drawing



Terminal screw: M3.5
Applicable cable: 2mm^2
Crimping terminal width: 7.2mm or less.

(3) Connection of MR-J2M-CN1TBL □ M cable and MR-TB50



Note 1. Symbol indicating cable length is put in □.

05: 0.5m

1: 1m

2. Keep open the terminals to which no signal is assigned.
3. PT: When using a point table

BCD: When using a 6-digit BCD input with symbol

14. COMMUNICATION FUNCTION

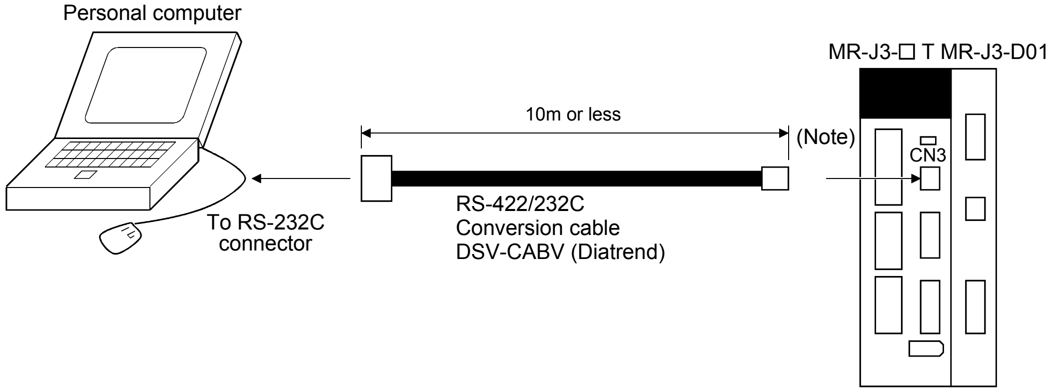
Using the serial communication function of RS-422, this servo amplifier enables servo operation, parameter change, monitor function, etc.

14.1 Configuration

POINT
・A personal computer cannot be connected to the CN30 connector of MR-J3-D01.

(1) Single axis

Operate the single-axis servo amplifier. It is recommended to use the following cable.

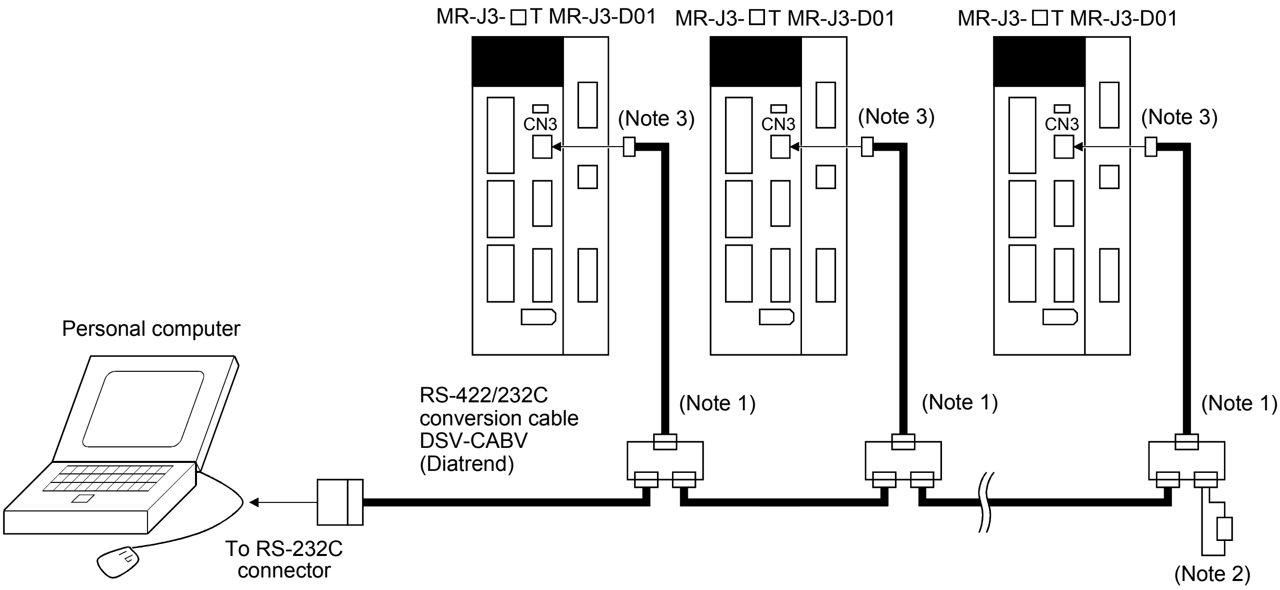


Note. Do not connect to the CN30 connector of MR-J3-D01. It cannot be used if connected.

(2) Multidrop connection

(a) Diagrammatic sketch

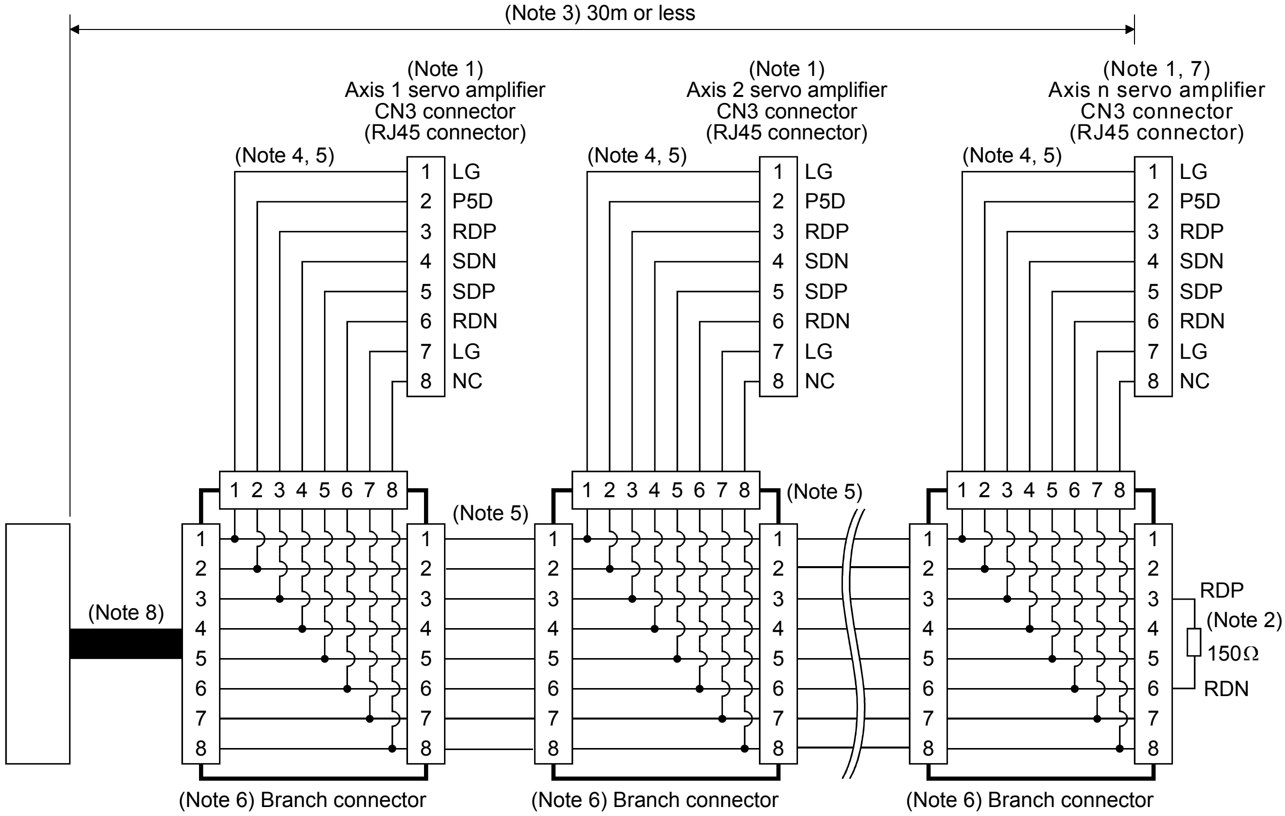
Up to 32 axes of servo amplifiers from stations 0 to 31 can be operated on the same bus.



Note 1. The BMJ-8 (Hakko Electric Machine Works) 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.
3. Do not connect to the CN30 connector of MR-J3-D01. It cannot be used if connected.

(b) Cable connection diagram

Wire the cables as shown below.



Note 1. Recommended connector (Hirose Electric)

Plug: TM10P-88P

Connection tool: CL250-0228-1

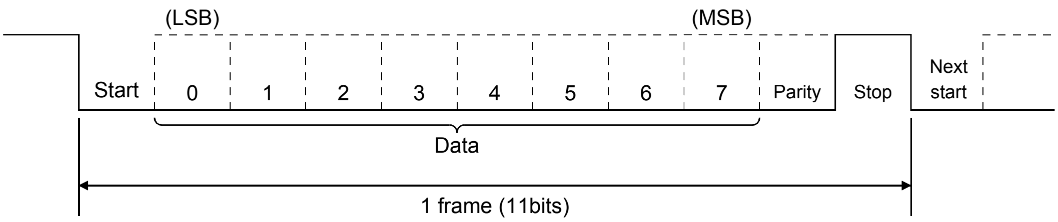
2. The final axis must be terminated between RDP (pin No. 3) and RDN (pin No.6) on the receiving side (servo amplifier) with a 150Ω resistor.
3. The overall length is 30m or less in low-noise environment.
4. The wiring between the branch connector and servo amplifier should be as short as possible.
5. Use the EIA568-compliant cable (10BASE-T cable, etc.).
6. Recommended branch connector: BMJ-8 (Hakko Electric Machine Works)
7. n ≤ 32 (Up to 32 axes can be connected.)
8. RS-422/232C conversion cable DSV-CABV (Diatrend)

14.2 Communication specifications

14.2.1 Communication overview

This servo amplifier is designed to send a reply on receipt of an instruction. The device which gives this instruction (e.g. personal computer) is called a master station and the device which sends a reply in response to the instruction (servo amplifier) is called a slave station. When fetching data successively, the master station repeatedly commands the slave station to send data.

Item	Description
Baud rate	9600/19200/38400/57600/115200 asynchronous system
Transfer code	Start bit : 1 bit Data bit : 8 bits Parity bit : 1 bit (even) Stop bit : 1 bit
Transfer protocol	Character system, half-duplex communication system



14.2.2 Parameter setting

When the USB/RS-422 communication function is used to operate the servo, set the communication specifications of the servo amplifier in the corresponding parameters.
After setting the values of these parameters, they are made valid by switching power off once, then on again.

(1) Serial communication baud rate

Choose the communication speed. Match this value to the communication speed of the sending end (master station).

Parameter No. PC21

Communication baud rate
0: 9600[bps]
1: 19200[bps]
2: 38400[bps]
3: 57600[bps]
4: 115200[bps]

(2) RS-422 communication response delay time

Set the time from when the servo amplifier (slave station) receives communication data to when it sends back data. Set "0" to send back data in less than 800μs or "1" to send back data in 800μs or more.

Parameter No. PC21

RS422 communication response delay time
0: Invalid
1: Valid, reply sent in 800μs or more

(3) Station number setting

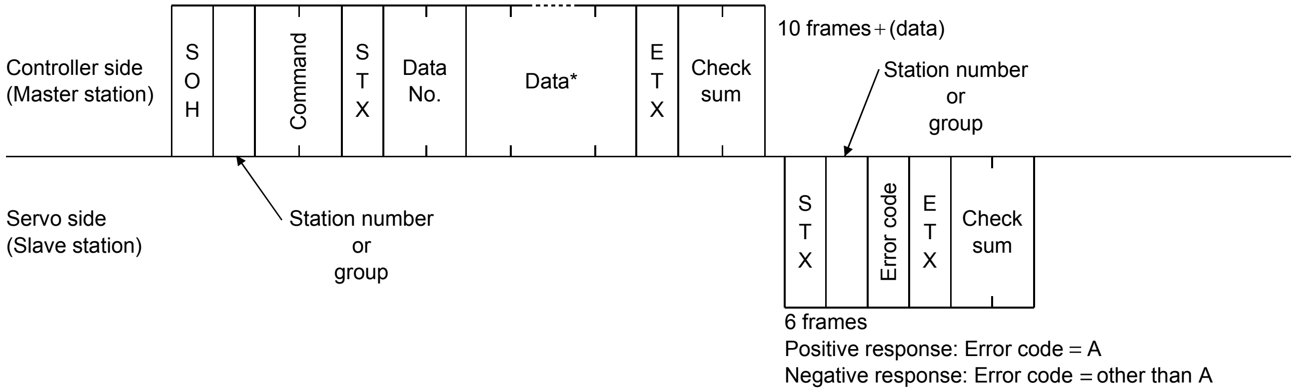
Set the station number of the servo amplifier in parameter No. PC20. The setting range is stations 0 to 31.

14.3 Protocol

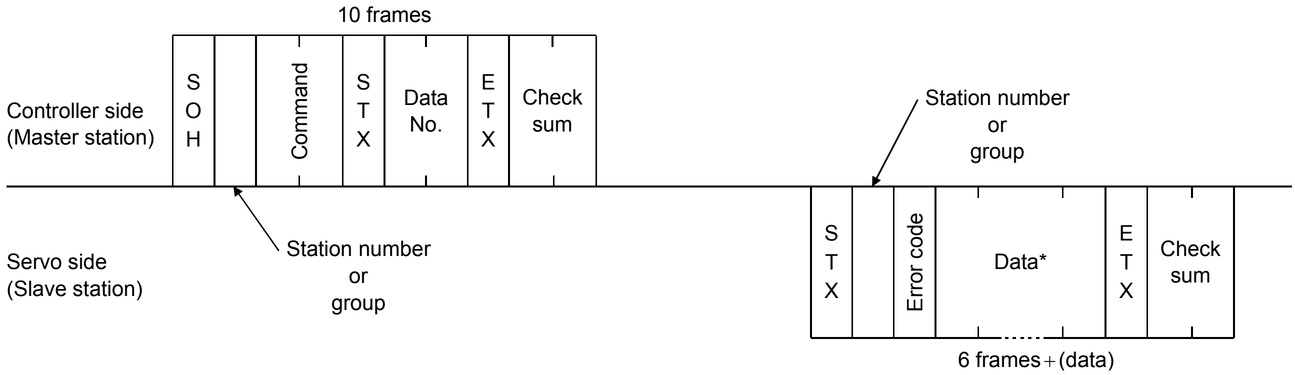
14.3.1 Transmission data configuration

Since up to 32 axes may be connected to the bus, add a station number or group to the command, data No., etc. to determine the destination servo amplifier of data communication. Set the station number to each servo amplifier using the parameter and set the group to each station using the communication command. Transmission data is valid for the servo amplifier of the specified station number or group.
When "*" is set as the station number added to the transmission data, the transmission data is made valid 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 number of the servo amplifier which must provide the return data.

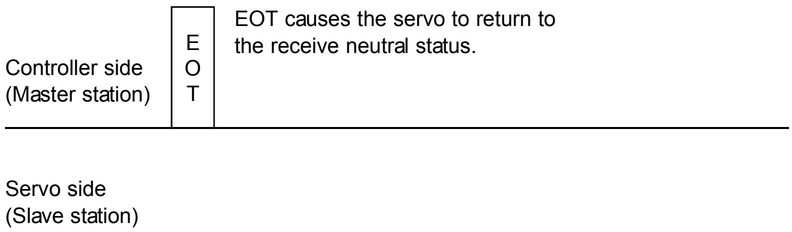
(1) Transmission of data from the controller to the servo



(2) Transmission of data request from the controller to the servo

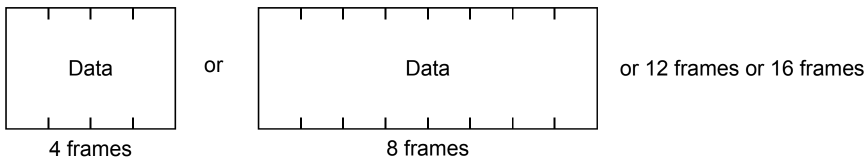


(3) Recovery of communication status by time-out



(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 codes are used.

b_8	0	0	0	0	0	0	0	0
b_7	0	0	0	0	1	1	1	1
b_6	0	0	1	1	0	0	1	1
b_5	0	1	0	1	0	1	0	1

b_8 to b_5	b_4	b_3	b_2	b_1	C / R	0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	Space	0	@	P	`	p
	0	0	0	1	1	SOH	DC_1	!	1	A	Q	a	q
	0	0	1	0	2	STX	DC_2	“	2	B	R	b	r
	0	0	1	1	3	ETX	DC_3	#	3	C	S	c	s
	0	1	0	0	4			$	4	D	T	d	t
	0	1	0	1	5			%	5	E	U	e	u
	0	1	1	0	6			&	6	F	V	f	v
	0	1	1	1	7			‘	7	G	W	g	w
	1	0	0	0	8			(	8	H	X	h	x
	1	0	0	1	9			)	9	I	Y	i	y
	1	0	1	0	10			*	:	J	Z	j	z
	1	0	1	1	11			+	;	K	[	k	{
	1	1	0	0	12			,	<	L	¥	l	|
	1	1	0	1	13			−	=	M	]	m	}
	1	1	1	0	14			.	>	N	^	n	‾
	1	1	1	1	15			/	?	O	_	o	DEL

(3) Station numbers

You may set 32 station numbers from station 0 to station 31 and the ASCII unit codes are used to specify the stations.

Station number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ASCII code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

Station number	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ASCII code	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V

For example, "30H" is transmitted in hexadecimal for the station number of "0" (axis 1).

(4) Group

Group	a	b	c	d	e	f	All group
ASCII code	a	b	c	d	e	f	*

For example, "61H" is transmitted in hexadecimal for group a.

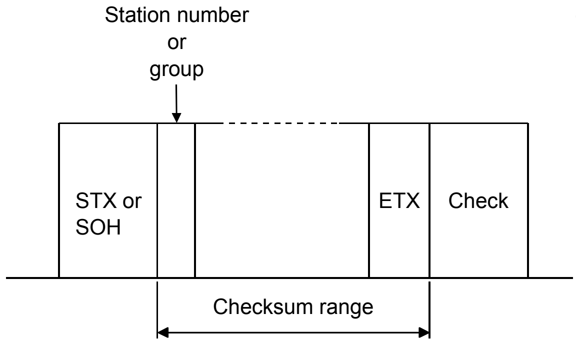
14.3.3 Error codes

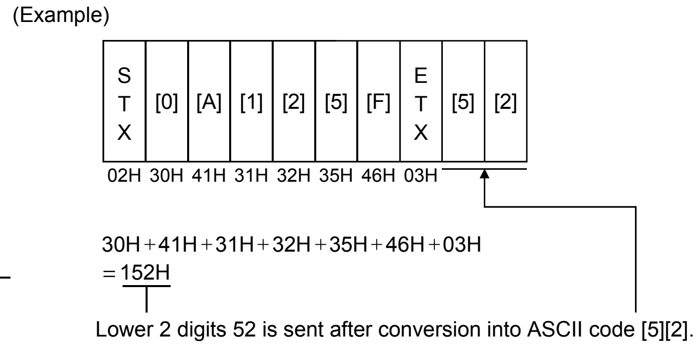
Error codes are used in the following cases and an error code of single-code length is transmitted.
On receipt of data from the master station, the slave station sends the error code corresponding to that data to the master station.
The error code sent in upper case indicates that the servo is normal and the one in lower case indicates that an alarm occurred.

Error code		Error name	Description	Remarks
Servo normal	Servo alarm			
[A]	[a]	Normal operation	Data transmitted was processed properly.	Positive response
[B]	[b]	Parity error	Parity error occurred in the transmitted data.	Negative response
[C]	[c]	Checksum error	Checksum error occurred in the transmitted data.	
[D]	[d]	Character error	Character not existing in the specifications was transmitted.	
[E]	[e]	Command error	Command not existing in the specifications was transmitted.	
[F]	[f]	Data No. error	Data No. not existing in the specifications was transmitted.	

14.3.4 Checksum

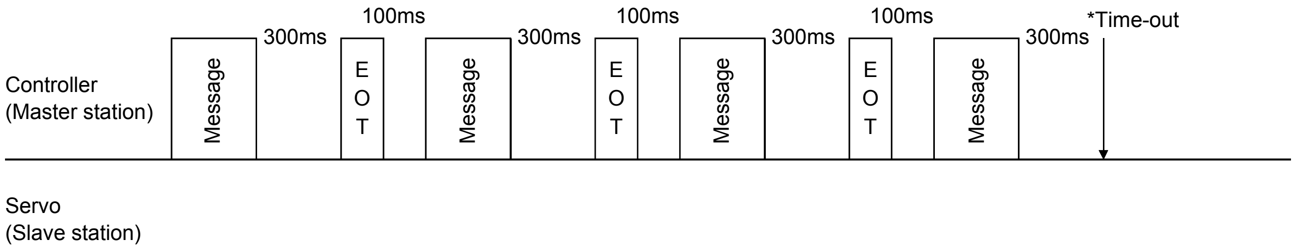
The checksum is a ASCII-coded hexadecimal representing the lower two digits of the sum of ASCII-coded hexadecimal numbers up to ETX, with the exception of the first control code (STX or SOH).





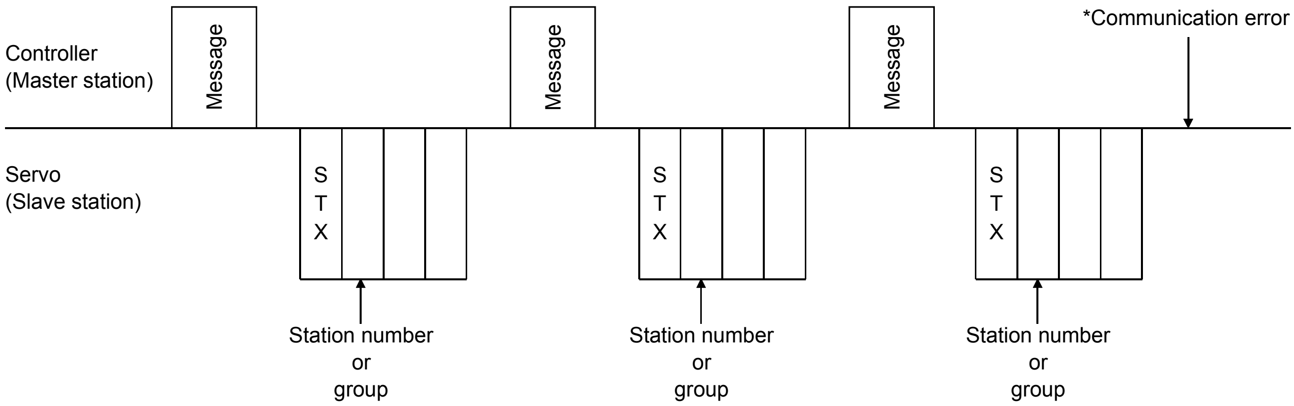
14.3.5 Time-out operation

The master station transmits EOT when the slave station does not start reply operation (STX is not received) 300ms after the master station has ended communication operation. 100ms 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 operation three times. (Communication error)



14.3.6 Retry operation

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 operation). A communication error occurs if the above operation 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 operation is performed three times.

14.3.7 Initialization

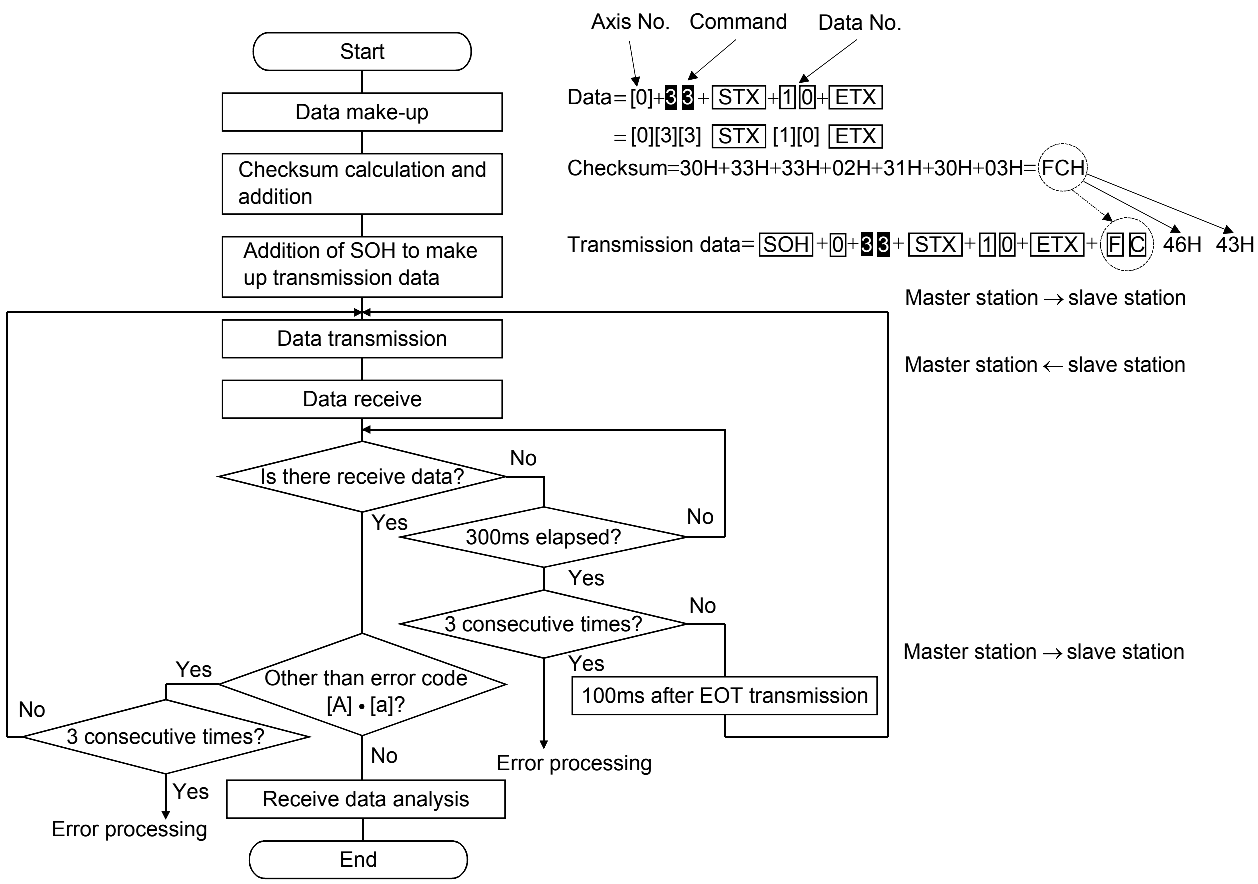
After the slave station is switched on, it cannot reply to communication until the internal initialization processing terminates. Hence, at power-on, ordinary communication should be started after:

(1) 1s or more time has elapsed after the slave station is switched on; and
(2) Making sure 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 number	0	Servo amplifier station 0
Command	33	Read command
Data No.	10	Alarm history (last alarm)



14.4 Command and data No. list

POINT

- If the command and data No. are the same, the description may be different depending on models of servo amplifiers.

14.4.1 Read commands

(1) Status display (Command [0][1])

Command	Data No.	Description	Display Item	Frame Length
[0][1]	00	Status display name and unit	Current position	16
	01		Command position	
	02		Command remaining distance	
	03		Point table No.	
	04		Cumulative feedback pulses	
	05		Servo motor speed	
	06		Droop pulses	
	07		Override voltage	
	08		Override	
	09		Analog torque limit voltage	
	0A		Regenerative load ratio	
	0B		Effective load ratio	
	0C		Peak load ratio	
	0D		Instantaneous torque	
	0E		Within one-revolution position	
	0F		ABS counter	
	10		Load inertia moment ratio	
	11		Bus voltage	
	80	Status display data value and processing information	Current position	12
	81		Command position	
	82		Command remaining distance	
	83		Point table No.	
	84		Cumulative feedback pulses	
	85		Servo motor speed	
	86		Droop pulses	
	87		Override voltage	
	88		Override	
	89		Analog torque limit voltage	
	8A		Regenerative load ratio	
	8B		Effective load ratio	
	8C		Peak load ratio	
	8D		Instantaneous torque	
	8E		Within one-revolution position	
	8F		ABS counter	
	90		Load inertia moment ratio	
	91		Bus voltage	

(2) Parameters (Command [0][4] ・ [0][5] ・ [0][6] ・ [0][7] ・ [0][8] ・ [0][9])

Command	Data No.	Description	Frame Length
[0] [4]	[0] [1]	Parameter group read 0000: Basic setting parameter (No.PA□□) 0001: Gain filter parameter (No.PB□□) 0002: Extension setting parameter (No.PC□□) 0003: I/O setting parameter (No.PD□□) 0009: Option unit parameter (No.Po□□)	4
[0] [5]	[0] [1] to [F] [F]	Current values of parameters 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 number.	8
[0] [6]	[0] [1] to [F] [F]	Upper limit values of parameter setting ranges 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 number.	8
[0] [7]	[0] [1] to [F] [F]	Lower limit values of parameter setting ranges 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 number.	8
[0] [8]	[0] [1] to [F] [F]	Abbreviations of parameters Reads the abbreviations of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading the abbreviations, 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 number.	12
[0] [9]	[0] [1] to [F] [F]	Write enable/disable of parameters Reads write enable/disable of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading write enable/disable, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. 0000: Write enabled 0001: Write disabled	4

(3) External I/O signals (Command [1][2])

Command	Data No.	Description	Frame Length
[1] [2]	[0] [0]	Input device status	8
	[0] [1]		
	[0] [2]		
	[4] [0]	External input pin status	
	[4] [1]		
	[6] [0]	Status of input device turned ON by communication	
	[6] [1]		
	[6] [2]		
	[8] [0]	Output device status	
	[8] [1]		
	[8] [2]		
	[C] [0]	External output pin status	
	[C] [1]		

(4) Alarm history (Command [3][3])

Command	Data No.	Description	Alarm Occurrence Sequence	Frame Length
[3] [3]	[1] [0]	Alarm number 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	
	[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	

(5) Current alarm (Command [0][2] ・ [3][5])

Command	Data No.	Description		Frame Length
[0] [2]	[0] [0]	Current alarm number		4
[3] [5]	[0][0]	Status display name and unit at alarm occurrence	Current position	16
	[0][1]		Command position	
	[0][2]		Command remaining distance	
	[0][3]		Point table No.	
	[0][4]		Cumulative feedback pulses	
	[0][5]		Servo motor speed	
	[0][6]		Droop pulses	
	[0][7]		Override voltage	
	[0][8]		Override	
	[0][9]		Analog torque limit voltage	
	[0][A]		Regenerative load ratio	
	[0][B]		Effective load ratio	
	[0][C]		Peak load ratio	
	[0][D]		Instantaneous torque	
	[0][E]		Within one-revolution position	
	[0][F]		ABS counter	
	[1][0]		Load inertia moment ratio	
	[1][1]		Bus voltage	
	[0][0]	Status display data value and processing information at alarm occurrence	Current position	12
	[0][1]		Command position	
	[0][2]		Command remaining distance	
	[0][3]		Point table No.	
	[0][4]		Cumulative feedback pulses	
	[0][5]		Servo motor speed	
	[0][6]		Droop pulses	
	[0][7]		Override voltage	
	[0][8]		Override	
	[0][9]		Analog torque limit voltage	
	[0][A]		Regenerative load ratio	
	[0][B]		Effective load ratio	
	[0][C]		Peak load ratio	
	[0][D]		Instantaneous torque	
	[0][E]		Within one-revolution position	
	[0][F]		ABS counter	
	[1][0]		Load inertia moment ratio	
	[1][1]		Bus voltage	

(6) Point table/position data (Command [4][0])

Command	Data No.	Description	Frame length
[4][0]	[0][1] to [F][F]	Position data read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(7) Point table/speed data (Command [5][0])

Command	Data No.	Description	Frame length
[5][0]	[0][1] to [F][F]	Speed data read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(8) Point table/acceleration time constant (Command [5][4])

Command	Data No.	Description	Frame length
[5][4]	[0][1] to [F][F]	Acceleration time constant read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(9) Point table/deceleration time constant (Command [5][8])

Command	Data No.	Description	Frame length
[5][8]	[0][1] to [F][F]	Deceleration time constant read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(10) Point table/dwell (Command [6][0])

Command	Data No.	Description	Frame length
[6][0]	[0][1] to [F][F]	Dwell read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(11) Point table/auxiliary function (Command [6][4])

Command	Data No.	Description	Frame length
[6][4]	[0][1] to [F][F]	Auxiliary function read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(12) Point table/M code (Command [4][5])

Command	Data No.	Description	Frame length
[4][5]	[0][1] to [F][F]	M code read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(13) Group setting (Command [1][F])

Command	Data No.	Description	Frame length
[1][F]	[0][0]	Reading of group setting value	4

(14) Test operation mode (Command [0][0])

Command	Data No.	Description	Frame length
[0] [0]	[1] [2]	Test operation mode read 0000: Normal mode (not test operation mode) 0001: JOG operation 0002: Positioning operation 0003: Motorless operation 0004: Output signal (DO) forced output 0005: Single-step feed	4

(15) Others

Command	Data No.	Description	Frame length
[0] [2]	[9] [0]	Servo motor end pulse unit absolute position	8
	[9] [1]	Command unit absolute position	8
	[7] [0]	Software version	16

14.4.2 Write commands

(1) Status display (Command [8][1])

Command	Data No.	Description	Setting Range	Frame length
[8] [1]	[0] [0]	Status display data erasure	1EA5	4

(2) Parameters (Command [8][4] ・ [8][5])

Command	Data No.	Description	Setting Range	Frame length
[8] [4]	[0] [1] to [F] [F]	Write of parameters 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 number.	Depending on the parameter	8
[8] [5]	[0] [0]	Parameter group write 0000: Basic setting parameter (No. PA□□) 0001: Gain filter parameter (No. PB□□) 0002: Extension setting parameter (No. PC□□) 0003: I/O setting parameter (No. PD□□) 0009: Option unit parameter (No. Po□□)	0000 to 0003 ・ 0009	4

(3) External I/O signal (Command [9][2])

Command	Data No.	Description	Setting Range	Frame length
[9] [2]	[6] [0]	Communication input device signal	Refer to section 15.5.5	8
	[6] [1]			
	[6] [2]			

(4) Alarm history (Command [8][2])

Command	Data No.	Description	Setting Range	Frame length
[8] [2]	[2] [0]	Alarm history erasure	1EA5	4

(5) Current alarm (Command [8][2])

Command	Data No.	Description	Setting Range	Frame length
[8] [2]	[0] [0]	Alarm erasure	1EA5	4

(6) Point table/position data (Command [C][0])

Command	Data No.	Description	Setting range	Frame length
[C][0]	[0][1] to [F][F]	Position data write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	−999999 to 999999	8

(7) Point table/speed data (Command [C][6])

Command	Data No.	Description	Setting range	Frame length
[C][6]	[0][1] to [F][F]	Speed data write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to Permissible instantaneous speed	8

(8) Point table/acceleration time constant (Command [C][7])

Command	Data No.	Description	Setting range	Frame length
[C][7]	[0][1] to [F][F]	Acceleration time constant write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 20000	8

(9) Point table/deceleration time constant (Command [C][8])

Command	Data No.	Description	Setting range	Frame length
[C][8]	[0][1] to [F][F]	Deceleration time constant write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 20000	8

(10) Point table/dwell (Command [C][A])

Command	Data No.	Description	Setting range	Frame length
[C][A]	[0][1] to [F][F]	Dwell write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 20000	8

(11) Point table/auxiliary function (Command [C][B])

Command	Data No.	Description	Setting range	Frame length
[C][B]	[0][1] to [F][F]	Auxiliary function write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 3	8

(12) Point table/M code (Command [C][2])

Command	Data No.	Description	Setting range	Frame length
[C][2]	[0][1] to [F][F]	M code write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	00 to 99	8

(13) External input signal disable (Command [9][0])

Command	Data No.	Description	Setting range	Frame length
[9][0]	[0][0]	Turns off the input devices, external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN, independently of the external ON/OFF statuses.	1EA5	4
[9][0]	[0][3]	Disables all output devices (DO).	1EA5	4
[9][0]	[1][0]	Enables the disabled input devices (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN.	1EA5	4
[9][0]	[1][3]	Enables the disabled output devices (DO).	1EA5	4

(14) Operation mode selection (Command [8][B])

Command	Data No.	Description	Setting Range	Frame Length
[8] [B]	[0] [0]	Operation mode switching 0000: Test operation mode cancel 0001: JOG operation 0002: Positioning operation 0003: Motorless operation 0004: Output signal (DO) forced output 0005: Single-step feed	0000 to 0005	4

(15) 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
	[0] [1]			
	[0] [2]			
	[A] [0]	Forced output of signal pin	Refer to section 14.5.9.	8
[A] [0]	[1] [0]	Writes the speed in the test operation mode (JOG operation, positioning operation).	0000 to 7FFF	4
	[1] [1]	Writes the acceleration/deceleration time constant in the test operation mode (JOG operation, positioning operation).	00000000 to 7FFFFFFF	8
	[2] [0]	Sets the moving distance in the test operation mode (JOG operation, positioning operation).	00000000 to 7FFFFFFF	8
	[2] [1]	Selects the positioning direction of test operation (positioning operation). 0 □ 0 □ 0: Forward rotation direction 1: Reverse rotation direction 0: Command pulse unit 1: Encoder pulse unit	0000 to 0001	4
	[4] [0]	Test operation (positioning operation) start command.	1EA5	4
	[4] [1]	Used to make a temporary stop during test operation (positioning operation). □in the data indicates a blank. STOP: Temporary stop G0□□: Restart for remaining distance CLR□: Remaining distance clear.	STOP G0□□ CLR□	4

(16) Group setting (Command [9][F])

Command	Data No.	Description	Setting range	Frame length
[9] [F]	[0] [0]	Setting of group	a to f	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 reply or data according to 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 according to 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 the 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.

0	0	3	0	0	0	0	0	0	9	2	9

Data 32-bit length (hexadecimal representation)
(Data conversion is required as indicated in the display type)

Display type
0: Data must be converted into decimal.
1: Data is used unchanged in hexadecimal.

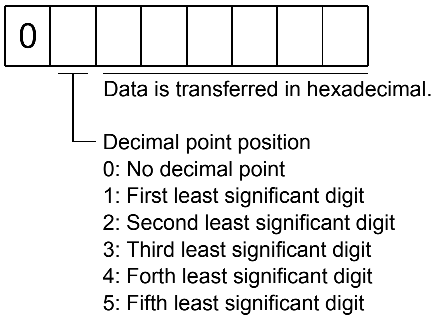
Decimal point position
0: No decimal point
1: First least significant digit (normally not used)
2: Second least significant digit
3: Third least significant digit
4: Forth least significant digit
5: Fifth least significant digit
6: Sixth least significant digit

Since the display type is "0" in this case, the hexadecimal data is converted into decimal.
00000929H→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 the 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.



By way of 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 digit, the decimal point position data is "2".

As the data to be sent is hexadecimal, the decimal data is converted into hexadecimal.

155→9B

Hence, "0200009B" is transmitted.

14.5.2 Status display

(1) Reading the status display name and unit

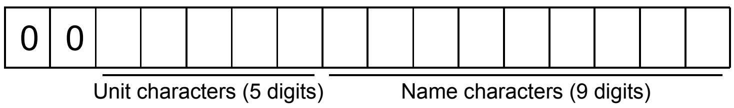
Read the status display name and unit.

(a) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read, [0][0] to [0][E]. (Refer to section 14.4.1.)

(b) Reply

The slave station sends back the status display name and unit requested.



(2) Status display data read

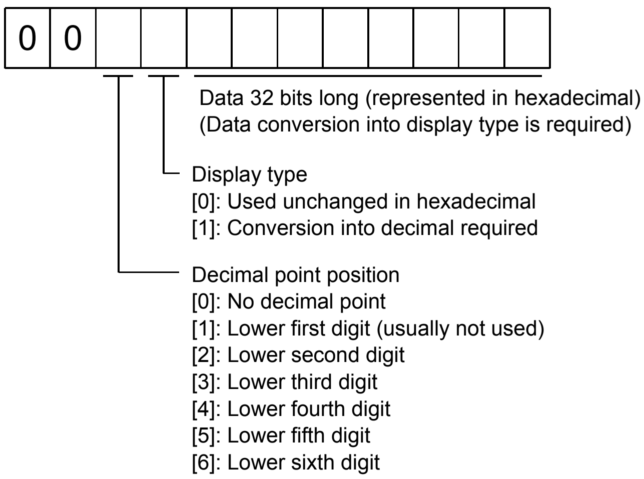
Read the status display data and processing information.

(a) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read.
Refer to section 14.4.1.

(b) Reply

The slave station sends back the status display data requested.



(3) Status display data clear

The cumulative feedback pulse data of the status display is cleared. Send this command immediately after reading the status display item. The data of the status display item transmitted is cleared to zero.

Command	Data No.	Data
[8][1]	[0][0]	[1][E][A][5]

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 zero.

14.5.3 Parameters

(1) Specify the parameter group

The group of the parameters to be operated must be specified in advance to read or write the parameter settings, etc. Write data to the servo amplifier as described below to specify the parameter group to be operated.

Command	Data No.	Transmission Data	Parameter Group
[8] [5]	[0] [0]	0000	Basic setting parameter (No.PA□□)
		0001	Gain filter parameter (No.PB□□)
		0002	Extension setting parameter (No.PC□□)
		0003	I/O setting parameter (No.PD□□)

(2) Reading the parameter group

Read the parameter group.

(a) Transmission

Send command [0][4] and data No.[0][1].

Command	Data No.
[0] [4]	[0] [1]

(b) Reply

The slave station sends back the preset parameter group.

0	0	0	

Parameter group
0: Basic setting parameter (No.PA□□)
1: Gain filter parameter (No.PB□□)
2: Extension setting parameter (No.PC□□)
3: I/O setting parameter (No.PD□□)
9: Option unit parameter (No.Po □□)

(3) Reading the symbol

Read the parameter name. Specify the parameter group in advance (refer to (1) in this section).

(a) Transmission

Transmit command [0][8] 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 number.

(b) Reply

The slave station sends back the name of the parameter No. requested.

0	0	0									

Name characters (9 digits)

(4) Reading the setting

Read the parameter setting. Specify the parameter group in advance (refer to (1) in this section).

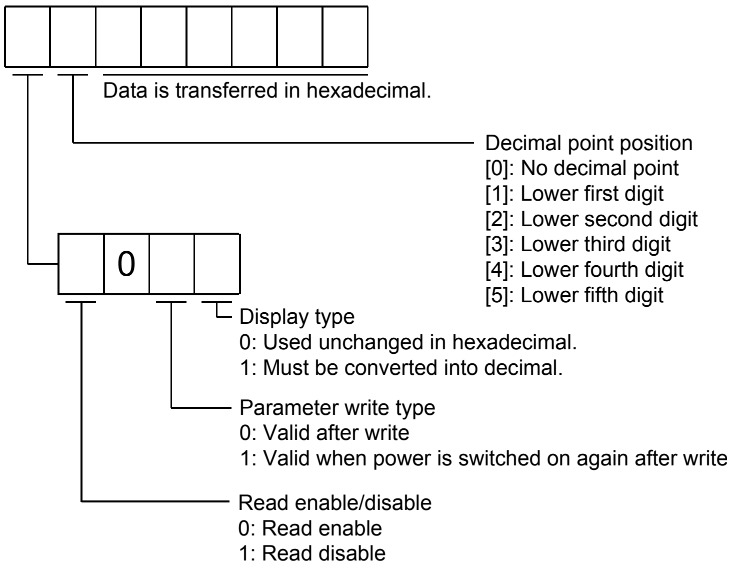
(a) Transmission

Transmit command [0][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 number.

(b) Reply

The slave station sends back the data and processing information of the parameter No. requested.



For example, data "1200270F" means 999.9 (decimal display format) and data "0003ABC" 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 "01FFF053" means 053 (special hexadecimal display format).

"1 (Read disable)" is transferred to the "Read enable/disable" section and "000000" is transferred to the data section when the parameter that was read is the one inaccessible for write/reference in the parameter write disable setting of parameter No. PA19.

(5) Reading the setting range

Read the parameter setting range. Specify the parameter group in advance (refer to (1) in this section).

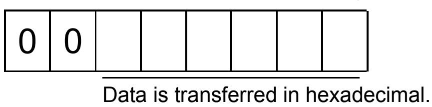
(a) Transmission

When reading the upper limit value, transmit command [0][6] and the data No. corresponding to the parameter No., [0][0] to [F][F]. When reading the lower limit value, transmit command [0][7] and the data No. corresponding to the parameter No., [0][0] 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 number.

(b) Reply

The slave station sends back the data and processing information of the parameter No. requested.



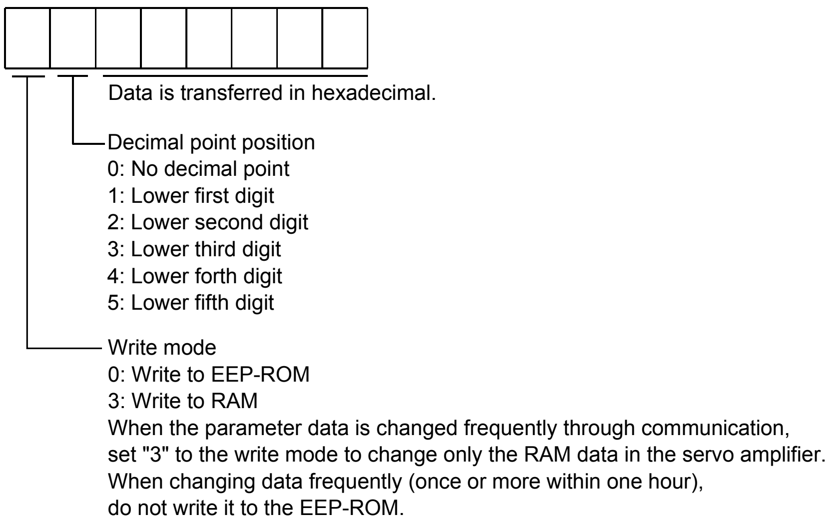
For example, data "10FFFFEC" means -20.

(6) Parameter write

> **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 EEP-ROM 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 the parameter group in advance (refer to (1) in this section).
Write the value within the setting enabled range. For the setting enabled range, refer to chapter 6 or read the setting range by performing operation in (3) in this section.
Transmit command [8][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 number.
When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, data cannot be written. When the data is handled as hexadecimal, specify 0 as the decimal point position.
Write the data after making sure that it is within the upper/lower limit value range.
Read the parameter data to be written, confirm the decimal point position, and create transmission data to prevent error occurrence. On completion of write, read the same parameter data to verify that data has been written correctly.

Command	Data No.	Set data
[8][4]	[0][1] to [F][F]	See below.



14.5.4 External I/O signal statuses (DIO diagnosis)

(1) Reading of input device statuses

Read the statuses of the input devices.

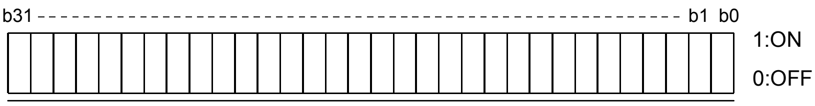
(a) Transmission

Transmit command [1][2] and the data No. corresponding to the input device.

Command	Data No.
[1][2]	[0][0]
	[0][1]
	[0][2]

(b) Reply

The slave station sends back the statuses of the input pins.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	Data No. [0][0]		Data No. [0][1]		Data No. [0][2]	
	Device name	Symbol	Device name	Symbol	Device name	Symbol
0	Servo-on	SON			Position data input 1	POS00
1	Forward rotation stroke end	LSP			Position data input 2	POS01
2	Reverse rotation stroke end	LSN			Position data input 3	POS02
3	External torque limit selection	TL			Position data input 4	POS03
4	Internal torque limit selection	TL1			Position data input 5	POS10
5	Proportion control	PC			Position data input 6	POS11
6	Reset	RES			Position data input 7	POS12
7	Clear	CR			Position data input 8	POS13
8					Position data input 9	POS20
9					Position data input 10	POS21
10					Position data input 11	POS22
11	Forward rotation start	ST1			Position data input 12	POS23
12	Reverse rotation start	ST2			Position data input symbol +	POSP
13					Position data input symbol −	POSN
14					Strobe input	STRB
15						
16						
17	Automatic/manual selection	MD0				
18	Proximity dog	DOG				
19						
20			Speed selection 1	SP0		
21			Speed selection 2	SP1		
22			Speed selection 3	SP2		
23	Override selection	OVR	Speed selection 4	SP3		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0		
25	Manual pulse generator multiplication 1	TP0	Point table No. selection 2	DI1		
26	Manual pulse generator multiplication 2	TP1	Point table No. selection 3	DI2		
27	Gain switch	CDP	Point table No. selection 4	DI3		
28			Point table No. selection 5	DI4		
29			Point table No. selection 6	DI5		
30			Point table No. selection 7	DI6		
31			Point table No. selection 8	DI7		

(2) External input pin status read

Read the ON/OFF statuses of the external output pins.

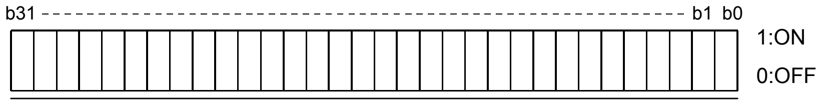
(a) Transmission

Transmit command [1][2] and the data No. corresponding to the pin.

Command	Data No.
[1][2]	[4][0]
	[4][1]

(b) Reply

The ON/OFF statuses of the input pins are sent back.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	Data No. [4][0]	Data No. [4][1]
	CN6 connector pin	CN10 connector pin
0	1	1
1	2	2
2	3	3
3	4	4
4		5
5		6
6		7
7		8
8		9
9		10
10		11
11		12
12		15
13		16
14		17
15		18

bit	Data No. [4][0]	Data No. [4][1]
	CN6 connector pin	CN10 connector pin
16		19
17		20
18		21
19		26
20		27
21		28
22		29
23		30
24		31
25		32
26		33
27		34
28		35
29		36
30		
31		

(3) Read of the statuses of input devices switched on through communication

Read the ON/OFF statuses of the input devices switched on through communication.

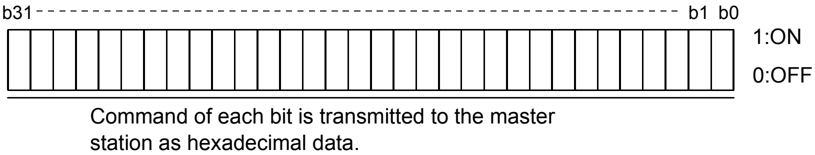
(a) Transmission

Transmit command [1][2] and the data No. corresponding to the input device.

Command	Data No.
[1][2]	[6][0]
	[6][1]
	[6][2]

(b) Reply

The slave station sends back the statuses of the input pins.



bit	Data No. [6][0]		Data No. [6][1]		Data No. [6][2]	
	Device name	Symbol	Device name	Symbol	Device name	Symbol
0	Servo-on	SON			Position data input 1	POS00
1	Forward rotation stroke end	LSP			Position data input 2	POS01
2	Reverse rotation stroke end	LSN			Position data input 3	POS02
3	External torque limit selection	TL			Position data input 4	POS03
4	Internal torque limit selection	TL1			Position data input 5	POS10
5	Proportion control	PC			Position data input 6	POS11
6	Reset	RES			Position data input 7	POS12
7	Clear	CR			Position data input 8	POS13
8					Position data input 9	POS20
9					Position data input 10	POS21
10					Position data input 11	POS22
11	Forward rotation start	ST1			Position data input 12	POS23
12	Reverse rotation start	ST2			Position data input symbol +	POSP
13					Position data input symbol −	POSN
14					Strobe input	STRB
15						
16						
17	Automatic/manual selection	MD0				
18	Proximity dog	DOG				
19						
20			Speed selection 1	SP0		
21			Speed selection 2	SP1		
22			Speed selection 3	SP2		
23	Override selection	OVR	Speed selection 4	SP3		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0		
25	Manual pulse generator multiplication 1	TP0	Point table No. selection 2	DI1		
26	Manual pulse generator multiplication 2	TP1	Point table No. selection 3	DI2		
27	Gain switch	CDP	Point table No. selection 4	DI3		
28			Point table No. selection 5	DI4		
29			Point table No. selection 6	DI5		
30			Point table No. selection 7	DI6		
31			Point table No. selection 8	DI7		

(4) External output pin status read

Read the ON/OFF statuses of the external output pins.

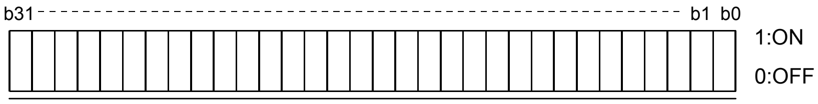
(a) Transmission

Transmit command [1][2] and the data No. corresponding to the pin.

Command	Data No.
[1][2]	[C][0]

(b) Reply

The slave station sends back the ON/OFF statuses of the output pins.



Command of each bit is transmitted to the master station as hexadecimal data.

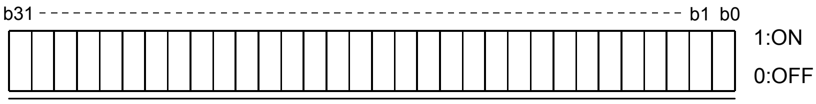
bit	Data No. [C][0] CN6 connector pin	Data No. [C][1] CN10 connector pin
0	14	22
1	15	23
2	16	24
3		25
4		38
5		39
6		40
7		41
8		42
9		43
10		44
11		45
12		46
13		47
14		48
15		49
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		

(5) Read of the statuses of output devices
Read the ON/OFF statuses of the output devices.

(a) Transmission
Transmit command [1][2] and the data No. corresponding to the output device.

Command	Data No.
[1][2]	[8][0]
	[8][1]
	[8][2]

(b) Reply
The slave station sends back the statuses of the output devices.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	Data No. [8][0]		Data No. [8][1]		Data No. [8][2]	
	Device name	Symbol	Device name	Symbol	Device name	Symbol
0	Ready	RD			M code output 1	MCD00
1					M code output 2	MCD01
2	Zero speed	ZSP			M code output 3	MCD02
3	Limiting torque	TLC			M code output 4	MCD03
4					M code output 5	MCD10
5	In position	INP			M code output 6	MCD11
6					M code output 7	MCD12
7	Warning	WNG			M code output 8	MCD13
8	Trouble	ALM			Alarm code 0	ACD0
9					Alarm code 1	ACD1
10	Electromagnetic brake interlock	MBR			Alarm code 2	ACD2
11	dynamic brake interlock	DB			Alarm code 3	ACD3
12					Position data request 1	PRQ1
13					Position data request 2	PRQ2
14						
15	Battery warning	BWNG				
16	Rough match	CPO				
17	Home position return completion	ZP				
18	Position range output	POT				
19	Temporary stop	PUS				
20						
21						
22						
23						
24			Point table No. output 1	PT0		
25	Variable gain selection	CDPS	Point table No. output 2	PT1		
26			Point table No. output 3	PT2		
27			Point table No. output 4	PT3		
28	Movement finish	MEND	Point table No. output 5	PT4		
29			Point table No. output 6	PT5		
30			Point table No. output 7	PT6		
31			Point table No. output 8	PT7		

14.5.5 Device ON/OFF

POINT
· The ON/OFF states of all devices in the servo amplifier are the states of the data received last. Hence, when there is a device which must be kept ON, send data which turns that device ON every time.

Each input device can be switched on/off. However, when the device to be switched off exists in the external input signal, also switch off that input signal.
Send command [9][2], data No. corresponding to the input device and data.

Command	Data No.	Set data
[9][2]	[6][0]	See below.
	[6][1]	
	[6][2]	

b31 --- b1 b0

1:ON
0:OFF

Command of each bit is transmitted to the slave station as hexadecimal data.

bit	Data No. [6][0]		Data No. [6][1]		Data No. [6][2]	
	Device name	Symbol	Device name	Symbol	Device name	Symbol
0	Servo-on	SON			Position data input 1	POS00
1	Forward rotation stroke end	LSP			Position data input 2	POS01
2	Reverse rotation stroke end	LSN			Position data input 3	POS02
3	External torque limit selection	TL			Position data input 4	POS03
4	Internal torque limit selection	TL1			Position data input 5	POS10
5	Proportion control	PC			Position data input 6	POS11
6	Reset	RES			Position data input 7	POS12
7	Clear	CR			Position data input 8	POS13
8					Position data input 9	POS20
9					Position data input 10	POS21
10					Position data input 11	POS22
11	Forward rotation start	ST1			Position data input 12	POS23
12	Reverse rotation start	ST2			Position data input symbol +	POSP
13					Position data input symbol −	POSN
14					Strobe input	STRB
15						
16						
17	Automatic/manual selection	MD0				
18	Proximity dog	DOG				
19						
20			Speed selection 1	SP0		
21			Speed selection 2	SP1		
22			Speed selection 3	SP2		
23	Override selection	OVR	Speed selection 4	SP3		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0		
25	Manual pulse generator multiplication 1	TP0	Point table No. selection 2	DI1		
26	Manual pulse generator multiplication 2	TP1	Point table No. selection 3	DI2		
27	Gain switch	CDP	Point table No. selection 4	DI3		
28			Point table No. selection 5	DI4		
29			Point table No. selection 6	DI5		
30			Point table No. selection 7	DI6		
31			Point table No. selection 8	DI7		

14.5.6 Disable/enable of I/O devices (DIO)

Inputs can be disabled independently of the I/O devices ON/OFF. When inputs are disabled, the input signals (devices) are recognized as follows. Among the input devices, EMG, LSP and LSN cannot be disabled.

Signal	Status
Input devices (DI)	OFF

(1) Disabling/enabling the input devices (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN.
Transmit the following communication commands.

(a) Disable

Command	Data No.	Data
[9][0]	[0][0]	1EA5

(b) Enable

Command	Data No.	Data
[9][0]	[1][0]	1EA5

(2) Disabling/enabling the output devices (DO)
Transmit the following communication commands.

(a) Disable

Command	Data No.	Data
[9][0]	[0][3]	1EA5

(b) Enable

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. when the device to be switched off exists in the external input signal, also switch off that input signal.
Send command [9] [2], data No. corresponding to the input device and data.

Command	Data No.	Set data
[9][2]	[0][0]	See below
	[0][1]	
	[0][2]	

b31 - b1 b0

1: ON
0: OFF

Command of each bit is transmitted to the slave station as hexadecimal data.

bit	Data No. [0][0]		Data No. [0][1]		Data No. [0][2]	
	Device name	Symbol	Device name	Symbol	Device name	Symbol
0	Servo-on	SON			Position data input 1	POS00
1	Forward rotation stroke end	LSP			Position data input 2	POS01
2	Reverse rotation stroke end	LSN			Position data input 3	POS02
3	External torque limit selection	TL			Position data input 4	POS03
4	Internal torque limit selection	TL1			Position data input 5	POS10
5	Proportion control	PC			Position data input 6	POS11
6	Reset	RES			Position data input 7	POS12
7	Clear	CR			Position data input 8	POS13
8					Position data input 9	POS20
9					Position data input 10	POS21
10					Position data input 11	POS22
11	Forward rotation start	ST1			Position data input 12	POS23
12	Reverse rotation start	ST2			Position data input symbol +	POSP
13					Position data input symbol −	POSN
14					Strobe input	STRB
15						
16						
17	Automatic/manual selection	MD0				
18	Proximity dog	DOG				
19						
20			Speed selection 1	SP0		
21			Speed selection 2	SP1		
22			Speed selection 3	SP2		
23	Override selection	OVR	Speed selection 4	SP3		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0		
25	Manual pulse generator multiplication 1	TP0	Point table No. selection 2	DI1		
26	Manual pulse generator multiplication 2	TP1	Point table No. selection 3	DI2		
27	Gain switch	CDP	Point table No. selection 4	DI3		
28			Point table No. selection 5	DI4		
29			Point table No. selection 6	DI5		
30			Point table No. selection 7	DI6		
31			Point table No. selection 8	DI7		

14.5.8 Test operation mode

POINT

- The test operation mode is used to confirm operation. Do not use it for actual operation.
- If communication stops for longer than 0.5s during test operation, the servo amplifier decelerates to a stop, resulting in servo lock. To prevent this, continue communication all the time, e.g. monitor the status display.
- Even during operation, the servo amplifier can be put in the test operation mode.

  In this case, as soon as the test operation mode is selected, the base circuit is shut off, coasting the servo amplifier.

(1) Preparation and cancel of test operation mode

(a) Preparation of test operation mode

Set the test operation mode type in the following procedure.

Send the command [8][B] + data No. [0][0] to select the test operation mode.

Command	Data No.	Transmission Data	Test Operation Mode Selection
[8][B]	[0][0]	0001	JOG operation
		0002	Positioning operation
		0003	Motorless operation
		0004	DO forced output
		0005	Single-step feed

2) Confirmation of test operation mode

Read the test operation mode set for the slave station, and confirm that it is set correctly.

a. Transmission

Send the command [0][0] + data No. [1][2].

Command	Data No.
[0][0]	[1][2]

b. Return

The slave station returns the set test operation mode.

0	0	0	

Test operation mode read
0: Normal mode (not test operation mode)
1: JOG operation
2: Positioning operation
3: Motorless operation
4: DO forced output
5: Single-step feed

(2) JOG operation

Send the command, data No. and data as indicated below to execute JOG operation.

Start
Command: [8][B]
Data No. : [0][0]
Data : 0001(JOG operation)

Select the JOG operation in the test operation mode.

Servo motor speed setting
Command: [A][0]
Data No. : [1][0]
Data : Write the speed [r/min] in hexadecimal.

Acceleration/deceleration time constant setting
Command: [A][0]
Data No. : [1][1]
Data : Write the acceleration/ deceleration time constant [ms] in hexadecimal.

Set the operation pattern.

When LSP/LSN was turned OFF by external input signal

Start
Command: [9][2]
Data No. : [0][0]
Data : ・Forward rotation direction 00000807 (SON, LSP, LSN, ST1 turned ON)
・Reverse rotation direction 00001007 (SON, LSP, LSN, ST2 turned ON)

Stop
Command: [9][2]
Data No. : [0][0]
Data : 00000007 (SON, LSP, LSN turned ON)

When LSP/LSN was turned OFF by external input signal or automatically

Start
Command: [9][2]
Data No. : [0][0]
Data : ・Forward rotation direction 00000801 (SON, ST1 turned ON)
・Reverse rotation direction 00001001 (SON, ST2 turned ON)

Stop
Command: [9][2]
Data No. : [0][0]
Data : 00000001 (SON turned ON)

Start.

Stop.

End
Command: [8][B]
Data No. : [0][0]
Data : 0000 (JOG operation cancel)

Cancel the JOG operation.

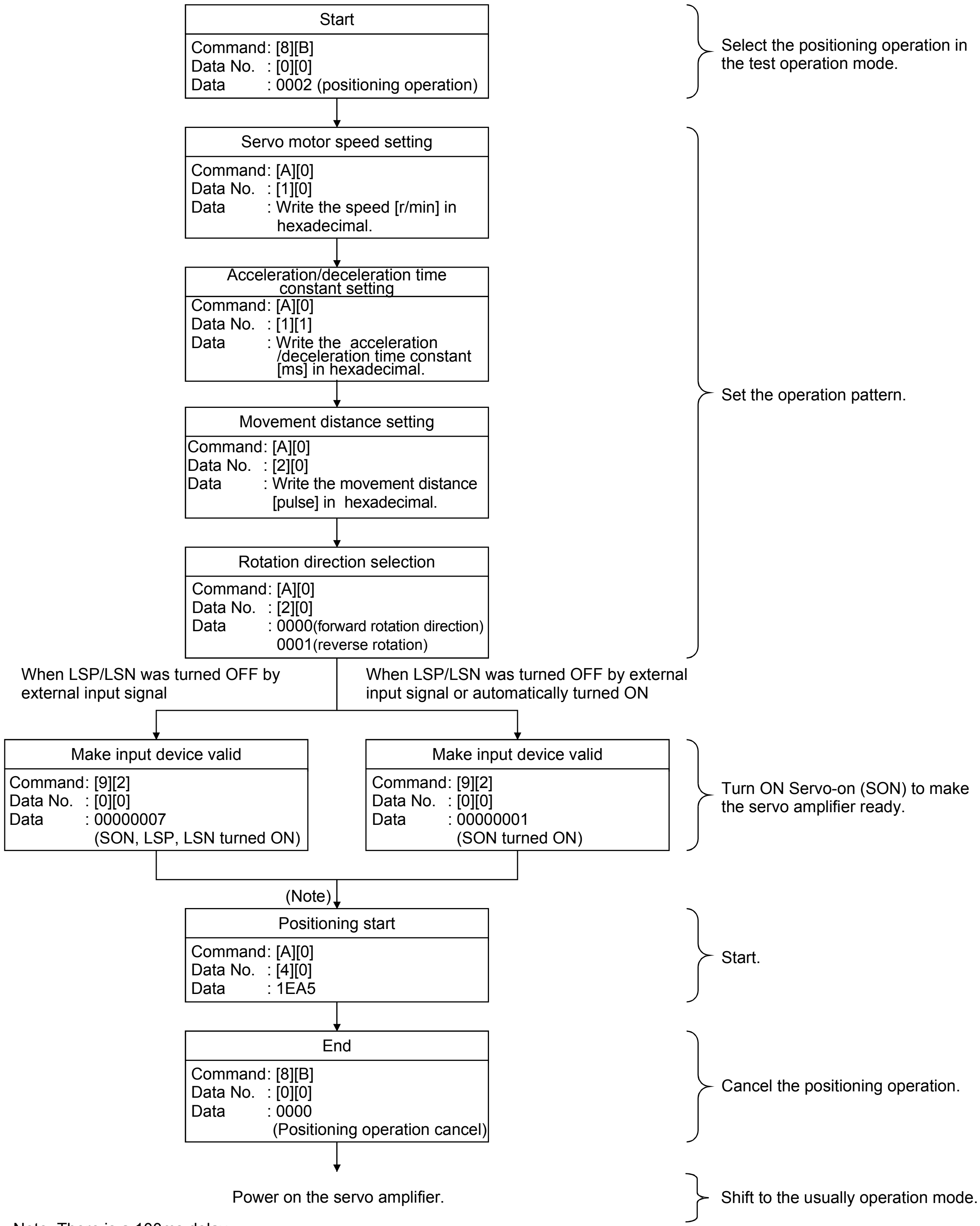
Power on the servo amplifier.

Shift to the usually operation mode.

(3) Positioning operation

(a) Operation procedure

Send the command, data No. and data as indicated below to execute positioning operation.



Note. There is a 100ms delay.

(b) Temporary stop/restart/remaining distance clear

Send 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

Send the following command, data No. and data during a temporary stop to make a restart.

Command	Data No.	(Note) Data
[A][0]	[4][1]	GO □□

Note. □ indicates a blank.

Send the following command, data No. and data during a temporary stop to stop positioning operation and erase the remaining movement distance.

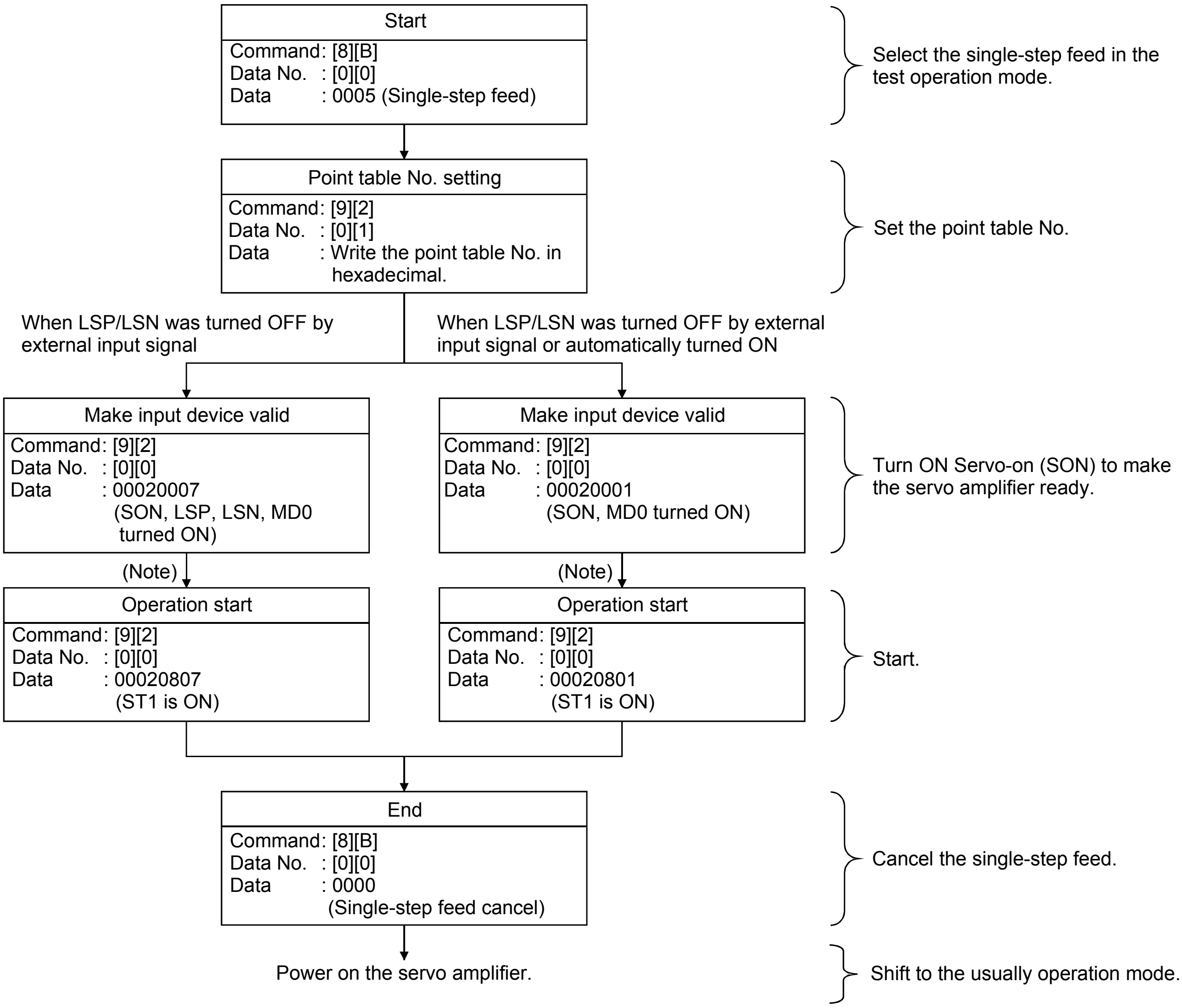
Command	Data No.	(Note) Data
[A][0]	[4][1]	CLR □

Note. □ indicates a blank.

(4) Single-step feed

Set necessary items to the point table before starting the single-step feed.

Send the command, data No. and data as indicated below to execute single-step feed.



(5) Output signal pin ON/OFF output signal (DO) forced output

In the test operation mode, the output signal pins can be turned on/off independently of the servo status. Using command [9][0], disable the output signals in advance.

(a) Choosing DO forced output in test operation mode

Transmit command [8][B] + data No. [0][0] + data "0004" to choose DO forced output.

0	0	0	4

Selection of test operation mode
4: DO forced output (output signal forced output)

(b) External output signal ON/OFF

Transmit the following communication commands.

Command	Data No.	Setting data
[9][2]	[A][0]	See below.
	[A][1]	

b31 -- b1 b0

1: ON
0: OFF

Command of each bit is transmitted to the slave station as hexadecimal data.

bit	Data No. [A][0]	Data No. [A][1]
	CN6 connector pin	CN10 connector pin
0	14	22
1	15	23
2	16	24
3		25
4		38
5		39
6		40
7		41
8		42
9		43
10		44
11		45
12		46
13		47
14		48
15		49

bit	Data No. [A][0]	Data No. [A][1]
	CN6 connector pin	CN10 connector pin
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		

(c) End of DO forced output

Transmit command [8][B] + data No. [0][0] + data to cancel DO forced output.

Command	Data No.	Transmission data	Description
[8][B]	[0][0]	0000	End of DO forced output

(6) Motorless operation

(a) Performing motorless operation

Transmit command [8][B] + data No. [0][0] + data "0003" to perform motorless operation.

0	0	0	3

Selection of test operation mode
3: Motorless operation

To perform operation after performing the motorless operation, issue a command from the host controller.

(b) End of motorless operation

The motorless operation cannot be canceled in the same way as the test operation mode (transmit command [8][B] + data No. [0][0] + data "0000"). To cancel the motorless operation, power on the servo amplifier and shift to the usually operation mode.

14.5.9 Alarm history

(1) Alarm No. read

Read the alarm No. which occurred in the past. The alarm numbers and occurrence times of No. 0 (last alarm) to No. 5 (sixth alarm in the past) are read.

(a) Transmission

Send command [3][3] and data No. [1][0] to [1][5]. Refer to section 14.4.1.

(b) Reply

The alarm No. corresponding to the data No. is provided.

0	0		

Alarm No. is transferred in decimal.

For example, "0032" means A32 and "00FF" means A_ _ (no alarm).

(2) Alarm occurrence time read

Read the occurrence time of alarm which occurred in the past.

The 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

Send command [3][3] and data No. [2][0] to [2][5].

Refer to section 14.4.1.

(b) Reply

The alarm occurrence time is transferred in decimal.
Hexadecimal must be converted into decimal.

For example, data "01F5" means that the alarm occurred in 501 hours after start of operation.

(3) Alarm history clear

Erase the alarm history.

Send command [8][2] and data No. [2][0].

Command	Data No.	Data
[8][2]	[2][0]	1EA5

14.5.10 Current alarm

(1) Current alarm read

Read the alarm No. which is occurring currently.

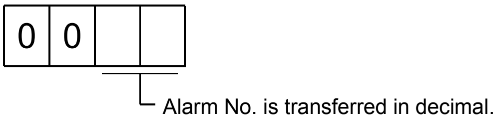
(a) Transmission

Send command [0][2] and data No. [0][0].

Command	Data No.
[0][2]	[0][0]

(b) Reply

The slave station sends back the alarm currently occurring.



For example, "0032" means A32 and "00FF" means A_ _ (no alarm).

(2) Read of the status display at alarm occurrence

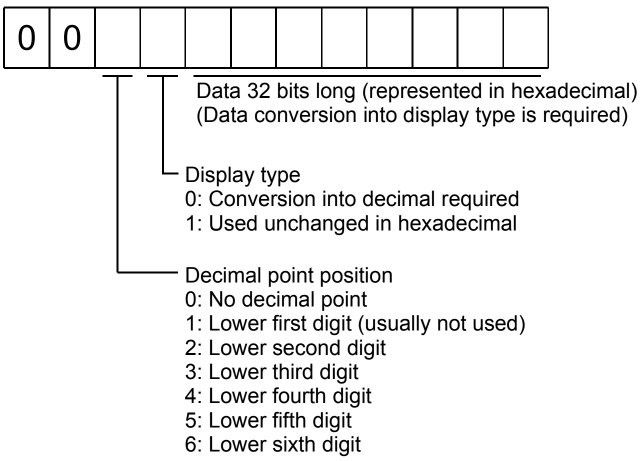
Read the status display data at alarm occurrence. When the data No. corresponding to the status display item is transmitted, the data value and data processing information are sent back.

(a) Transmission

Send command [3][5] and any of data No. [8][0] to [8][E] corresponding to the status display item to be read. Refer to section 14.4.1.

(b) Reply

The slave station sends back the requested status display data at alarm occurrence.



(3) Current alarm clear

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

14.5.11 Point table

(1) Data read

(a) Position data

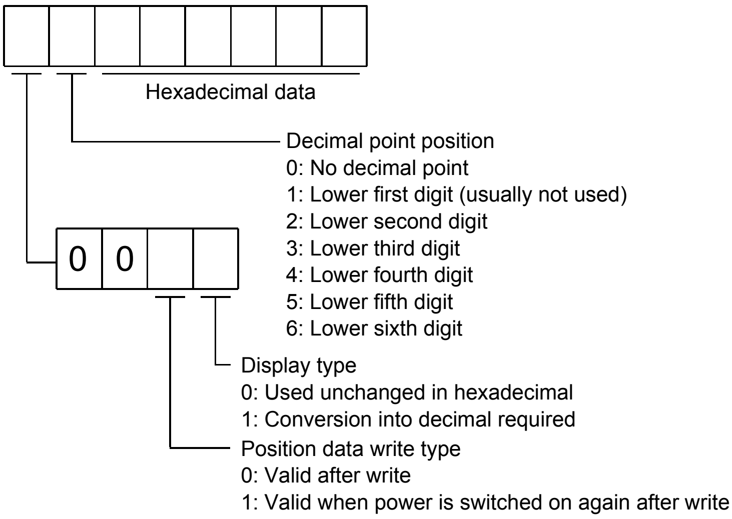
Read the position data of the point table.

1) Transmission

Transmit command [4][0] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the position data of the requested point table.



(b) Speed data

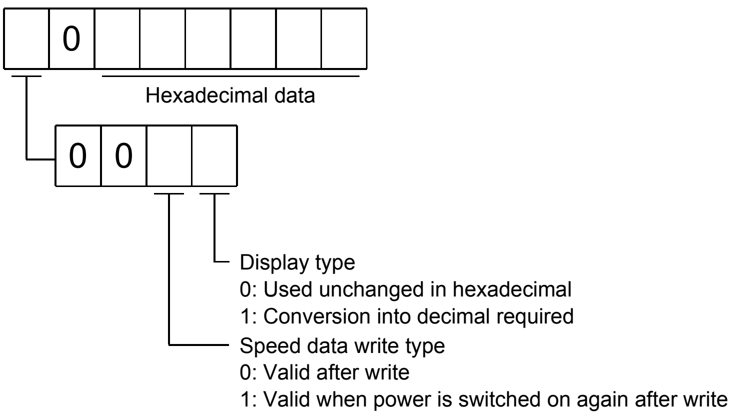
Read the speed data of the point table.

1) Transmission

Transmit command [5][0] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the speed data of the requested point table.



(c) Acceleration time constant

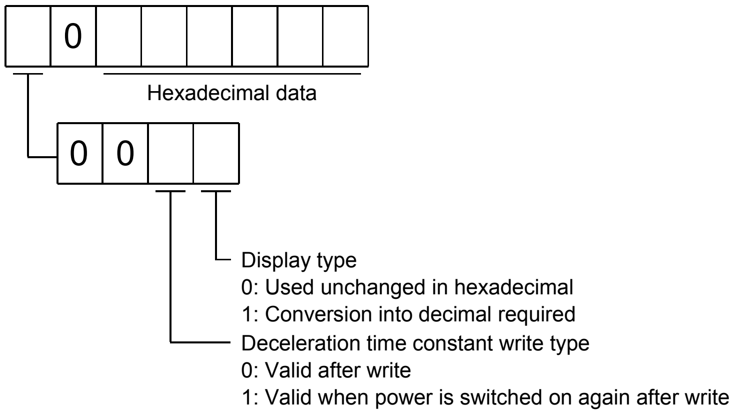
Read the acceleration time constant of the point table.

1) Transmission

Transmit command [5][4] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the acceleration time constant of the requested point table.



(d) Deceleration time constant

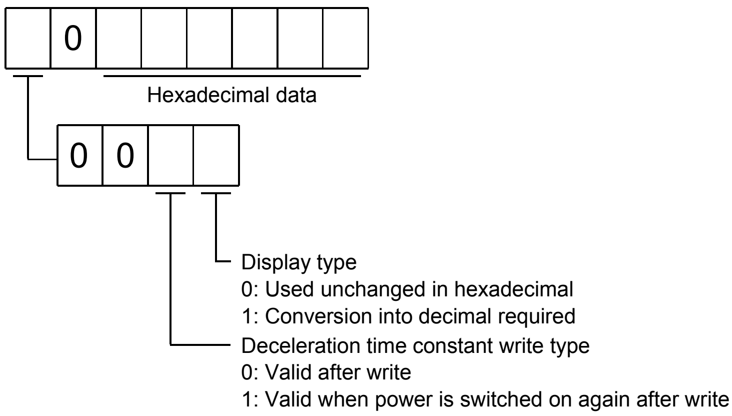
Read the deceleration time constant of the point table.

1) Transmission

Transmit command [5][8] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the deceleration time constant of the requested point table.



(e) Dwell

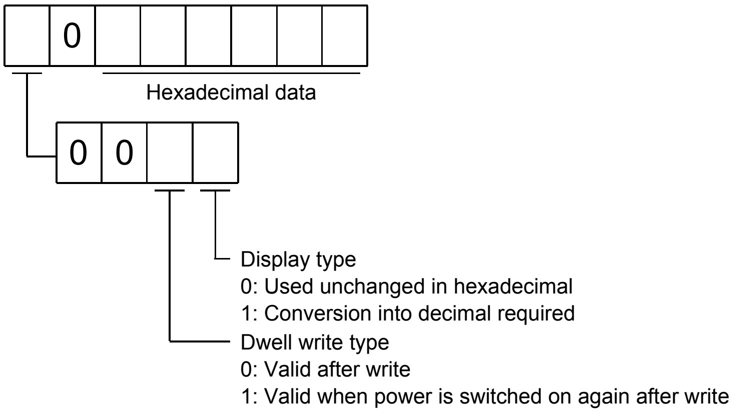
Read the dwell of the point table.

1) Transmission

Transmit command [6][0] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the dwell of the requested point table.



(f) Auxiliary function

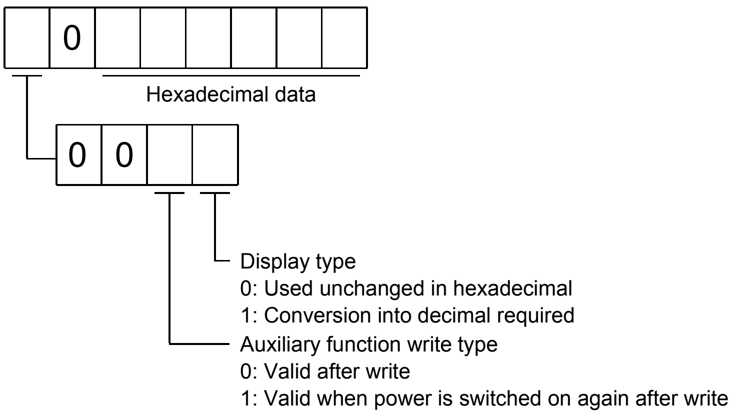
Read the auxiliary function of the point table.

1) Transmission

Transmit command [6][4] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the auxiliary function of the requested point table.



(g) M code

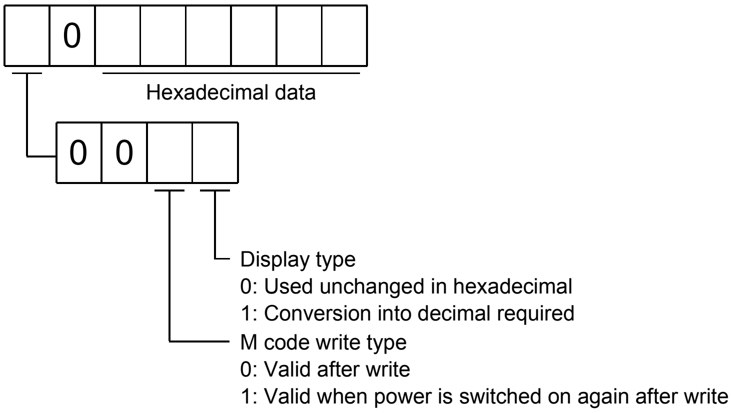
Read the M code of the point table.

1) Transmission

Transmit command [4][5] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the M code of the requested point table.



(2) Data write

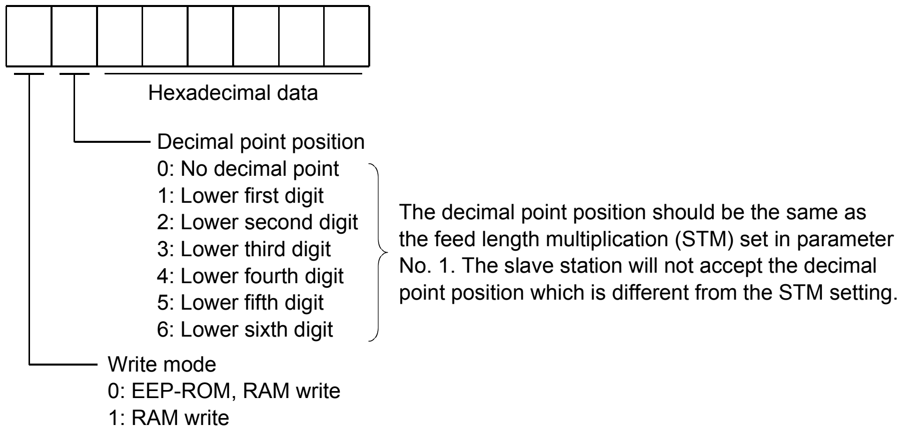
POINT
・If setting values need to be changed with a high frequency (i.e. one time or more per one hour), write the setting values to the RAM, not the EEP-ROM. The EEP-ROM has a limitation in the number of write times and exceeding this limitation causes the servo amplifier to malfunction. Note that the number of write times to the EEP-ROM is limited to approximately 100, 000.

(a) Position data

Write the position data of the point table.

Transmit command [C][0], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][0]	[0][1] to [F][F]	See below.



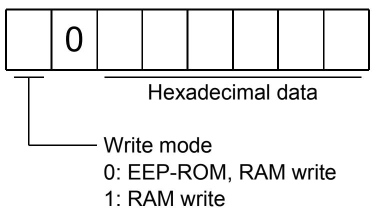
When the position data is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(b) Speed data

Write the speed data of the point table.

Transmit command [C][6], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][6]	[0][1] to [F][F]	See below.



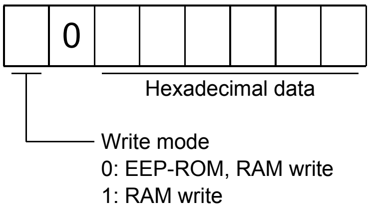
When the speed data is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(c) Acceleration time constant

Write the acceleration time constant of the point table.

Transmit command [C][7], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][7]	[0][1] to [F][F]	See below.



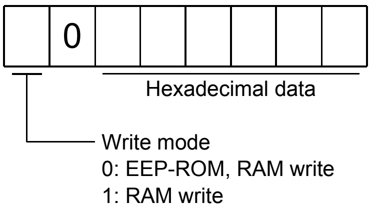
When the acceleration time constant is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(d) Deceleration time constant

Write the deceleration time constant of the point table.

Transmit command [C][8], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][8]	[0][1] to [F][F]	See below.



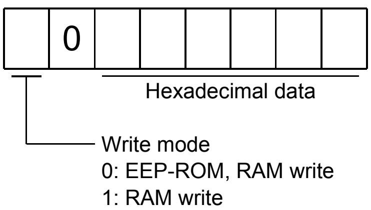
When the deceleration time is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(e) Dwell

Write the dwell of the point table.

Transmit command [C][A], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][A]	[0][1] to [F][F]	See below.



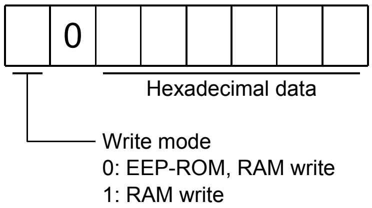
When the dwell constant is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(f) Auxiliary function

Write the auxiliary function of the point table.

Transmit command [C][B], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][B]	[0][1] to [F][F]	See below.



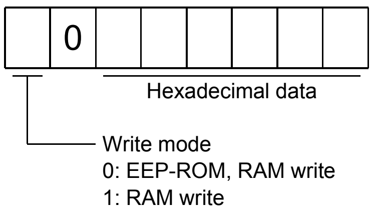
When the auxiliary function constant is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier.
When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(g) M code

Write the M code of the point table.

Transmit command [C][B], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][B]	[0][1] to [F][F]	See below.



When the M code constant is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier.
When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

14.5.12 Servo amplifier group designation

With group setting made to the slave stations, data can be transmitted simultaneously to two or more slave stations set as a group.

(1) Group setting write

Write the group designation value to the slave station.

(a) Transmission

Transmit command [9][F], data No. [0][0] and data.

Command	Data No.	Data
[9][F]	[0][0]	See below.

0		0	

Group designation
0: No group designation
1: Group a
2: Group b
3: Group c
4: Group d
5: Group e
6: Group f

Response command enable
Set whether data can be sent back or not in response to the read command of the master station.
0: Response disable
Data cannot be set back.
1: Response enable
Data can be set back.

(2) Group setting read

Read the set group designation value from the slave station.

(a) Transmission

Transmit command [1][F] and data No. [0][0].

Command	Data No.
[1][F]	[0][0]

(b) Reply

The slave station sends back the group setting of the point table requested.

0		0	

Group designation
0: No group designation
1: Group a
2: Group b
3: Group c
4: Group d
5: Group e
6: Group f

Response command enable
0: Response disable
1: Response enable

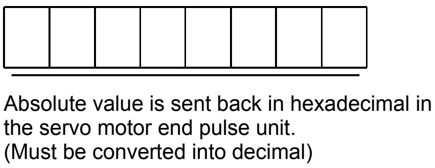
14.5.13 Other commands

(1) Servo motor end pulse unit absolute position
Read the absolute position in the servo motor end pulse unit.
Note that overflow will occur in the position of 8192 or more revolutions from the home position.

(a) Transmission
Send command [0][2] and data No. [9][0].

Command	Data No.
[0][2]	[9][0]

(b) Reply
The slave station sends back the requested servo motor end pulses.



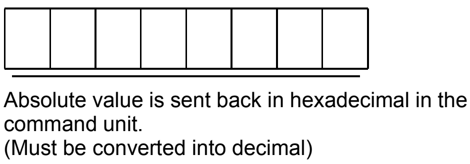
For example, data "000186A0" is 100000 [pulse] in the motor end pulse unit.

(2) Command unit absolute position
Read the absolute position in the command unit.

(a) Transmission
Send command [0][2] and data No. [9][1].

Command	Data No.
[0][2]	[9][1]

(b) Reply
The slave station sends back the requested command pulses.



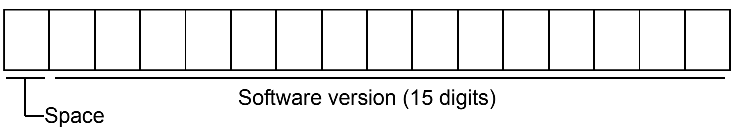
For example, data "000186A0" is 100000 [pulse] in the command unit.

(3) Software version
Reads the software version of the servo amplifier.

(a) Transmission
Send command [0][2] and data No.[7][0].

Command	Data No.
[0][2]	[7][0]

(b) Reply
The slave station returns the software version requested.



MEMO

App. 1 Parameter list

POINT

・For any parameter whose symbol is preceded by *, set the parameter value and switch power off once, then switch it on again to make that parameter setting valid.

Basic setting parameters (PA □□)		
No.	Symbol	Name
PA01	*STY	Control mode
PA02	*REG	Regenerative option
PA03	*ABS	Absolute position detection system
PA04	*AOP1	Function selection A-1
PA05	*FTY	Feeding function selection
PA06	*CMX	Electronic gear numerator
PA07	*CDV	Electronic gear denominator
PA08	ATU	Auto tuning
PA09	RSP	Auto tuning response
PA10	INP	In-position range
PA11	TLP	Forward torque limit
PA12	TLN	Reverse torque limit
PA13		For manufacturer setting
PA14	*POL	Rotation direction selection
PA15	*ENR	Encoder output pulses
PA16 to PA18		For manufacturer setting
PA19	*BLK	Parameter write inhibit

Gain/filter parameters (PB □□)		
No.	Symbol	Name
PB01	FILT	Adaptive tuning mode (Adaptive filter Ⅱ)
PB02	VRFT	Vibration suppression control filter tuning mode (Advanced vibration suppression control)
PB03		For manufacturer setting
PB04	FFC	Feed forward gain
PB05		For manufacturer setting
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation
PB11	VDC	Speed differential compensation
PB12		For manufacturer setting
PB13	NH1	Machine resonance suppression filter 1
PB14	NHQ1	Notch form selection 1
PB15	NH2	Machine resonance suppression filter 2
PB16	NHQ2	Notch form selection 2
PB17		Automatic setting parameter
PB18	LPF	Low-pass filter
PB19	VRF1	Vibration suppression control vibration frequency setting
PB20	VRF2	Vibration suppression control resonance frequency setting
PB21 PB22		For manufacturer setting
PB23	VFBF	Low-pass filter selection
PB24	*MVS	Slight vibration suppression control selection
PB25		For manufacturer setting
PB26	*CDP	Gain changing selection
PB27	CDL	Gain changing condition
PB28	CDT	Gain changing time constant
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment
PB30	PG2B	Gain changing position loop gain
PB31	VG2B	Gain changing speed loop gain
PB32	VICB	Gain changing speed integral compensation
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting
PB35 to PB45		For manufacturer setting

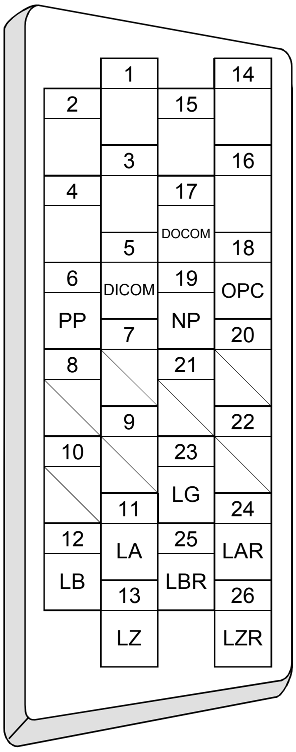
Extension setting parameters (PC □□)		
No.	Symbol	Name
PC01		For manufacturer setting
PC02	*ZTY	Home position return type
PC03	*ZDIR	Home position return direction
PC04	ZRF	Home position return speed
PC05	CRF	Creep speed
PC06	ZST	Home position shift distance
PC07	*ZPS	Home position return position data
PC08	DCT	Moving distance after proximity dog
PC09	ZTM	Stopper type home position return stopper time
PC10	ZTT	Stopper type home position return torque limit value
PC11	CRP	Rough match output range
PC12	JOG	Jog speed
PC13	*STC	S-pattern acceleration/deceleration time constant
PC14	*BKC	Backlash compensation
PC15		For manufacturer setting
PC16	MBR	Electromagnetic brake sequence output
PC17	ZSP	Zero speed
PC18	*BPS	Alarm history clear
PC19	*ENRS	Encoder output pulse selection
PC20	*SNO	Station number setting
PC21	*SOP	RS-422 communication function selection
PC22	*COP1	Function selection C-1
PC23		For manufacturer setting
PC24	*COP3	Function selection C-3
PC25		For manufacturer setting
PC26	*COP5	Function selection C-5
PC27		For manufacturer setting
PC28	*COP7	Function selection C-7
PC29 PC30		For manufacturer setting
PC31	LMPL	Software limit +
PC32	LMPH	
PC33	LMNL	Software limit −
PC34	LMNH	
PC35	TL2	Internal torque limit 2
PC36	*DMD	Status display selection
PC37	*LPPL	Position range output address +
PC38	*LPPH	
PC39	*LNPL	Position range output address −
PC40	*LNPH	
PC41 to PC50		For manufacturer setting

I/O setting parameters (PD □□)		
No.	Symbol	Name
PD01	*DIA1	Input signal automatic ON selection 1
PD02		For manufacturer setting
PD03	*DIA3	Input signal automatic ON selection 3
PD04	*DIA4	Input signal automatic ON selection 4
PD05		For manufacturer setting
PD06	*DI2	Input signal device selection 2 (CN6-2)
PD07	*DI3	Input signal device selection 3 (CN6-3)
PD08	*DI4	Input signal device selection 4 (CN6-4)
PD09	*DO1	Output signal device selection 1 (CN6-pin 14)
PD10	*DO2	Output signal device selection 2 (CN6-pin 15)
PD11	*DO3	Output signal device selection 3 (CN6-pin 16)
PD12 to PD15		For manufacturer setting
PD16	*DIAB	Input polarity selection
PD17 PD18		For manufacturer setting
PD19	*DIF	Response level setting
PD20	*DOP1	Function selection D-1
PD21		For manufacturer setting
PD22	*DOP3	Function selection D-2
PD23		For manufacturer setting
PD24	*DOP5	Function selection D-5
PD25 to PD30		For manufacturer setting

Option unit parameters (Po □□)		
No.	Symbol	Name
Po01		For manufacturer setting
Po02	*ODI1	MR-J3-D01 input signal device selection 1 (CN10-21, 26)
Po03	*ODI2	MR-J3-D01 input signal device selection 2 (CN10-27, 28)
Po04	*ODI3	MR-J3-D01 input signal device selection 3 (CN10-29, 30)
Po05	*ODI4	MR-J3-D01 input signal device selection 4 (CN10-31, 32)
Po06	*ODI5	MR-J3-D01 input signal device selection 5 (CN10-33, 34)
Po07	*ODI6	MR-J3-D01 input signal device selection 6 (CN10-35, 36)
Po08	*ODO1	MR-J3-D01 output signal device selection 1 (CN10-46, 47)
Po09	*ODO2	MR-J3-D01 output signal device selection 2 (CN10-48, 49)
Po10	*OOP1	Function selection O-1
Po11		For manufacturer setting
Po12	*OOP2	Function selection O-3
Po13	MOD1	MR-J3-D01 analog monitor output 1
Po14	MOD2	MR-J3-D01 analog monitor output 2
Po15	MO1	MR-J3-D01 analog monitor 1 offset
Po16	MO2	MR-J3-D01 analog monitor 2 offset
Po17 to Po20		For manufacturer setting
Po21	VCO	MR-J3-D01 override offset
Po22	TLO	MR-J3-D01 analog torque limit offset
Po23 to Po35		For manufacturer setting

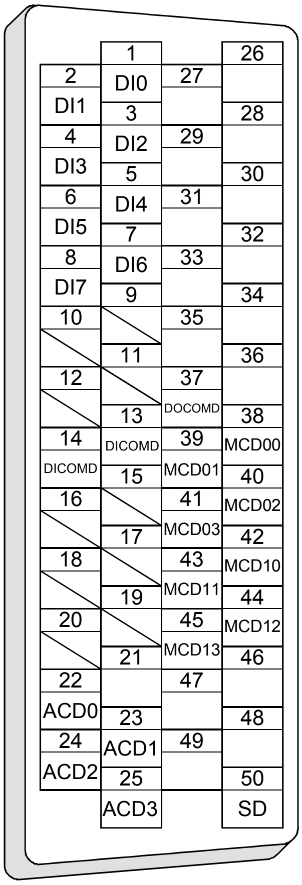
App. 2 Signal layout recording paper

CN6

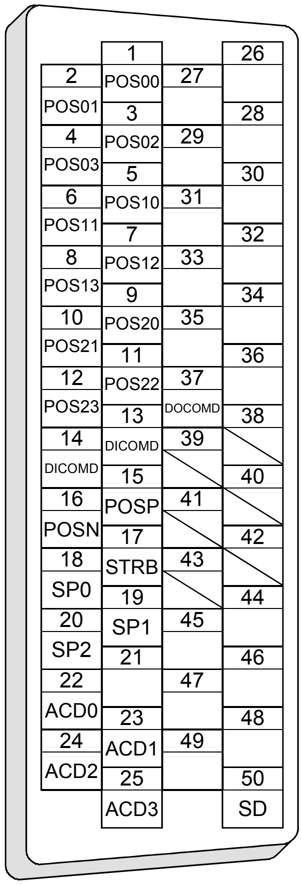


CN10

When using the point table



When using BCD input



App. 3 Change of connector sets to the RoHS compatible products

Connector sets (options) in the following table are changed to the RoHS compatible products after September, 2006 shipment.
Please accept that the current products might be mixed with RoHS compatible products based on availability.

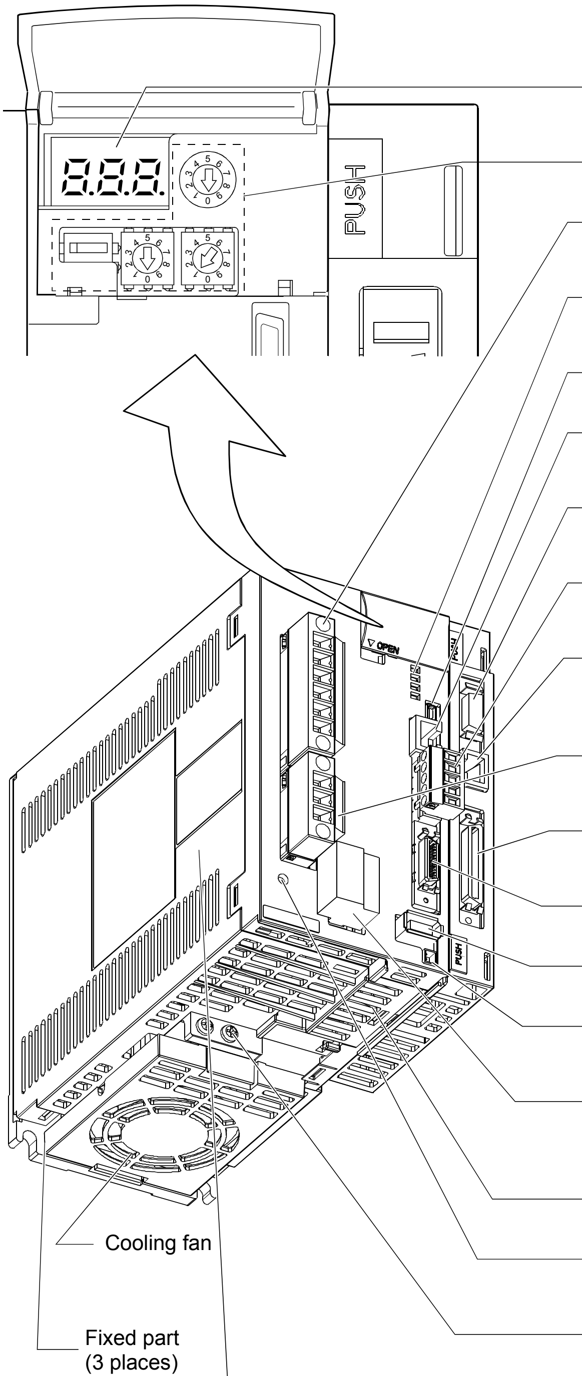
Model	Current Product	RoHS Compatible Product
MR-J3SCNS MR-ECNM	Amplifier connector (3M or equivalent of 3M) 36210-0100JL (Receptacle) (Note)	Amplifier connector (3M or equivalent of 3M) 36210-0100PL (Receptacle)
MR-PWCNS4	Power supply connector (DDK) CE05-6A18-10SD-B-BSS (Connector and Back shell) CE3057-10A-1 (D265) (Cable clump)	Power supply connector (DDK) CE05-6A18-10SD-D-BSS (Connector and Back shell) CE3057-10A-1-D (Cable clump)
MR-PWCNS5	Power supply connector (DDK) CE05-6A22-22SD-B-BSS (Connector and Back shell) CE3057-12A-1 (D265) (Cable clump)	Power supply connector (DDK) CE05-6A22-22SD-D-BSS (Connector and Back shell) CE3057-12A-1-D (Cable clump)
MR-PWCNS3	Power supply connector (DDK) CE05-6A32-17SD-B-BSS (Connector and Back shell) CE3057-20A-1 (D265) (Cable clump)	Power supply connector (DDK) CE05-6A32-17SD-D-BSS (Connector and Back shell) CE3057-20A-1-D (Cable clump)
MR-PWCNS1	Power supply connector (DDK) CE05-6A22-23SD-B-BSS (Connector and Back shell) CE3057-12A-2 (D265) (Cable clump)	Power supply connector (DDK) CE05-6A22-23SD-D-BSS (Connector and Back shell) CE3057-12A-2-D (Cable clump)
MR-PWCNS2	Power supply connector (DDK) CE05-6A24-10SD-B-BSS (Connector and Back shell) CE3057-16A-2 (D265) (Cable clump)	Power supply connector (DDK) CE05-6A24-10SD-D-BSS (Connector and Back shell) CE3057-16A-2-D (Cable clump)
MR-BKCN	Electromagnetic brake connector MS3106A10SL-4S(D190) (Plug, DDK)	Electromagnetic brake connector D/MS3106A10SL-4S(D190) (Plug, DDK)
MR-J2CMP2	Amplifier connector (3M or equivalent of 3M) 10126-3000VE (connector)	Amplifier connector (3M or equivalent of 3M) 10126-3000PE (connector)

Note. RoHS compatible 36210-0100FD may be packed with current connector sets.

App. 4 MR-J3-200T-RT servo amplifier

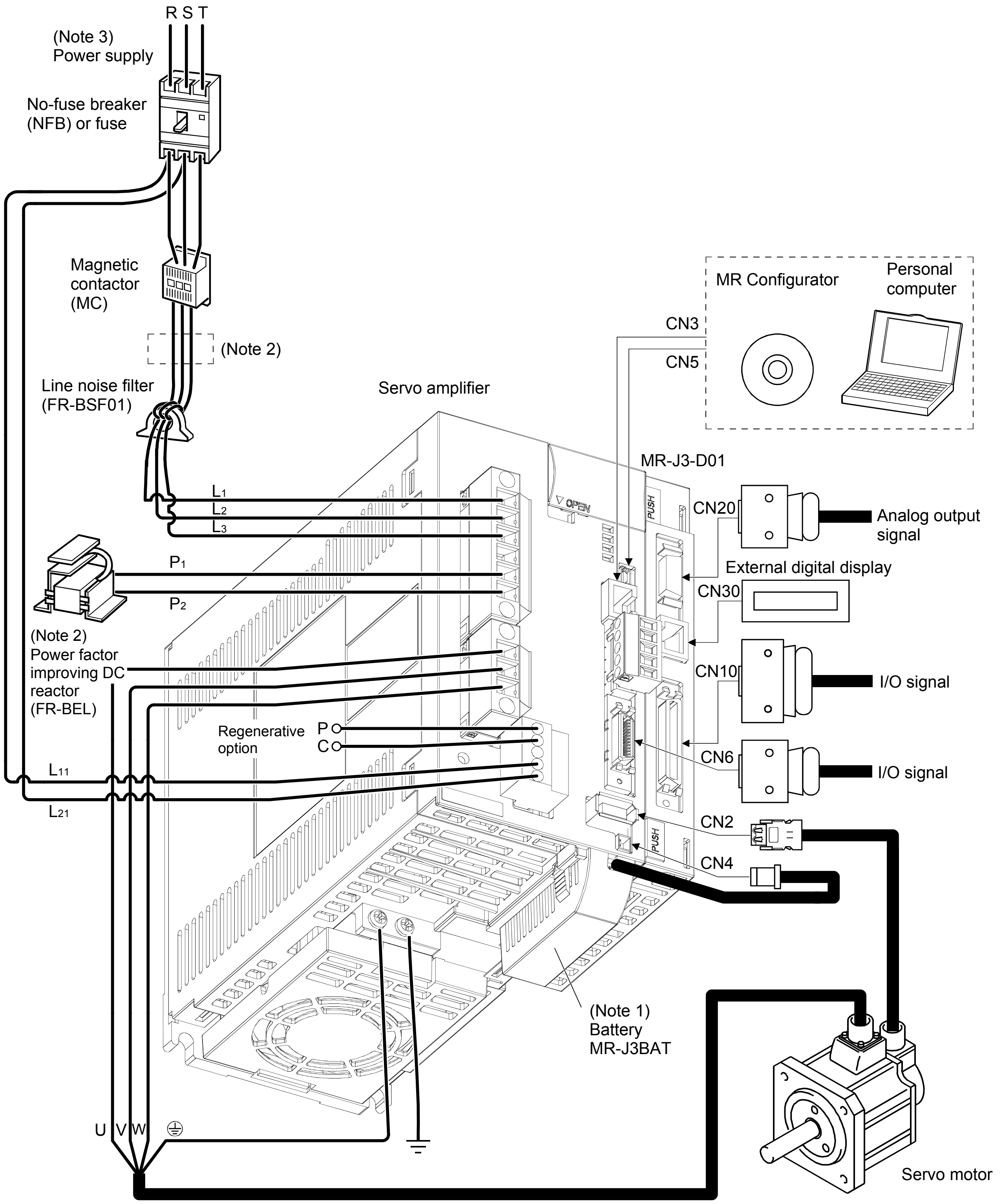
Connectors (CNP1, CNP2, and CNP3) and appearance of MR-J3-200T servo amplifier have been changed from June 2014 production. Model name of the existing servo amplifier is changed to MR-J3-200T-RT. The difference between new MR-J3-200T servo amplifier and existing MR-J3-200T-RT servo amplifier is described in this appendix. Sections within parentheses in the following sections indicate corresponding sections of the instruction manual.

App. 4.1 Parts identification (1.6.1 Parts identification)



Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 4.3 Chapter 10
When using in combination with MR-J3-D01, do not change the setting (default) shown in the figure.	
Main circuit power supply connector (CNP1) Used to connect the input power supply.	Section 3.1 Section 3.3 Section 11.1
Communication alarm display section When using in combination with MR-J3-D01, the LED display does not have any meaning.	
USB communication connector (CN5) Used to connect the personal computer.	Chapter 6
RS-422 communication connector (CN3) Used to connect the MR-PRU03 parameter unit or personal computer.	Chapter 6 Chapter 7 Chapter 14
Analog input connector (CN20) Used to connect the analog torque limit or override analog input signal.	
CC-Link connector (CN1) When using in combination with MR-J3-D01, this connector is not used. Do not connect anything to it.	
Digital display connector (CN30) Used to connect the MR-DP60 digital display. The MR-PRU03 parameter unit or a personal computer cannot be connected.	
Servo motor power connector (CNP3) Used to connect the servo motor.	Section 3.1 Section 3.3 Section 11.1
I/O signal connector (CN10) Used to connect the digital I/O signal or analog output signal.	
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 3.2 Section 3.4
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.10 Section 13.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 4.9 Section 13.7
Control circuit connector (CNP2) Used to connect the control circuit power supply/ regenerative ption.	Section 3.1 Section 3.3 Section 11.1 Section 13.2
Battery holder Contains the battery for absolute position data backup.	Section 4.9
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Protective earth (PE) terminal (⏚) Ground terminal.	Section 3.1 Section 3.3 Section 11.1
Rating plate	Section 1.4

App. 4.2 Configuration including auxiliary equipment (1.7 Configuration including auxiliary equipment)



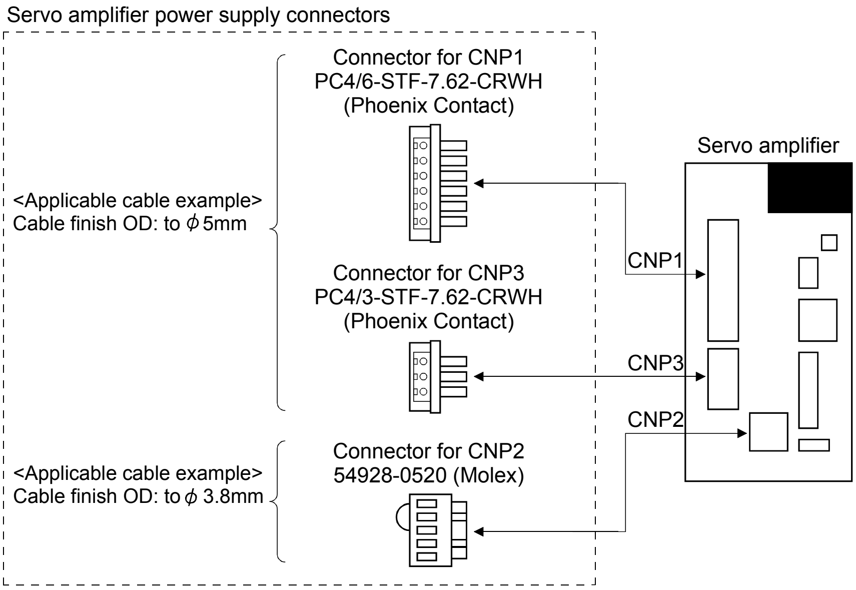
Note 1. The battery (option) is used for the absolute position detection system in the position control mode.

2. The AC reactor can also be used. In this case, the DC reactor cannot be used. When not using DC reactor, short P_1-P_2.

3. Refer to section 1.2 for the power supply specification.

App. 4.3 CNP1, CNP2, CNP3 wiring method (3.3.3 CNP1, CNP2, CNP3 wiring method)

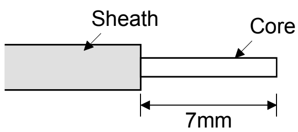
(a) Servo amplifier power supply connectors



(b) Termination of the cables

1) CNP1・CNP3

Solid wire: After the sheath has been stripped, the cable can be used as it is.



Twisted wire: Use the cable after stripping the sheath and twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

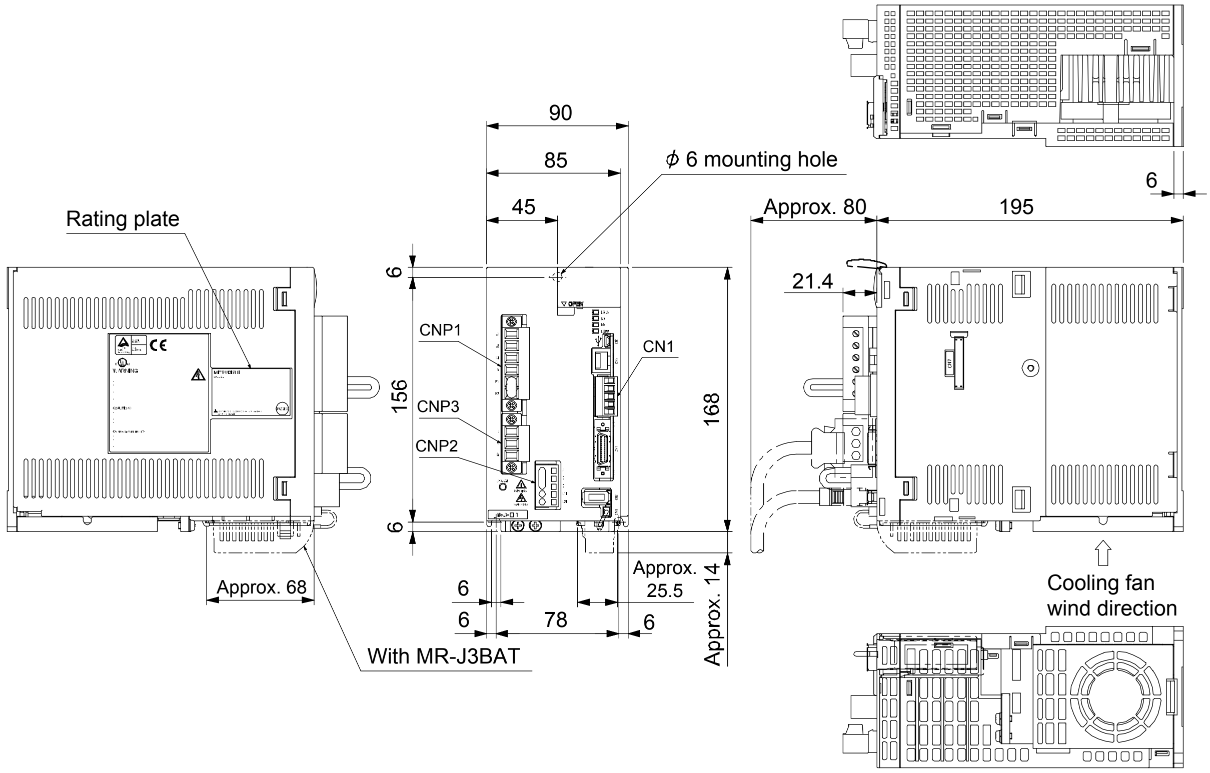
Cable size		Bar terminal type		Crimping tool	Manufacturer
[mm^2]	AWG	For 1 cable	For 2 cables		
1.25/1.5	16	AI1.5-8BK	AI-TWIN2×1.5-8BK	CRIMPFOX-ZA3	Phoenix Contact
2.0/2.5	14	AI2.5-8BU	AI-TWIN2×2.5-10BU		
3.5	12	AI4-10Y			

2) CNP2

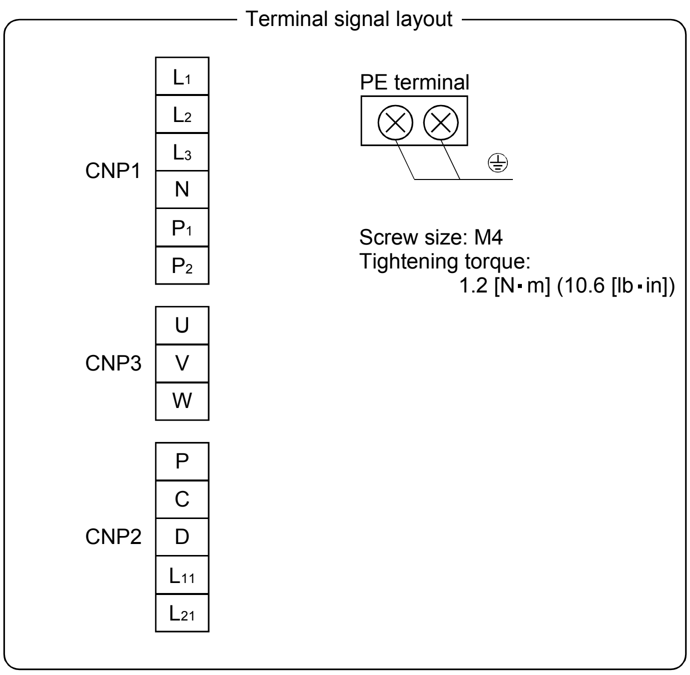
CNP2 is the same as MR-J3-100T or smaller capacities. Refer to section 3.3.3 (1) (b).

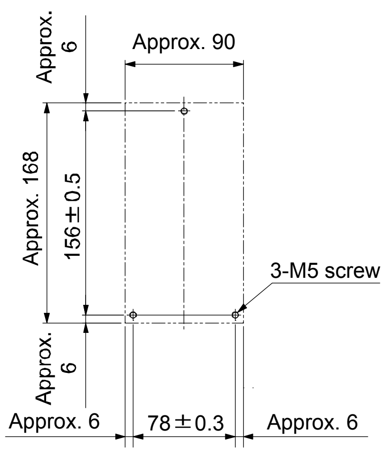
App. 4.4 OUTLINE DRAWINGS (Chapter 11 OUTLINE DRAWINGS)

[Unit: mm]



Mass: 2.3 [kg] (5.07 [lb])





Mounting hole process drawing

Mounting screw
Screw size: M5
Tightening torque: 3.24[N・m] (28.7[lb・in])

App. 5 Selection example of servo motor power cable

POINT

- Selection condition of wire size is as follows.

  Wire length: 30m or less

- Depending on the cable selected, there may be cases that the cable does not fit into the Mitsubishi optional or recommended cable clamp. Select a cable clamp according to the cable diameter.

Selection example when using the 600V grade EP rubber insulated chloroprene sheath cab-tire cable (2PNCT) for servo motor power (U, V, and W) is indicated below.

Servo motor	Wire size [mm^2]
HF-SP52	1.25
HF-SP102	1.25
HF-SP152	2
HF-SP202	2
HF-SP352	3.5
HF-SP502	5.5
HF-SP702	8
HF-SP51	1.25
HF-SP81	1.25
HF-SP121	2
HF-SP201	2
HF-SP301	3.5
HF-SP421	5.5
HF-SP524	1.25
HF-SP1024	1.25
HF-SP1524	2
HF-SP2024	2
HF-SP3524	2
HF-SP5024	3.5
HF-SP7024	5.5
HC-RP103	2

Servo motor	Wire size [mm^2]
HC-RP153	2
HC-RP203 (Note)	3.5
HC-RP353 (Note)	5.5
HC-RP503 (Note)	5.5
HC-LP52	1.25
HC-LP102	1.25
HC-LP152	2
HC-LP202	3.5
HC-LP302	5.5
HC-UP72	1.25
HC-UP152	2
HC-UP202	3.5
HC-UP352	5.5
HC-UP502	5.5
HA-LP601	8
HA-LP801	14
HA-LP12K1	14
HA-LP15K1	22
HA-LP20K1	38
HA-LP25K1	38
HA-LP701M	8

Servo motor	Wire size [mm^2]
HA-LP11K1M	14
HA-LP15K1M	22
HA-LP22K1M	38
HA-LP502	5.5
HA-LP702	8
HA-LP11K2	14
HA-LP15K2	22
HA-LP22K2	22
HA-LP6014	5.5
HA-LP8014	5.5
HA-LP12K14	8
HA-LP15K14	14
HA-LP20K14	14
HA-LP701M4	5.5
HA-LP11K1M4	8
HA-LP15K1M4	14
HA-LP22K1M4	14
HA-LP11K24	8
HA-LP15K24	14
HA-LP22K24	14

Note. Use a composite cable and others when combining with wiring of the electromagnetic brake power in the same cable.

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Data	*Manual Number	Revision	
Jun. 2006	SH(NA)030061-A	First edition	
Oct. 2007	SH(NA)030061-B	Servo amplifiers MR-J3-60T4 to 22KT4 are added	
		Servo motors HF-SP524/1024/1524/2024/3524/5024/7024 are added	
		Servo motor HA-LP6014/701M4 are added	
		Compliance with EC directives in EU	MR-J3-60T4 to MR-J3-22KT4 are added
		Compliance with UL/C-UL standard	MR-J3-60T4 to MR-J3-22KT4 are added
		Section 1.1.2	Note on cooling fan is added
		Section 1.5	Servo motor combination table is added
		Section 1.6.1	Motor power supply connector is changed to servo motor power connector
		Section 1.7	Note is added with the power supply indication change
		Section 2.1 (1)(b)	“POINT” detail is changed
		Section 3.1	Note on stepdown transformer is added
		Section 3.3.3 (3)	Wiring for MR-J3-200T ▪ 350T4 is added as (3)
		Section 3.3.3 (4)	Insertion of cable into WAGO JAPAN connector is added
		Section 3.3.3 (5)	Insertion of cable into Phoenix Contact connector is changed
		Section 3.5.4	Permissible current is added to −12VDC power supply description
		Section 3.8.1	Error in the diagram is corrected
		Section 3.10.2 (2)(a), (3)(a)	400V class motor is added to the servo motor signal description
		Section3.11.3	Note on shutting off the circuit is deleted
		Section 4.5.2 (2)(C)	Timing chart is revised
		Section 5.1.4	80 to 87 are added to the parameter No.PA02 setting value
		Section 6.1	Compatible version is added to the table
		Section 10.4	Added
		Section 11.2	Connector model is changed due to compliance with RoHS
		Section 12.1	Layout of the figure is changed
		Section 12.2	400V class is added
		Section 12.3	Dynamic brake time constant for 400V class, and load inertia moment ratio are added. Calculation and graphs are in the section 12.3.1, and permissible load inertia moment is in section12.3.2
		Section 12.5	Inrush currents for 400V class are added
		Section 13.1.1	Connector model and shape are changed due to compliance with RoHS
		Section 13.1.1 2)	MR-J3-200T4 ▪ 350T4 connector is added
		Section 13.1.2	Connector model and shape are changed due to compliance with RoHS
		Section 13.2 (1)	Regenerative options for 400V class are added
		Section 13.2 (2)(b)	Contents of the table are revised
		Section 13.2 (3)	80 to 87 are added to the parameter No.PA02 setting value
		Section 13.2 (4)	Regenerative options for 400V class are added
		Section 13.2 (5)(b), (c)	Variable dimensions and description are added due to the MR-RB34-4 and MR-RB54-4 addition
		Section 13.2 (5)	Description added

Print Data	*Manual Number	Revision	
Oct. 2007	SH(NA)030061-B	Section 13.3	Brake unit is changed to FR-BU2-(H) brake unit
		Section 13.4 (2)	Note on stepdown transformer is added
		Section 13.4 (3)	FR-RC-H15K, FR-RC-H30K, and FR-RC-H55K are added
		Section 13.4 (4)	FR-RC-H15K, FR-RC-H30K, and FR-RC-H55K are added
		Section 13.5 (3)(b)	Note on stepdown transformer is added
		Section 13.5 (4)(b) 2)	Wire size selection is changed
		Section 13.5 (6)	JIS indication is deleted
		Section 13.6 (2)	Connection example circuit is changed and note on stepdown transformer is added Parameter No. for Dynamic brake (DB) is revised
		Section 13.7 (3)	Outline drawing is added
		Section 13.16 (2)	Error on the figure for selection example is corrected
		Section 13.19 (1)	Description of the setting is changed
		App. 6	Change of connector sets to the RoHS compatible products is added
Feb. 2008	SH(NA)030061-C	Safety Instructions	
		1. To prevent electric shock	Partial change of sentence
		2. To prevent fire	Partial change of sentence
		4. Additional Instructions	
		(1) Transportation and installation	Partial change of sentence
		(2) Wiring	Sentence is added
		CONFORMANCE WITH UL/C-UL STANDARD	
		(3) Short circuit	Current values changed
		<<About the wires used for wiring>>	Addition
		Section 1.2 (1)	MR-J3-200T capacity changed
		Section 1.4.1	MR-J3-200 appearance changed
		Section 1.6.1 (2)	MR-J3-200T appearance changed Note added
		Section 1.7 (3)	MR-J3-200T appearance changed Note added
		Section 2.1 (1)(b)	POINT Change of sentence
		Section 3.3.3 (2)	Addition of MR-J3-200T Note added
		Section 3.10.2 (3)(a)	Note 1 changed
		Section 3.10.2 (3)(b)	Drawing of terminal box inside (HA-LP601(4), 701M(4), 11K2(4)) changed
		Section 4.3 (2)	Indication list added Note 1 added
		Section 4.5.2 (2)(b) 1)	Drawing of “Positioning that reverses the direction midway” changed
		Section 5.1.13 (3)	Drawing changed
		Section 6.2	Personal computer specifications changed. Note 3 added RS-422/232C converter FA-T-RS40VS (Mitsubishi Electric Engineering) deleted
		Section 10.2.2	Parameter error (A37) definition added
		Section 11.1 (5)	MR-J3-200T drawing changed Point added
		Section 13.1.1 2)	MR-J3-200T terminal block configuration changed Applicable cable size for terminal block produced by WAGO JAPAN changed

Print Data	*Manual Number	Revision	
Feb. 2008	SH(NA)030061-C	Section 13.1.3 (2)	Note added
		Section 13.1.4 (2)	Note added
		Section 13.5 (4)	POINT addition
		Section 13.5 (4)(b) 1)	Wire size changed
		Section 13.6 (3)	Note in table added
		Section 13.9	600V grade heat-resistance PVC insulated wire (HIV cable) added
		Section 13.10	Fuse class (K5 class) in table changed
		Section 13.11	Note in table added
		Section 14.1	RS-422/232C converter FA-T-RS40VS (Mitsubishi Electric Engineering) deleted
		App. 4	Addition
		App. 5	Addition
Oct. 2008	SH(NA)030061-D	Section 3.8.3 (2)	Change of diagram
Jun. 2014	SH(NA)030061-E	Section 13.2 (4)(c)	CAUTION is added.

Country/Region	Sales office	Tel/Fax
USA	MITSUBISHI ELECTRIC AUTOMATION, INC. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A.	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, C.P.54030, México	Tel : +52-55-9171-7600 Fax : +52-55-9171-7649
Brazil	MITSUBISHI ELECTRIC DO BRASIL COMÉRCIO E SERVIÇOS LTDA. Rua Jussara, 1750- Bloco B Anexo, Jardim Santa Cecilia, CEP 06465-070, Barueri - SP, Brasil	Tel : +55-11-4689-3000 Fax : +55-11-4689-3016
Germany	MITSUBISHI ELECTRIC EUROPE B.V. German Branch Gothaer Strasse 8, D-40880 Ratingen, Germany	Tel : +49-2102-486-0 Fax : +49-2102-486-1120
UK	MITSUBISHI ELECTRIC EUROPE B.V. UK Branch Travellers Lane, 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 Rubí, 76-80-Apdo. 420, 08173 Sant Cugat del Vallés (Barcelona), Spain	Tel : +34-935-65-3131 Fax : +34-935-89-1579
France	MITSUBISHI ELECTRIC EUROPE B.V. French Branch 25, Boulevard des Bouvets, F-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 Praha5, 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 : +48-12-630-47-00 Fax : +48-12-630-47-01
Russia	MITSUBISHI ELECTRIC EUROPE B.V. Russian Branch St. Petersburg office Piskarevsky pr. 2, bld 2, lit "Sch", BC "Benua", office 720; RU-195027 St. Petersburg, Russia	Tel : +7-812-633-3497 Fax : +7-812-633-3499
Turkey	MITSUBISHI ELECTRIC TURKEY A.Ş Ümraniye Branch Şerifali Mahallesi Nutuk Sokak No:5 TR-34775 Ümraniye, İstanbul, Türkey	Tel : +90-216-526-3990 Fax : +90-216-526-3995
South Africa	ADROIT TECHNOLOGIES 20 Waterford Office Park, 189 Witkoppen Road, ZA-Fourways, South Africa	Tel : +27-11-658-8100 Fax : +27-11-658-8101
China	MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD. No.1386 Hongqiao Road, Mitsubishi Electric Automation Center, Changning District, 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, R.O.C.	Tel : +886-2-2299-2499 Fax : +886-2-2299-2509
Korea	MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD. 1480-6, Gayang-Dong, Gangseo-Gu, Seoul, 157-200, 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 State, India	Tel : +91-20-2710-2000 Fax : +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

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;
- (i) 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 responsibility for compensation against loss of opportunity, secondary loss, etc.

Whether under or after the term of warranty, we assume no responsibility for any damages arisen from causes for which we are not responsible, any losses of opportunity and/or profit incurred by you due to a failure of the Product, any damages, secondary damages or compensation for accidents arisen under a specific circumstance that are foreseen or unforeseen by our company, any damages to products other than the Product, and also compensation for any replacement work, readjustment, start-up test run of local machines and the Product and any other operations conducted by you.

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.

SH(NA)030061-E

MODEL	
MODEL CODE	

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BLDG MARUNOUCHI TOKYO 100-8310

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