MITSUBISHI
ELECTRIC

General-Purpose AC Servo

MELSERVO-J3W Series

SSCNETⅢ interface 2-axis AC Servo Amplifier

MODEL

MR-J3W-□B

SERVO AMPLIFIER
INSTRUCTION MANUAL

● 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 (Vol.2) 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. 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.

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 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 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.
- Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier and servo motor.
- Always connect a no-fuse breaker to the power supply of the servo amplifier.

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 mass.
- Stacking in excess of the specified number of products is not allowed.
- Do not carry the servo motor by the cables, shaft or encoder.
- 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.
- Do not block the intake and exhaust areas of the servo amplifier. Doing so may cause faults.
- Do not drop or strike servo amplifier or servo motor. Isolate from all impact loads.
- Securely attach the servo motor to the machine. If attach insecurely, the servo motor may come off during operation.
- The servo motor with a 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.
- 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, contact your local sales office.
- When you keep or use it, please fulfill the following environmental conditions.

<table>
<tr><th colspan="3" rowspan="2">Items</th><th colspan="3">Environmental conditions</th></tr>
<tr><th colspan="2">Servo amplifier</th><th>Servo motor</th></tr>
<tr><td rowspan="4">Ambient temperature</td><td rowspan="2">In operation</td><td>[°C]</td><td colspan="2">0 to 55 (non-freezing)</td><td>0 to 40 (non-freezing)</td></tr>
<tr><td>[°F]</td><td colspan="2">32 to 131 (non-freezing)</td><td>32 to 104 (non-freezing)</td></tr>
<tr><td rowspan="2">In storage</td><td>[°C]</td><td colspan="2">−20 to 65 (non-freezing)</td><td>−15 to 70 (non-freezing)</td></tr>
<tr><td>[°F]</td><td colspan="2">−4 to 149 (non-freezing)</td><td>5 to 158 (non-freezing)</td></tr>
<tr><td rowspan="2">Ambient humidity</td><td colspan="2">In operation</td><td colspan="2">90%RH or less (non-condensing)</td><td>80%RH or less (non-condensing)</td></tr>
<tr><td colspan="2">In storage</td><td colspan="3">90%RH or less (non-condensing)</td></tr>
<tr><td colspan="3">Ambience</td><td colspan="3">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="3">Max. 1000m above sea level</td></tr>
<tr><td colspan="3" rowspan="3">(Note)
Vibration</td><td rowspan="3">5.9 m/s^2 or less at 10 to 55Hz (directions of X, Y and Z axes)</td><td>HF-MP series　HF-KP series</td><td>X, Y: 49 m/s^2</td></tr>
<tr><td>HF-SP51 · 52　HC-UP72</td><td>X, Y: 24.5 m/s^2</td></tr>
<tr><td>HC-LP52</td><td>X: 9.8 m/s^2　Y: 24.5 m/s^2</td></tr>
</table>

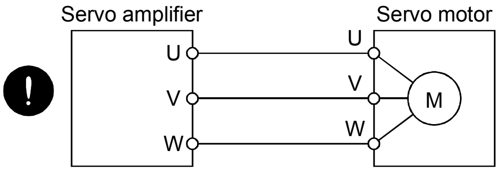
Note. Except the servo motor with a reduction gear.

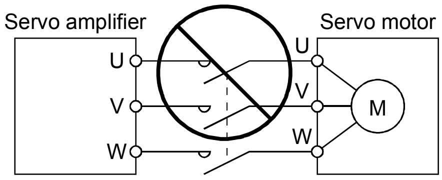
- When treating the servo amplifier be careful about the edged parts such as the corners of the servo amplifier.
- The servo amplifier must install in the metal cabinet (control box).

(2) Wiring

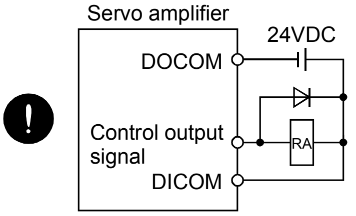
⚠ CAUTION

- 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 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. Not doing so may cause unexpected operation.
- 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.

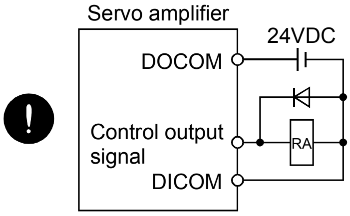




- Do not connect AC power directly to the servo motor. Otherwise, a fault may occur.
- The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



For the sink output interface



For the source output interface

- 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.

(4) Usage

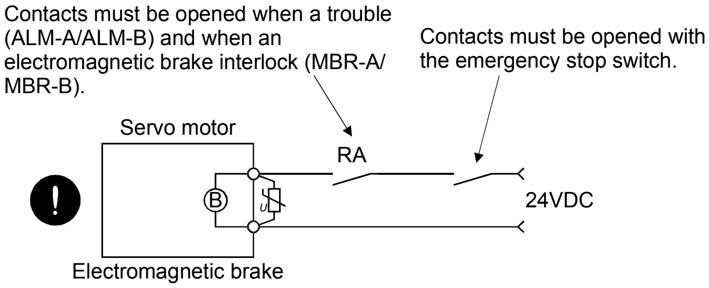
⚠ CAUTION

- Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately.
- 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 an electromagnetic brake or an external brake mechanism for the purpose of prevention.
- Configure a electromagnetic brake circuit so that it is activated also by an external emergency stop switch.



- When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation.
- 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 contact your local sales office.

(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.

● DISPOSAL OF WASTE ●

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

⚠ EEP-ROM life

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

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

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 THE EUROPEAN EC DIRECTIVES

Refer to Appendix 3 for the compliance with EC Directives.

COMPLIANCE WITH UL/CSA STANDARD

Refer to Appendix 4 for the compliance with UL/CSA standard.

<<About the manuals>>

This Instruction Manual and the following Servo Amplifier/Servo Motor Instruction Manuals (Vol.2) are required if you use the General-Purpose AC servo MR-J3W-☐B for the first time. Always purchase them and use the MR-J3W-☐B safely.

Relevant manuals

Manual name	Manual No.
MELSERVO-J3W Series Instructions and Cautions for Safe Use of AC Servos	IB(NA)0300148
MELSERVO Servo Motor Instruction Manual (Vol.2)	SH(NA)030041
EMC Installation Guidelines	IB(NA)67310

<<Wiring>>

Wires mentioned in this instruction manual are selected based on the ambient temperature of 40℃ (104℉).

MEMO

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MEMO

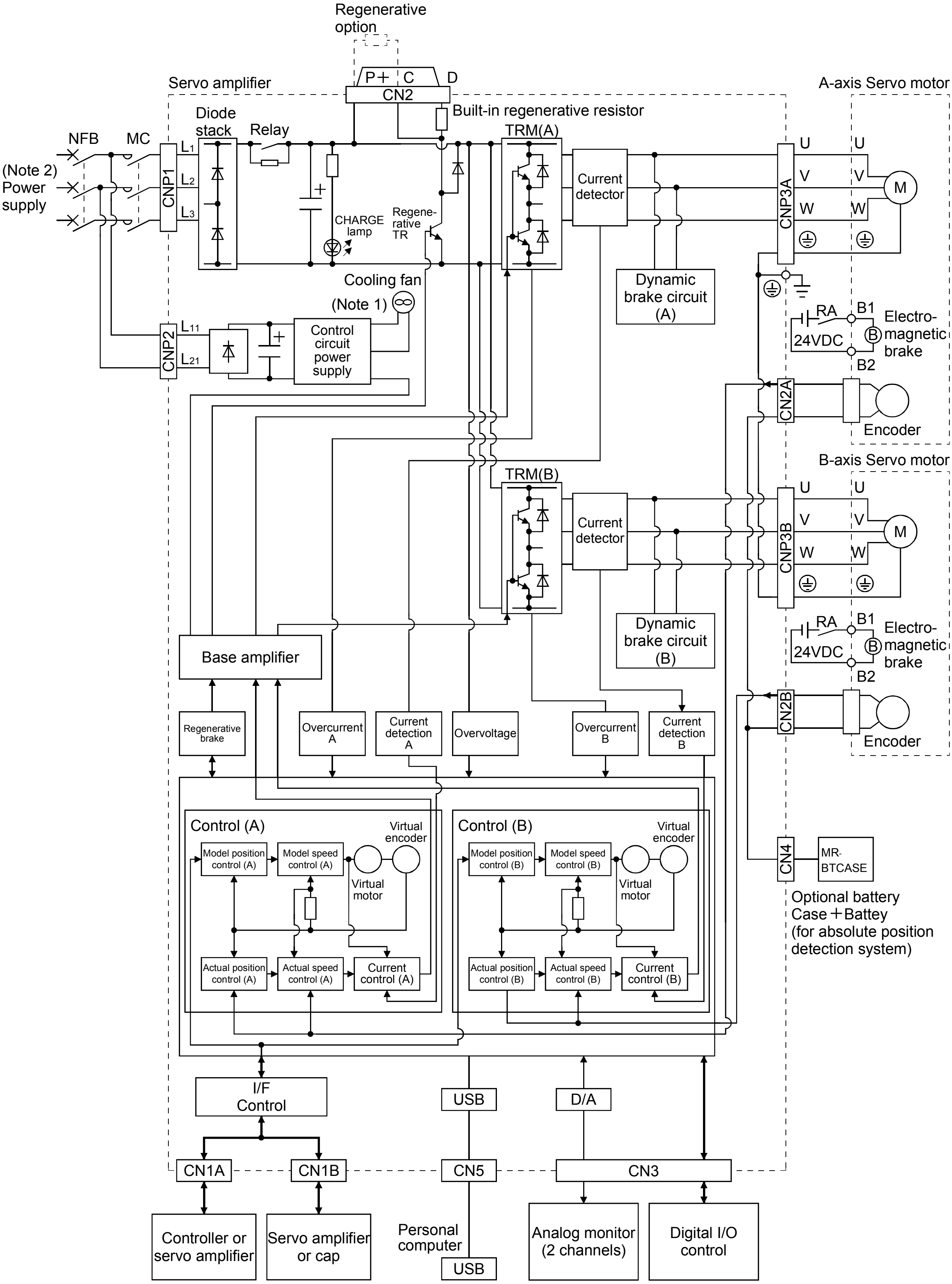
1. FUNCTIONS AND CONFIGURATION

1.1 Summary

The Mitsubishi AC servo amplifier MELSERVO-J3W series is an AC servo that requires less space, less wiring, and less energy while it maintains high performance, functionality and usability of MELSERVO-J3-B.
Two servo motors can be driven by this MR-J3W servo amplifier. Driving two servo motors by one MR-J3W servo amplifier cuts down the installation area compared to the area required for two MR-J3 servo amplifiers. Side-by-side installation is also available, making the system more compact.
Integrated 2-axis structure allows two axes to share the same SSCNETⅢ cable, control circuit power cable, and main circuit power cable, cutting down the wiring area.
The capacitor in the MELSERVO-J3W series is re-charged, doubling the reusable energy compared to it of the MELSERVO-J3 series. Regenerative energy is generated during deceleration of a servo motor. By reusing that energy, much energy is saved. Depending on the operating condition, the regenerative option may be disabled. The MR-J3W-77B servo amplifier has a 100W regenerative resistor built in, making the regenerative option unnecessary even for a large regenerative load.
By simply shifting the switch, a rotary servo motor or a linear servo motor can be used for each axis for the MR-J3W servo amplifier. A rotary servo motor and a linear servo motor with different capacities can be connected to the MR-J3W-22B and MR-J3W-44B servo amplifier axes.
Using MELSERVO-J3W makes the linear servo motor structure simple and the equipment compact with high performance. Using MELSERVO-J3W also saves the space.
As explained above, integrated 2-axis structure, multi-function, and improved regeneration efficiency reduce the required parts for a servo system.

1.2 Function block diagram

The function block diagram of this servo is shown below.



Note 1. MR-J3W-22B dose not have a cooling fan.

2. For 1-phase 200 to 230VAC, connect the power supply to L_1, L_2 and leave L_3 open. Refer to section 1.3 for the power supply specification.

1.3 Servo amplifier standard specifications

Servo amplifier MR-J3W-☐ Item		22B		44B		77B	
Rated output capacity		A-axis 200W	B-axis 200W	A-axis 400W	B-axis 400W	A-axis 750W	B-axis 750W
Output	Rated voltage	3-phase 170VAC					
	Rated current [A]	1.5	1.5	2.8	2.8	5.8	5.8
Main circuit power supply	Voltage, frequency	3-phase or 1-phase 200 to 230VAC, 50/60Hz				3-phase 200 to 230VAC, 50/60Hz	
	Rated current [A]	3.5		6.1		10.4	
	Permissible voltage fluctuation	3-phase or 1-phase 200 to 230VAC: 170 to 253VAC				3-phase 170 to 253VAC	
	Permissible frequency fluctuation	Within±5%					
	Power supply capacity	Refer to section 10.2					
	Inrush current	Refer to section 10.5					
Control circuit power supply	Voltage, frequency	1-phase 200 to 230VAC, 50/60Hz					
	Rated current [A]	0.4					
	Permissible voltage fluctuation	1-phase 170 to 253VAC					
	Permissible frequency fluctuation	Within±5%					
	Power consumption [W]	55					
	Inrush current	Refer to section 10.5					
Interface power supply	Voltage	24VDC±10%					
	Power supply capacity [A]	(Note 1) 0.25					

Item / Servo amplifier MR-J3W-☐				22B	44B	77B
Condenser's charging energy	Reusable regenerative energy (Note 3) [J]			17	22	46
	Rotary servo motor's inertia moment equivalent to permissible charging amount (Note 4) [× 10^{-4}kg・m^2]			3.45	4.46	9.32
	Linear servo motor's mass equivalent to permissible charging amount (Note 5) [kg]			8.5	11.0	23.0
Control system				Sine-wave PWM control, current control system		
Built-in regenerative resistor [W]				10		100
Dynamic brake				Built-in		
Protective functions				Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal relay), servo motor overheat protection, encoder error protection, regenerative error protection, undervoltage, instantaneous power failure protection, overspeed protection, excessive error protection.		
Structure				Self-cooled, open (IP rating: IP00)	Force-cooling, open (IP rating: IP00)	
Side-by-side installation				○	○ (Note 2)	○
Environmental conditions	Ambient temperature	In operation	[°C]	(Note 2) 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 at 10 to 55Hz (X, Y and Z directions)		
Mass	[kg]			1.4		2.3
	[lb]			3.09		5.07

Note 1. 0.25A is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points.

2. When closely mounting MR-J3W-44B, operate them at 90% or smaller effective load ratio.

3. For the rotary servo motor, the reusable regenerative energy is a energy that occurs when a machine with a moment inertia equivalent to permissible charging amount decelerates from the rated speed to a stop. For the linear servo motor, the reusable regenerative energy is a energy that occurs when a machine with mass equivalent to permissible charging amount decelerates from the maximum speed to a stop.

4. This value is inertia moment when decelerating rotary servo motor from the rated speed to a stop. When decelerating two axes simultaneously, the inertia moment is a total of two axes. When not decelerating two axes simultaneously, the inertia moment is for one axis.

5. This value is mass when decelerating linear servo motor from the rated speed to a stop. The mass includes a mass of primary side (coil). When decelerating two axes simultaneously, the mass is a total of two axes. When not decelerating two axes simultaneously, the mass is for one axis.

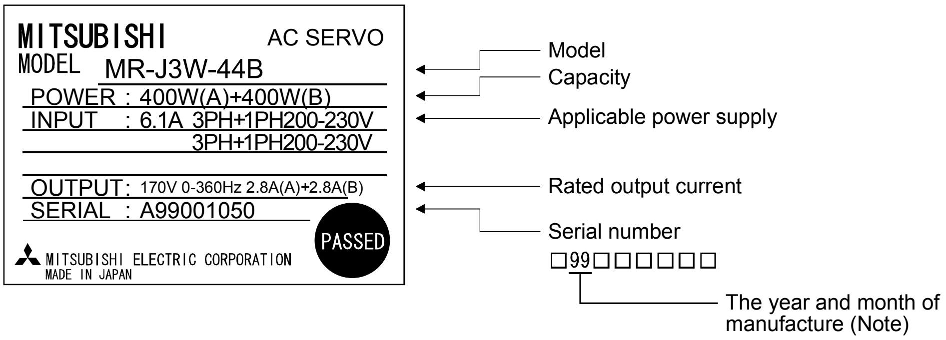
1.4 Function list

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

Function	Description	Reference
High-resolution encoder	High-resolution encoder of 262144 pulses/rev is used as a servo motor encoder.	
Absolute position detection system	Merely setting a home position once makes home position return unnecessary at every power-on.	Chapter 12
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 7.5
Low-pass filter	Suppresses high-frequency resonance which occurs as servo system response is increased.	Section 7.4
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
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	Chapter 6
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 11.2
Alarm history clear	Alarm history is cleared.	Parameter No.PC21
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 4.5.1 (1) (d)
Test operation mode	JOG operation・positioning operation・DO forced output However, MR Configurator is necessary for positioning operation.	Section 4.5
Analog monitor output	Servo status is output in terms of voltage in real time.	Parameter No.PC09
MR Configurator	Using a personal computer, parameter setting, test operation, status display, etc. can be performed.	Section 11.4

1.5 Model code definition

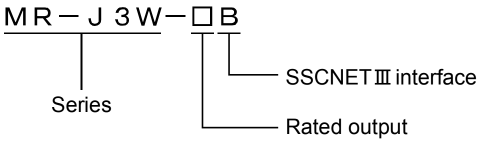
(1) Rating plate



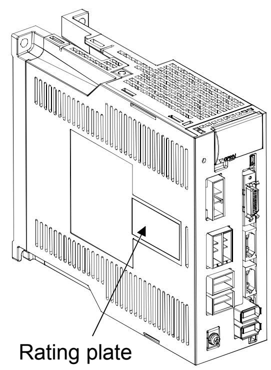
MITSUBISHI AC SERVO
MODEL MR-J3W-44B
POWER : 400W(A)+400W(B)
INPUT : 6.1A 3PH+1PH200-230V
3PH+1PH200-230V
OUTPUT: 170V 0-360Hz 2.8A(A)+2.8A(B)
SERIAL : A99001050
MITSUBISHI ELECTRIC CORPORATION
MADE IN JAPAN

Note. Production year and month of the servo amplifier are indicated in a serial number on the rating plate. 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 September 2009, the Serial No. is like, "SERIAL: □99□□□□□□".

(2) Model



Symbol	Rated outpur[W]	
	A-axis	B-axis
22	200	200
44	400	400
77	750	750



1.6 Combination with servo motor

POINT

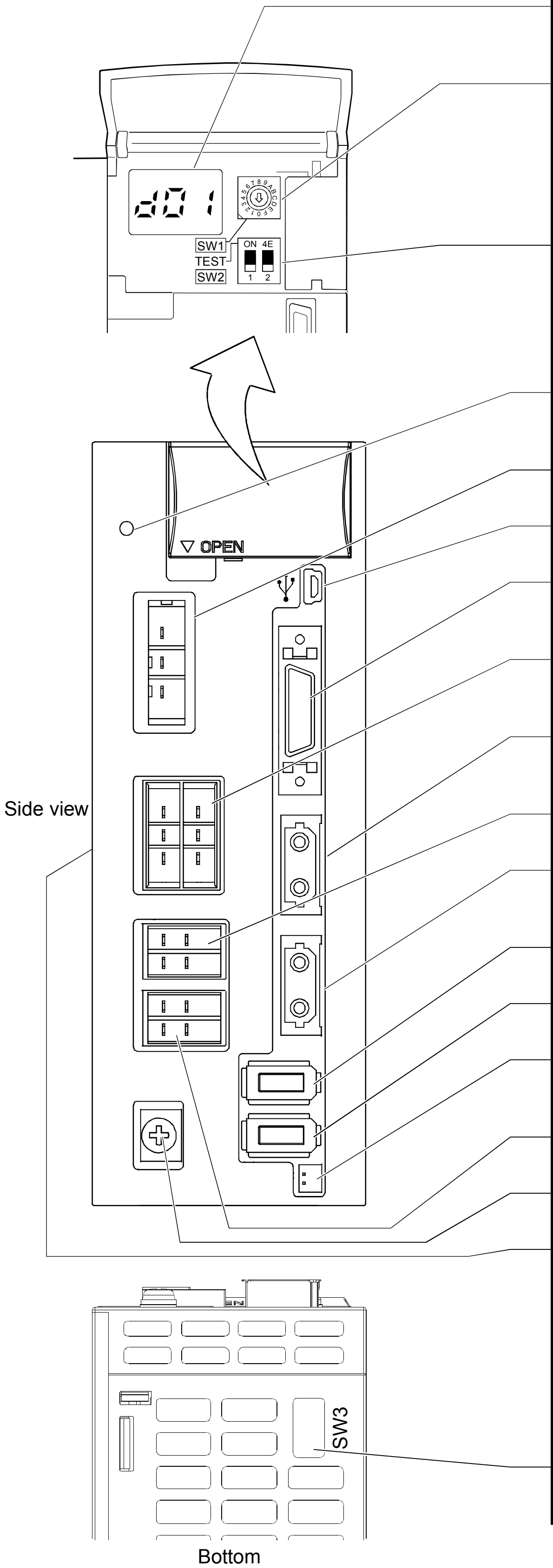
- Refer to section 13.3.2 for the combinations with linear servo motors.

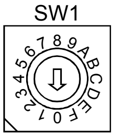
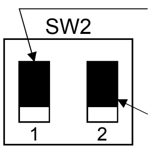
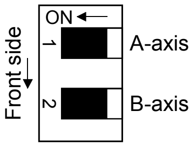
The following table lists combinations of servo amplifiers and servo motors. The same combinations apply to the models with an electromagnetic brake and the models with a reduction gear.

Servo amplifier	Axis	Servo motor				
		HF-MP	HF-KP	HF-SP	HC-LP	HC-UP
MR-J3W-22B	A	053 13 23	053 13 23			
	B					
MR-J3W-44B	A	053 (Note) 13 (Note) 23 43	053 (Note) 13 (Note) 23 43			
	B					
MR-J3W-77B	A	43 (Note)	43 (Note)	51 (Note)	52 (Note)	72 (Note)
	B	73	73	52 (Note)		

Note. This servo motor can be used by setting "□□1□" to parameter No.Po04.

1.7 Parts identification



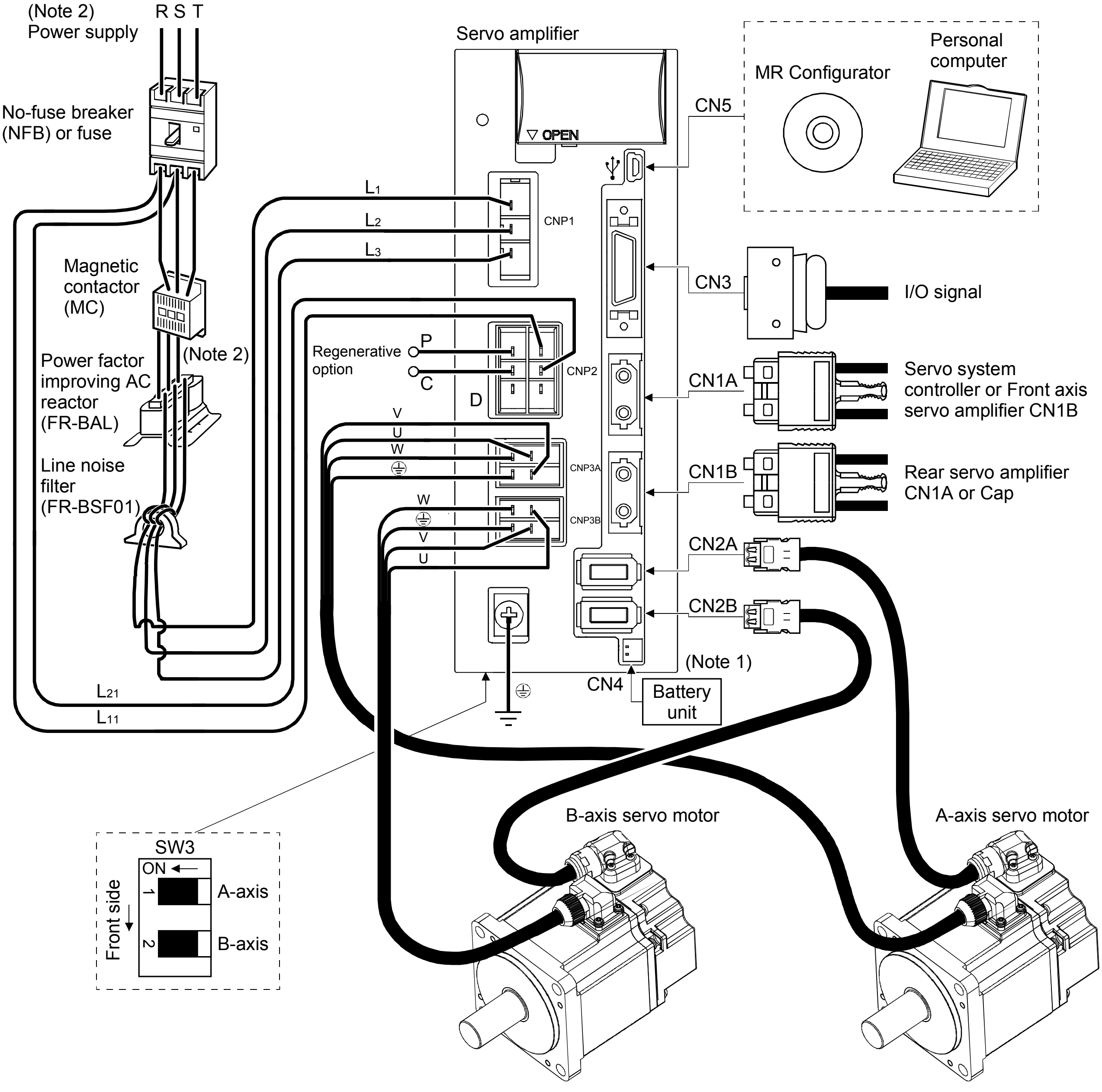
Name/Application	Detailed explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 4.3
Rotary axis setting switch (SW1)  Used to set the axis No. of servo amplifier.	Section 3.13
 Test operation select switch (SW2-1) Used to perform the test operation mode by using MR Configurator. For manufacturer setting (Be sure to set to the "Down" position).	
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Main circuit power supply connector (CNP1) Connect the input power supply.	Section 3.1 Section 3.3
USB communication connector (CN5) Connect the personal computer.	Section 11.4
I/O signal connector (CN3) Used to connect digital I/O signals. More over an analog monitor is output.	Section 3.2 Section 3.4
Control circuit connector (CNP2) Connect the control circuit power supply/regenerative option.	Section 3.1 Section 3.3
SSCNETⅢ cable connector (CN1A) Used to connect the servo system controller or the front axis servo amplifier.	Section 3.2 Section 3.4
A-axis servo motor power connector (CNP3A) Connect the A-axis servo motor.	Section 3.1 Section 3.3
SSCNETⅢ cable connector (CN1B) Used to connect the rear axis servo amplifier. For the final axis, puts a cap.	Section 3.2 Section 3.4
A-axis servo motor encoder connector (CN2A) Used to connect the A-axis servo motor encoder.	Section 3.4 Section 11.1
B-axis servo motor encoder connector (CN2B) Used to connect the B-axis servo motor encoder.	
Battery connector (CN4) Used to connect the battery for absolute position data backup. Battery is not required in fully closed control.	Section 11.3 Chapter 12
B-axis servo motor power connector (CNP3B) Connect the B-axis servo motor.	Section 3.1 Section 3.3
Protective earth (PE) terminal (⏚) Ground terminal.	
Rating plate	Section 1.5
Servo motor selection switch (SW3)  Used to select the servo motor to be used. OFF: Rotary servo motor ON : Linear servo motor	Section 3.14

1.8 Configuration including auxiliary equipment

⚠ CAUTION	・Connecting an incorrect servo amplifier to CNP3A, CNP3B, CN2A, or CN2B causes unexpected movement or an alarm.

POINT

- Equipment other than the servo amplifier and the servo motor are optional or recommended products.
- To use a rotary servo motor, turn SW3 off (factory setting).



Note 1. A battery unit consists of one MR-BTCASE battery case and eight MR-BAT batteries. Use the battery unit in the absolute position detection system of the position control mode. (Refer to section 12.3.)

2. For 1-phase 200V to 230VAC, connect the power supply to L_1 ・ L_2 and leave L_3 open. Refer to section 1.3 for the power supply specification.

2. INSTALLATION

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

⚠CAUTION	- Stacking in excess of the limited number of products is not allowed. - Install the equipment on incombustible material. Installing them directly or close to combustibles will lead 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 1.3.) - Provide an adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier. - Do not block the intake and exhaust areas of the servo amplifier. Doing so may cause faults. - Do not drop or strike the servo amplifier. Isolate from all impact loads. - Do not install or operate the servo amplifier which has been damaged or has any parts missing. - Do not install or operate a faulty servo amplifier. - When the product has been stored for an extended period of time, contact your local sales office. - When treating the servo amplifier, be careful about the edged parts such as the corners of the servo amplifier. - The servo amplifier must install in the metal cabinet (control box).

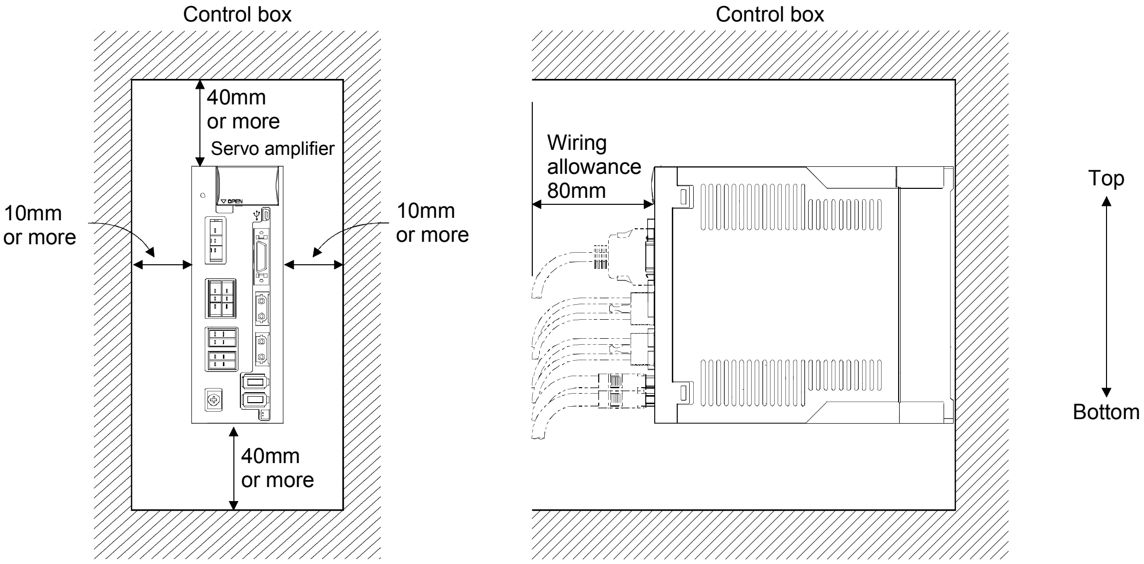
2.1 Installation direction and clearances

⚠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.

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.

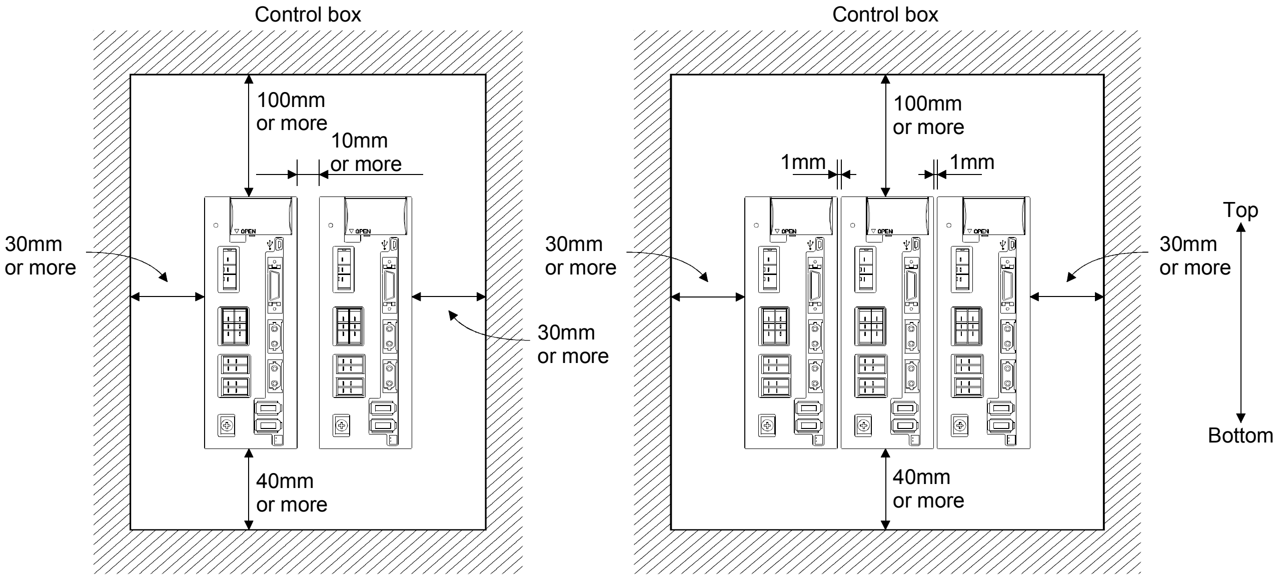
(1) Installation of one servo amplifier



(2) Installation of two or more servo amplifiers

POINT
▪ MR-J3W-☐B can be installed side-by-side. However, use MR-J3W-44B with the effective load ratio of 90% or less.

Leave a large clearance between the inner surface of a control box and the servo amplifier to circulate air above and below the servo amplifier.
When installing the servo amplifiers closely, leave a clearance of 1mm between the adjacent servo amplifiers in consideration of mounting tolerances.



Leaving clearance

Mounting closely

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 10.4 for the flexing life.

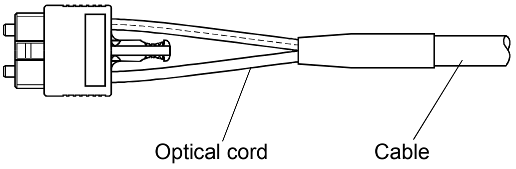
2.4 SSCNETⅢ cable laying

SSCNETⅢ cable is made from optical fiber. If optical fiber is added a power such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or breaks, and optical transmission will not be available. Especially, as optical fiber for MR-J3BUS□M・MR-J3BUS□M-A is made of synthetic resin, it melts down if being left near the fire or high temperature. Therefore, do not make it touched the part, which becomes high temperature, such as radiator or regenerative option of servo amplifier.
Read described item of this section carefully and handle it with caution.

(1) Minimum bend radius
Make sure to lay the cable with greater radius than the minimum bend radius. Do not press the cable to edges of equipment or others. For SSCNETⅢ cable, the appropriate length should be selected with due consideration for the dimensions and arrangement of servo amplifier. When closing the door of control box, pay careful attention for avoiding the case that SSCNETⅢ cable is hold down by the door and the cable bend becomes smaller than the minimum bend radius.
For the minimum bend radius, refer to section 11.1.5.

(2) Prohibition of vinyl tape use

Migrating plasticizer is used for vinyl tape. Keep the MR-J3BUS☐M, and MR-J3BUS☐M-A cables away from vinyl tape because the optical characteristic may be affected.



SSCNETⅢ cable	Cord	Cable
MR-J3BUS☐M	△	
MR-J3BUS☐M-A	△	△
MR-J3BUS☐M-B	○	○

△: Phthalate ester plasticizer such as DBP and DOP may affect optical characteristic of cable.

○: Cable is not affected by plasticizer.

(3) Precautions for migrating plasticizer added materials

Generally, soft polyvinyl chloride (PVC), polyethylene resin (PE) and Teflon (fluorine resin) contain non-migrating plasticizer and they do not affect the optical characteristic of SSCNETⅢ cable.

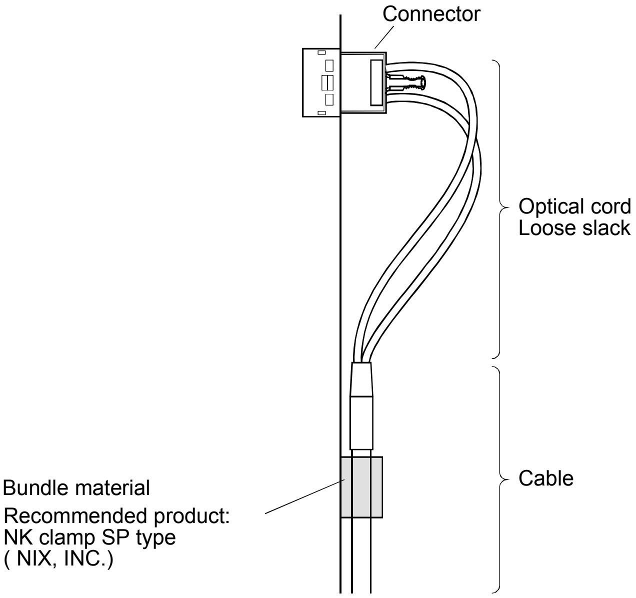
However, some wire sheaths and cable ties, which contain migrating plasticizer (phthalate ester), may affect MR-J3BUS☐M and MR-J3BUS☐M-A cables.

In addition, MR-J3BUS☐M-B cable is not affected by plasticizer.

(4) Bundle fixing

Fix the cable at the closest part to the connector with bundle material in order to prevent SSCNETⅢ cable from putting its own weight on CN1A・CN1B connector of servo amplifier. Optical cord should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted. When bundling the cable, fix and hold it in position by using cushioning such as sponge or rubber which does not contain migratable plasticizers.

If using adhesive tape for bundling the cable, fire resistant acetate cloth adhesive tape 570F (Teraoka Seisakusho Co., Ltd) is recommended.



(5) Tension

If tension is added on optical cable, the increase of transmission loss occurs because of external force which concentrates on the fixing part of optical fiber or the connecting part of optical connector. At worst, the breakage of optical fiber or damage of optical connector may occur. For cable laying, handle without putting forced tension. For the tension strength, refer to section 11.1.5.

(6) Lateral pressure
If lateral pressure is added on optical cable, the optical cable itself distorts, internal optical fiber gets stressed, and then transmission loss will increase. At worst, the breakage of optical cable may occur. As the same condition also occurs at cable laying, do not tighten up optical cable with a thing such as nylon band (TY-RAP).
Do not trample it down or tuck it down with the door of control box or others.

(7) Twisting
If optical fiber is twisted, it will become the same stress added condition as when local lateral pressure or bend is added. Consequently, transmission loss increases, and the breakage of optical fiber may occur at worst.

(8) Disposal
When incinerating optical cable (cord) used for SSCNETⅢ, hydrogen fluoride gas or hydrogen chloride gas which is corrosive and harmful may be generated. For disposal of optical fiber, request for specialized industrial waste disposal services who has incineration facility for disposing hydrogen fluoride gas or hydrogen chloride gas.

2.5 Inspection items

⚠WARNING	・Before wiring or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, 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.

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

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

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

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

2.6 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 emergency stop times: 100,000 times
	Cooling fan	50,000 to 70,000 hours (2 to 3 years)
	Absolute position battery	Refer to section 12.2

(1) 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 (40℃ (104℉) surrounding air temperature or less).

(2) 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 emergency stop times is 100,000, which depends on the power supply capacity.

(3) Servo amplifier cooling fan

The cooling fan bearings reach the end of their life in 50,000 to 70,000 hours. Normally, therefore, the fan must be changed in seven or eight years of continuous operation as a guideline.

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

The life of the servo amplifier cooling fan applies under an environment of an average ambient temperature of 40℃ (104℉) a year, and a corrosive gas-free, flammable gases-free, an oil-mist-free, and a dust-free environment.

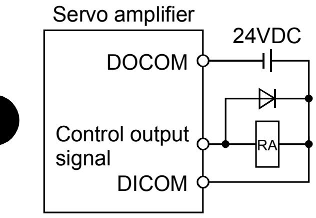
3. SIGNALS AND WIRING

WARNING

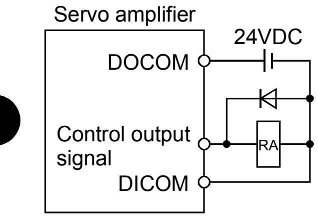
- Any person who is involved in wiring should be fully competent to do the work.
- Before wiring or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, always confirm from the front of the servo amplifier, 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 for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



For the sink output interface



For the source output interface

- 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 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.

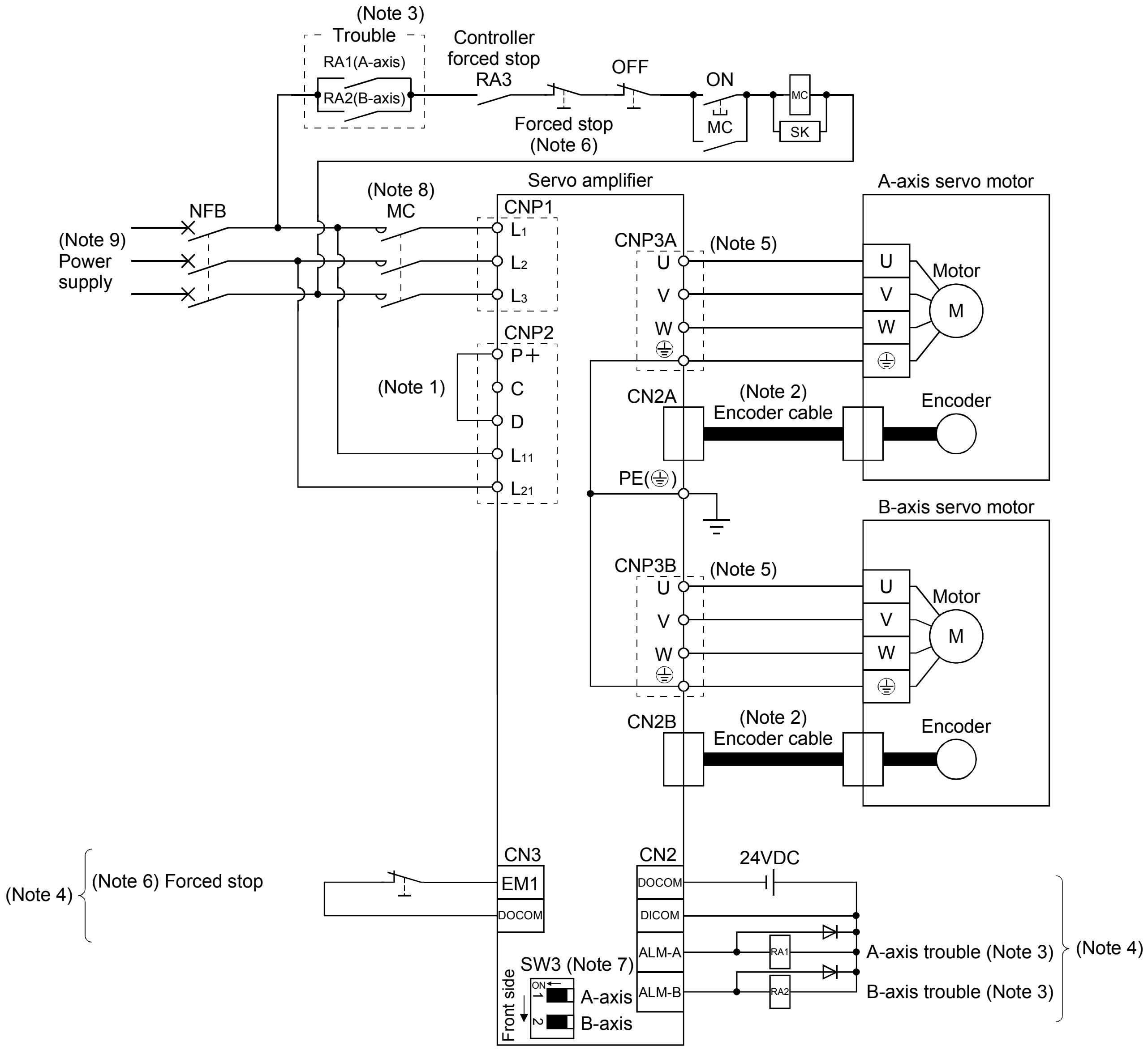
3.1 Input power supply circuit

CAUTION	
⚠ CAUTION	･Always connect a magnetic contactor 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 is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions. ･Shut off the main circuit power supply when alarms are occurring in both of the A-axis and the B-axis. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

POINT

- Even if alarm has occurred, do not switch off the control circuit power supply. When the control circuit power supply has been switched off, optical module does not operate, and optical transmission of SSCNETⅢ communication is interrupted. Therefore, the servo amplifier on the rear axis displays "AA" at the indicator and turns into base circuit shut-off. The servo amplifier stops with starting dynamic brake.

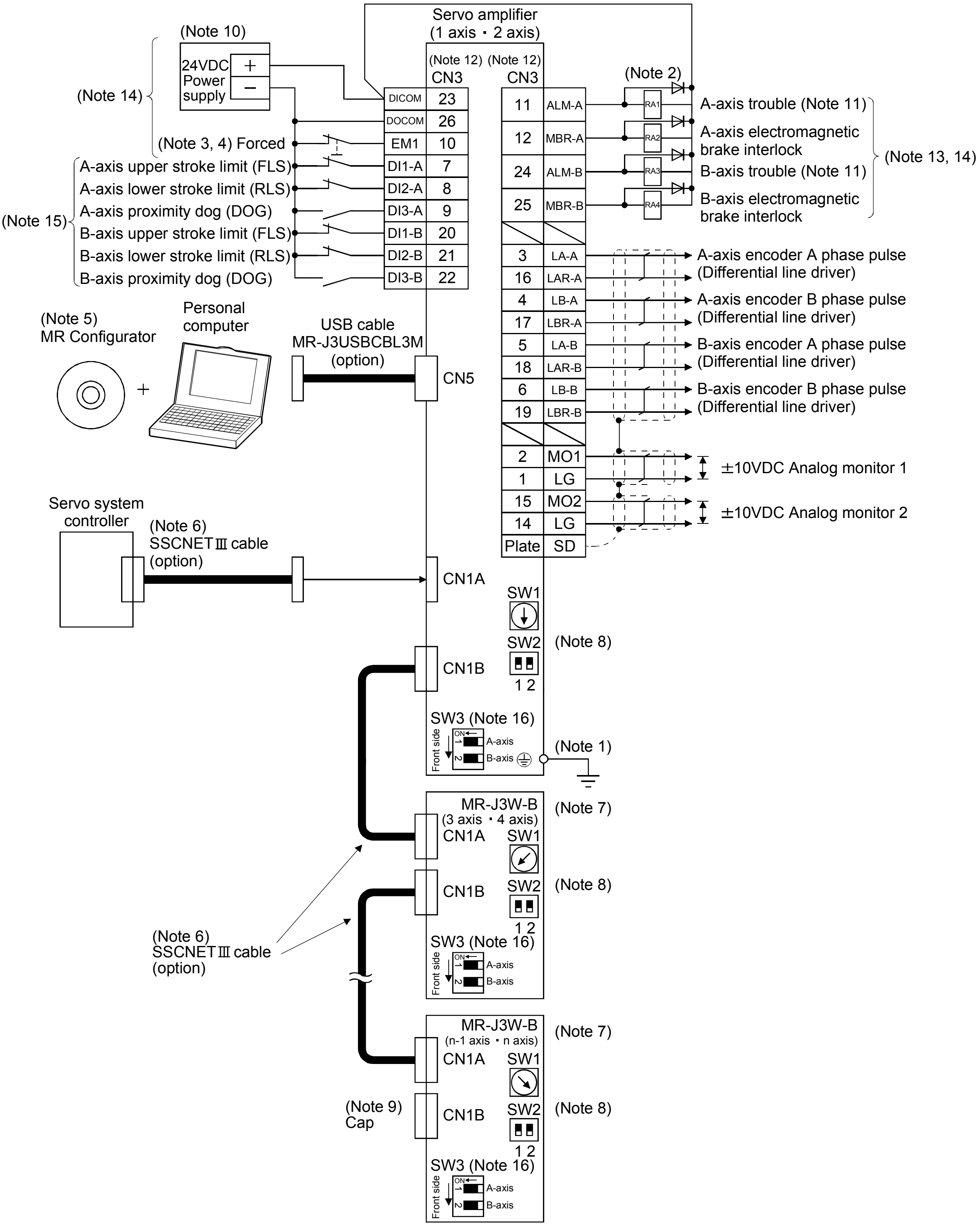
Wire the power supply/main circuit as shown below so that power is shut off and the servo-on command turned off as soon as an alarm occurs, a servo forced stop is made valid, or a controller forced stop is made valid. A no-fuse breaker (NFB) must be used with the input cables of the main circuit power supply.



Note 1. Always connect P+ and D. When using the regenerative option, refer to section 11.2.

2. For the encoder cable, use of the option cable is recommended. Refer to section 11.1 for selection of the cable.
3. If deactivating output of trouble (ALM-A/ALM-B) with parameter change, configure up the power supply circuit which switches off the magnetic contactor after detection of alarm occurrence on the controller side. In this connection example, the operation continues in the other axis when an alarm occurs in the A-axis or the B-axis. To stop both axes in an alarm occurrence, connect RA1 and RA2 in series.
4. For the sink I/O interface. For the source I/O interface, refer to section 3.7.3.
5. Refer to section 3.10.
6. Configure the circuit to shut down the main circuit power supply simultaneously with the turn off of forced stop (EM1) using the external sequence.
7. This connection example is a connection using a rotary servo motor. Turn SW3 off (factory setting). (Refer to section 3.14.)
8. Be sure to use a magnetic contactor with an operation delay time of 80ms or less. The operation delay time is the time interval between current being applied to the coil until closure of contacts.
9. For 1-phase 200V to 230VAC, connect the power supply to L1・L2 and leave L3 open. Refer to section 1.3 for the power supply specification.

3.2 I/O signal connection example



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 will be faulty and will not output signals, disabling the emergency stop and other protective circuits.
3. If the controller does not have forced stop function, always install the forced stop 2 switch (Normally closed contact).
4. When starting operation, always turn on the forced stop (EM1). (Normally closed contact) By setting "□1□□" in parameter No.PA04 the forced stop (EM1) can be made invalid.
5. Use MRZJW3-SETUP 221E. (Refer to section 11.4)
6. Use SSCNETⅢ cables listed in the following table.

Cable	Cable model name	Cable length
Standard cord inside panel	MR-J3BUS□M	0.15m to 3m
Standard cable outside panel	MR-J3BUS□M-A	5m to 20m
Long-distance cable	MR-J3BUS□M-B	30m to 50m

7. The wiring of the third and subsequent axes is omitted.
8. Up to sixteen axes may be connected. Refer to section 3.13 for setting of axis selection.
9. Make sure to put a cap on the unused CN1A・CN1B.
10. Supply 24VDC±10% 250mA current for interfaces from the outside. 250mA 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 3.7.2 (1) that gives the current value necessary for the interface.
11. Trouble (ALM-A/ALM-B) turns on in normal alarm-free condition.
12. The pins with the same signal name are connected in the servo amplifier.
13. The signal can be changed by parameter No.PD07, PD09.
14. For the sink I/O interface. For the source I/O interface, refer to section 3.7.3.
15. Devices can be assigned for DI1-A・DI2-A・DI3-A・DI1-B・DI2-B・DI3-B with controller setting. For devices that can be assigned, refer to the controller instruction manual. The assigned devices are for the Q173DCPU・Q172DCPU・Q173HCPU・Q172HCPU, Q170MCPU, QD74MH□ and QD75MH□.
16. Select the servo motor to be used as below. (Refer to section 3.14.)
OFF: Rotary servo motor, ON: Linear servo motor

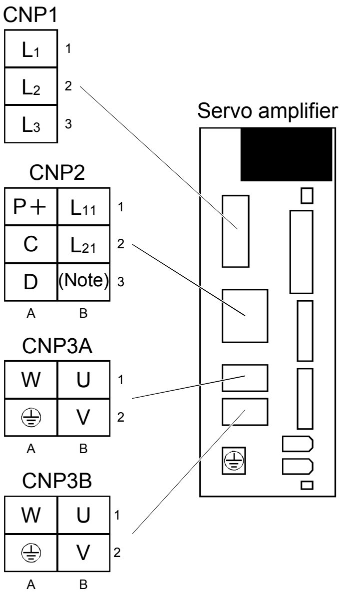
3.3 Explanation of power supply system

3.3.1 Signal explanations

POINT

- Keep the manufacturer-setting terminals open.

(1) Signal layout and connector application



Connector	Name	Function/Application
CNP1	Main circuit power supply connector	Used to input the main circuit power supply.
CNP2	Control circuit power supply connector	Used to input the control circuit power supply. Used to connect the regenerative option.
CNP3A	A-axis Servo motor power connector	Used to connect to the A-axis servo motor.
CNP3B	B-axis Servo motor power connector	Used to connect to the B-axis servo motor.

Note. For manufacturer setting. Keep the manufacturer-setting terminals open.

(2) Detailed description

<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>Servo amplifier
Power supply</th><th>MR-J3W-22B
MR-J3W-44B</th><th>MR-J3W-77B</th></tr>
<tr><td>3-phase 200V to 230VAC, 50/60Hz</td><td colspan="2">L_1 ・ L_2 ・ L_3</td></tr>
<tr><td>1-phase 200V to 230VAC, 50/60Hz</td><td>L_1 ・ L_2</td><td></td></tr>
</table>
</td></tr>
<tr><td>P＋ ・C・D</td><td>Regenerative option</td><td>When using servo amplifier built-in regenerative resistor, connect P＋ and D. When using regenerative option, connect regenerative option to P＋ and C.
Refer to section 11.2.</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>Servo amplifier
Power supply</th><th>MR-J3W-22B to MR-J3W-77B</th></tr>
<tr><td>1-phase 200V to 230VAC, 50/60Hz</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>⏚</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

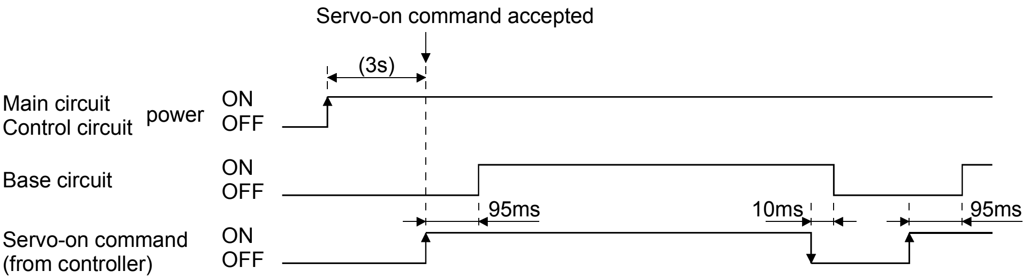
(1) Power-on procedure

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 an external sequence which switches off the magnetic contactor when an alarm occurs in both A and B axes.

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 command within 3s the main circuit power supply is switched on. (Refer to paragraph (2) of this section.)

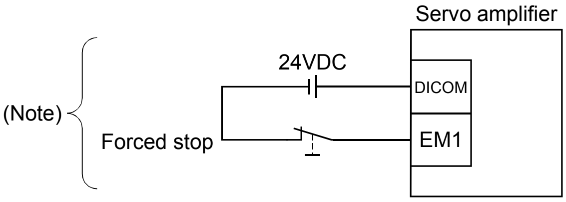
(2) Timing chart



(3) Forced stop

⚠CAUTION	· Install an forced stop circuit externally to ensure that operation can be stopped and power shut off immediately.

If the controller does not have an forced stop function, make up a circuit that switches off main circuit power as soon as EM1 is turned off at a forced stop. When EM1 is turned off, the dynamic brake is operated to stop the servo motor. At this time, the display shows the servo forced stop warning (E6.1).
During ordinary operation, do not use forced stop (EM1) to alternate stop and run. The service life of the servo amplifier may be shortened.



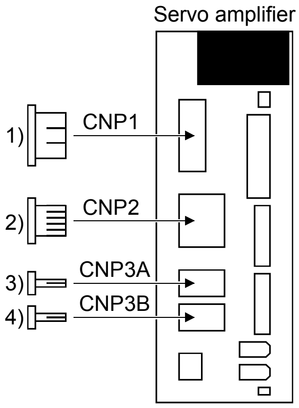
Note. For the sink I/O interface. For the source I/O interface, refer to section 3.7.3.

3.3.3 CNP1, CNP2, CNP3A, CNP3B wiring method

POINT

- Refer to section 11.5 for the wire sizes used for wiring.
- Connectors to wire CNP1, CNP2, CNP3A, and CNP3B are not supplied with the servo amplifier. Purchase the connectors separately.

Use the recommended products shown here.

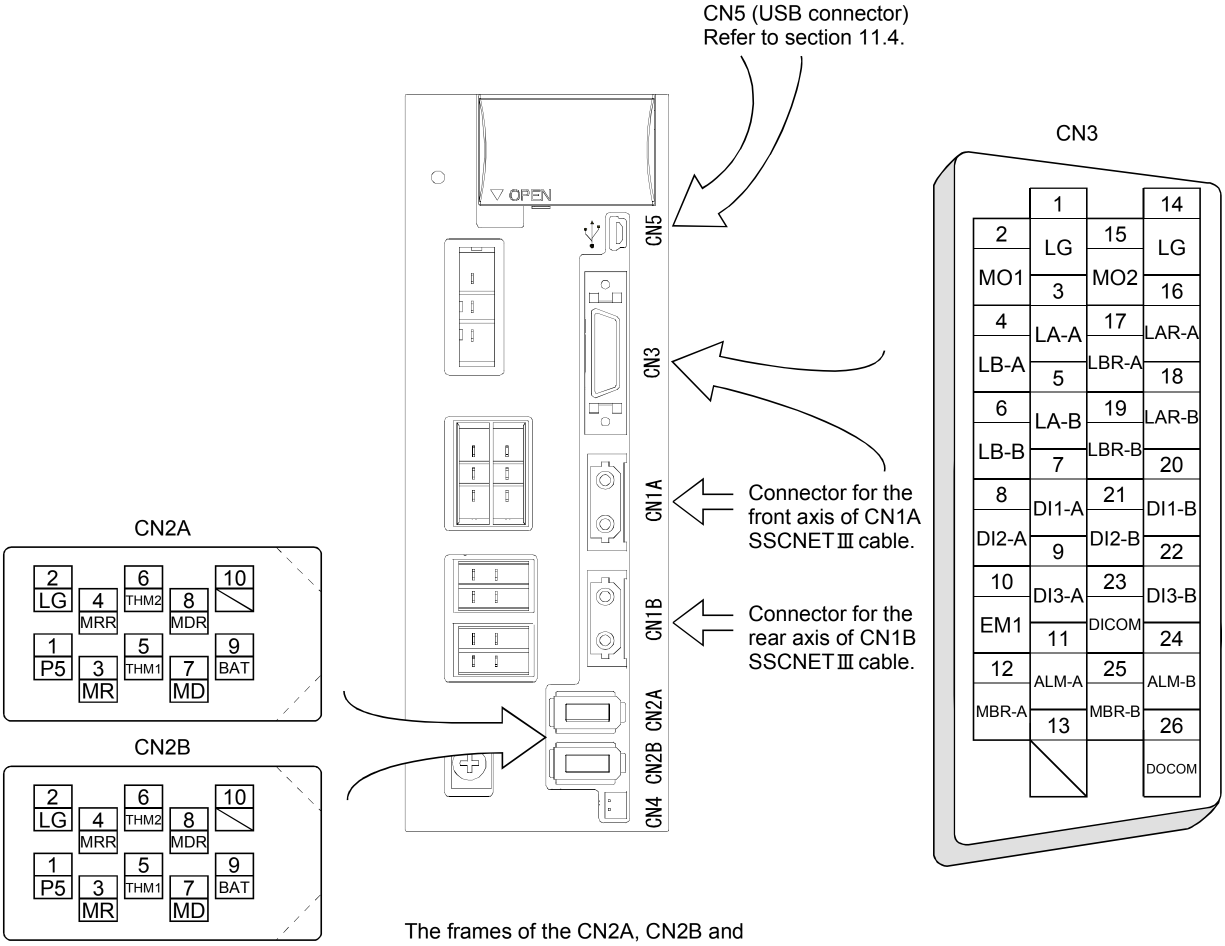


No.	Connector for	Receptacle housing	Receptacle contact		Crimping tool	Manufacturer
			Model	Description		
1)	CNP1	J43FSS-03V-KX	BJ4F-71GF-M3.0	Cable size: 1.25mm^2 (AWG16) to 2.0mm^2 (AWG14) Outer diameter of sheath: ϕ2.0 to 3.8mm	YRF-1130	Japan Solderless Terminals
2)	CNP2	F32FMS-06V-KXY	BF3F-71GF-P2.0	Cable size: 1.25mm^2 (AWG16) to 2.0mm^2 (AWG14) Outer diameter of sheath: ϕ2.4 to 3.4mm	YRF-1070	Japan Solderless Terminals
			LF3F-41GF-P2.0	Cable size: 0.75mm^2 (AWG19) to 1.25mm^2 (AWG16) Outer diameter of sheath: ϕ1.8 to 2.8mm	YRF-880	
		3-178129-6	917511-2	Cable size: 1.25mm^2 (AWG16) to 2.0mm^2 (AWG14) Outer diameter of sheath: ϕ2.2 to 2.8mm	91560-1	Tyco Electronics
			353717-2	Cable size: 1.25mm^2 (AWG16) to 2.0mm^2 (AWG14) Outer diameter of sheath: ϕ3.3 to 3.8mm	91561-1	

No.	Connector for	Receptacle housing	Receptacle contact		Crimping tool	Manufacturer
			Application	Description		
3) 4)	CNP3A CNP3B	F35FDC-04V-K	BF3F-71GF-P2.0	Cable size: 1.25mm^2 (AWG16) to 2.0mm^2 (AWG14) Outer diameter of sheath: ϕ2.4 to 3.4mm	YRF-1070	Japan Solderless Terminals
			LF3F-41GF-P2.0	Outer diameter of finished cable: ϕ2.4 to 3.3mm Outer diameter of sheath: ϕ1.8 to 2.8mm Option cable: MR-PWS☐CBL	YRF-880	
		175363-1	917511-2	Cable size: 1.25mm^2 (AWG16) to 2.0mm^2 (AWG14) Outer diameter of sheath: ϕ2.2 to 2.8mm	91560-1	Tyco Electronics
			353717-2	Cable size: 1.25mm^2 (AWG16) to 2.0mm^2 (AWG14) Outer diameter of sheath: ϕ3.3 to 3.8mm	91561-1	
			175218-2	Option cable: MR-PWS☐CBL	PEW12 + 1762957-1 (Dice)	

3.4 Connectors and signal arrangements

> **POINT**
>
> - The pin configurations of the connectors are as viewed from the cable connector wiring section.



CN5 (USB connector)
Refer to section 11.4.

Connector for the front axis of CN1A SSCNETⅢ cable.

Connector for the rear axis of CN1B SSCNETⅢ cable.

The 3M make connector is shown. When using any other connector, refer to section 11.1.2.

The frames of the CN2A, CN2B and CN3 connectors are connected to the PE (earth) terminal (⏚) in the amplifier.

3.5 Signal (device) explanations

For the I/O interfaces (symbols in I/O division column in the table), refer to section 3.7.2.
In the control mode field of the table
The pin No.s in the connector pin No. column are those in the initial status.

(1) Connector applications

Connector	Name	Function/Application
CN1A	Connector for bus cable from preceding axis.	Used for connection with the controller or preceding-axis servo amplifier.
CN1B	Connector for bus cable to next axis	Used for connection with the next-axis servo amplifier or for connection of the cap.
CN2A	A-axis encoder connector	Used for connection with the A-axis servo motor encoder.
CN2B	B-axis encoder connector	Used for connection with the B-axis servo motor encoder.
CN4	(Note) Battery unit connection connector	When using as absolute position detection system, connect to battery unit. Before connecting a battery unit, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, always confirm from the front of the servo amplifier whether the charge lamp is off or not. Replace the battery unit with main circuit power OFF and with control circuit power ON. Replacing the battery with the control circuit power OFF results in loosing absolute position data.
CN5	Communication connector	The personal computer is connected.

Note. A battery unit is a unit that has eight MR-BAT batteries inserted in a MR-BTCASE battery case.

(2) I/O device

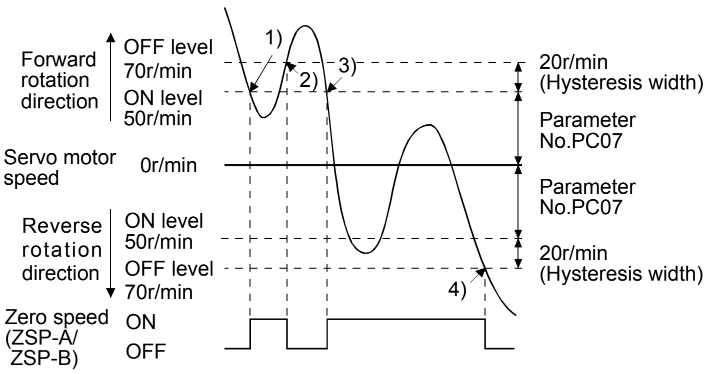
(a) Input device

Device	Symbol	Connector pin No.	Function/Application	I/O division
Forced stop	EM1	CN3-10	Turn EM1 off (open between commons) to bring the motor to an forced stop state, in which the base circuit is shut off and the dynamic brake is operated. Turn EM1 on (short between commons) in the forced stop state to reset that state. When parameter No.PA.04 is set to "□1□□", automatically ON (always ON) can be set inside.	DI-1
	DI1-A	CN3-7	Devices can be assigned for DI1-A DI2-A DI3-A DI1-B DI2-B DI3-B with controller setting. For devices that can be assigned, refer to the controller instruction manual. The following devices can be assigned for Q173DCPU・Q172DCPU・Q173HCPU・Q172HCPU・Q170MCPU・QD74MH□ ・QD75MH□. DI1-A: A-axis upper stroke limit (FLS) DI2-A: A-axis lower stroke limit (RLS) DI3-A: A-axis proximity dog (DOG) DI1-B: B-axis upper stroke limit (FLS) DI2-B: B-axis lower stroke limit (RLS) DI3-B: B-axis proximity dog (DOG)	DI-1
	DI2-A	CN3-8		DI-1
	DI3-A	CN3-9		DI-1
	DI1-B	CN3-20		DI-1
	DI2-B	CN3-21		DI-1
	DI3-B	CN3-22		DI-1

(b) Output device

Device	Symbol	Connector pin No.	Function/Application	I/O division
A-axis trouble	ALM-A	CN3-11	ALM-A/ALM-B turns off when power is switched off or the protective circuit is activated to shut off the base circuit. Without alarm occurring, ALM-A/ALM-B turns on within about 1.5s after power-on.	DO-1
B-axis trouble	ALM-B	CN3-24		

(b) Output device

Device	Symbol	Connector pin No.	Function/Application	I/O division
A-axis electromagnetic brake interlock	MBR-A	CN3-12	When using this signal, set operation delay time of the electromagnetic brake in parameter No.PC02. In the servo-off or alarm status, MBR-A/MBR-B turns off.	DO-1
B-axis electromagnetic brake interlock	MBR-B	CN3-25		
A-axis in-position	INP-A		When using the signal, make it usable by the setting of parameter No.PD07 or PD09. INP-A/INP-B turns on when the number of droop pulses is in the preset in-position range. The in-position range can be changed using parameter No.PA10. When the in-position range is increased, INP-A/INP-B may be on conductive status during low-speed rotation. INP turns on when servo on turns on. This signal cannot be used in the speed loop mode.	DO-1
B-axis in-position	INP-B			
A-axis ready	RD-A		When using the signal, make it usable by the setting of parameter No.PD07 or PD09. RD-A/RD-B turns on when the servo is switched on and the servo amplifier is ready to operate.	DO-1
B-axis ready	RD-B			
A-axis speed reached	SA-A		When using this signal, make it usable by the setting of parameter No.PD07 or PD09. When the servo is off, SA will be turned OFF. When servo motor rotation speed becomes approximately setting speed, SA-A/SA-B will be turned ON. When the preset speed is 20r/min or less, SA-A/SA-B always turns on. This signal cannot be used in position loop mode.	DO-1
B-axis speed reached	SA-B			
A-axis limiting torque	TLC-A		When using this signal, make it usable by the setting of parameter No.PD07 or PD09. When torque is produced level of torque set with controller, TLC-A/TLC-B will be turned ON. When the servo is off, TLC-A/TLC-B will be turned OFF.	DO-1
B-axis limiting torque	TLC-B			
A-axis zero speed	ZSP-A		When using this signal, make it usable by the setting of parameter No.PD07 or PD09. ZSP-A/ZSP-B turns on when the servo motor speed is zero speed (50r/min) or less. Zero speed can be changed using parameter No.PC07. Example Zero speed is 50r/min  ZSP-A/ZSP-B turns on 1) when the servo motor is decelerated to 50r/min, and ZSP-A/ZSP-B turns off 2) when the servo motor is accelerated to 70r/min again. ZSP-A/ZSP-B 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-A/ZSP-B 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 the MR-J3W-B servo amplifier.	DO-1
B-axis zero speed	ZSP-B			

Device	Symbol	Connector pin No.	Function/Application	I/O division
A-axis warning	WNG-A		When using this signal, make it usable by the setting of parameter No.PD07 or PD09. When warning has occurred, WNG-A/WNG-B turns on. When there is no warning, WNG-A/WNG-B turns off within about 1.5s after power-on.	DO-1
B-axis warning	WNG-B			
A-axis battery warning	BWNG-A		When using this signal, make it usable by the setting of parameter No.PD07 or PD09. BWNG-A/BWNG-B turns on when battery cable disconnection warning (92.1) or battery warning (9F.1) has occurred. When there is no battery warning, BWNG-A/BWNG-B turns off within about 1.5s after power-on.	DO-1
B-axis battery warning	BWNG-B			
A-axis variable gain selection	CDPS-A		When using this signal, make it usable by the setting of parameter No.PD07 or PD09. CDPS-A/CDPS-B is on during variable gain.	DO-1
B-axis variable gain selection	CDPS-B			
A-axis absolute position erasing	ABSV-A		When using this signal, make it usable by the setting of parameter No.PD07 or PD09. ABSV-A/ABSV-B turns on when the absolute position erased. This signal cannot be used in position loop mode.	DO-1
B-axis absolute position erasing	ABSV-B			

(c) Output signals

Signal name	Symbol	Connector pin No.	Function/Application
A-axis encoder A-phase pulse (Differential line driver)	LA-A LAR-A	CN3-6 CN3-16	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.PC03. Output pulse specification and dividing ratio setting can be set. (Refer to section 5.1.10.)
A-axis encoder B-phase pulse (Differential line driver)	LB-A LBR-A	CN3-4 CN3-17	
B-axis encoder A-phase pulse (Differential line driver)	LA-B LAR-B	CN3-5 CN3-18	
B-axis encoder B-phase pulse (Differential line driver)	LB-B LBR-B	CN3-6 CN3-19	
Analog monitor 1	MO1	CN3-2	Used to output the data set in parameter No.PC09 to across MO1-LG in terms of voltage. Resolution 10 bits
Analog monitor 2	MO2	CN3-15	Used to output the data set in parameter No.PC10 to across MO2-LG in terms of voltage. Resolution 10 bits

(d) Power supply

Signal name	Symbol	Connector pin No.	Function/Application
Digital I/F power supply input	DICOM	CN3-23	Used to input 24VDC (24VDC 10% 250mA) 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. For the sink interface, connect ⊕ of 24VDC external power supply. For the source interface, connect ⊖ of 24VDC external power supply.
Digital I/F common	DOCOM	CN3-26	Common terminal for input device such as EM1 of the servo amplifier. Pins are connected internally. Separated from LG. For the sink interface, connect ⊖ of 24VDC external power supply. For the source interface, connect ⊕ of 24VDC external power supply.
Monitor common	LG	CN3-1	Common terminal of MO1 ･ MO2 Pins are connected internally.
Shield	SD	Plate	Connect the external conductor of the shield cable.

3.6 Alarm occurrence timing chart

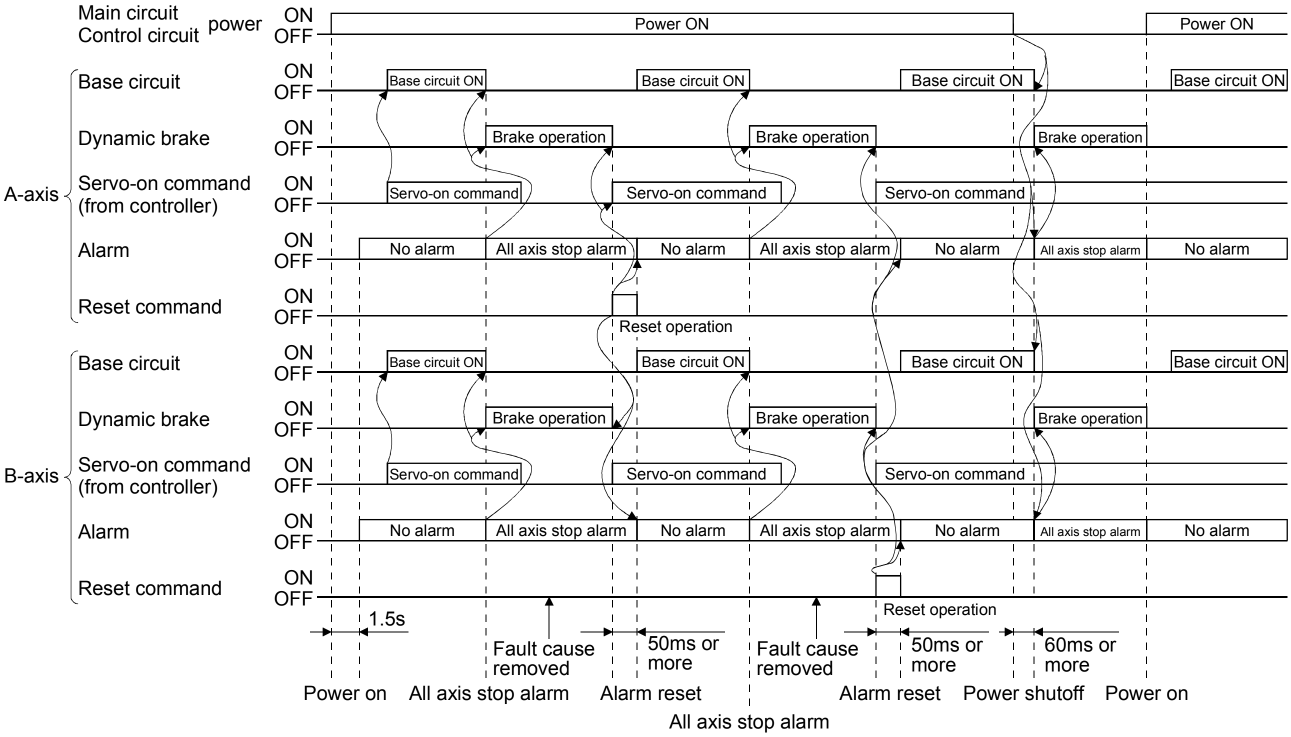
⚠CAUTION

- 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.
- Shut off the main circuit power supply when alarms are occurring in both of the A-axis and the B-axis. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

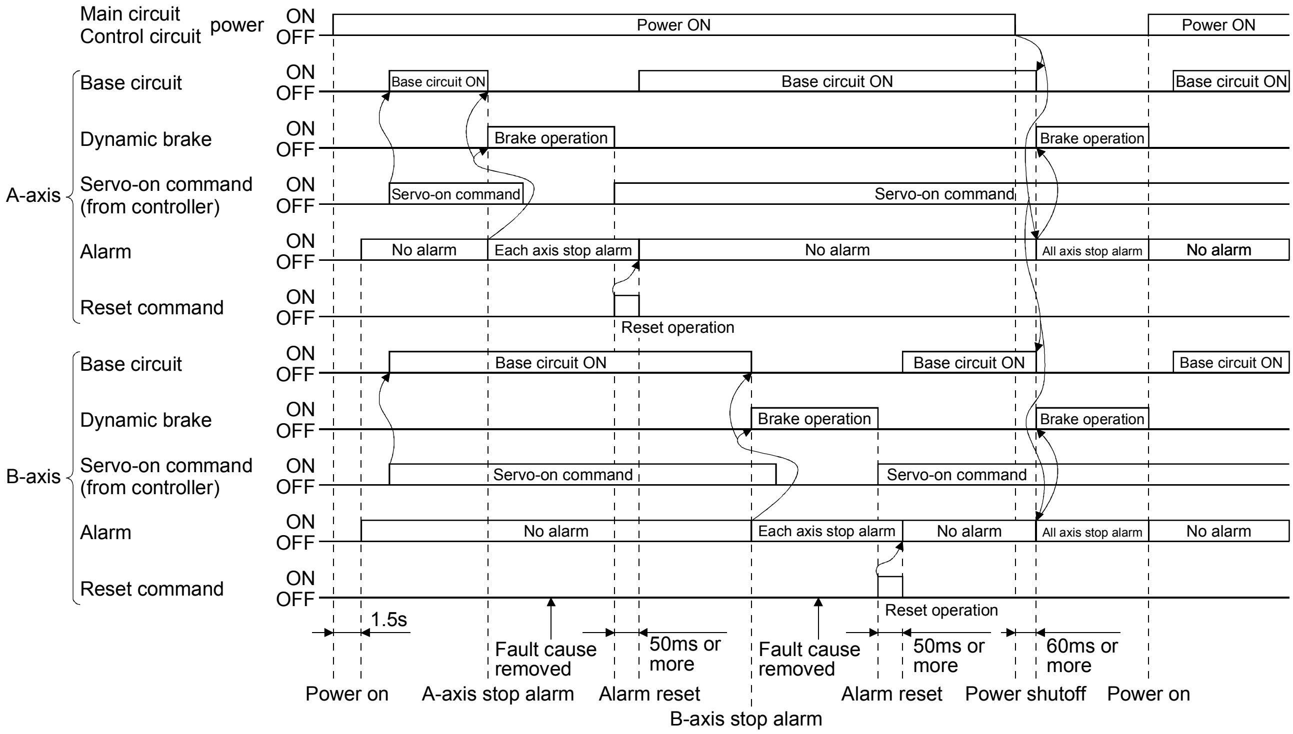
When an alarm occurs in the servo amplifier, the base circuit is shut off and the servo motor is coated to a stop. Switch off the main circuit power supply in the external sequence. To deactivate the alarm, power the control circuit off, then on or give the error reset or CPU reset command from the servo system controller. However, the alarm cannot be deactivated unless its cause is removed.

3.6.1 Timing chart

(1) Occurrence of all axis stop alarm



(2) Occurrence of each axis stop alarm



3.6.2 Supplementary information

(1) Overcurrent, overload 1 or overload 2

If operation is repeated by switching control circuit power off, then on to reset the overcurrent (32.□), overload 1 (50.□) or overload 2 (51.□) 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 (30.□) alarm after its occurrence, the regenerative resistor will generate heat, resulting in an accident.

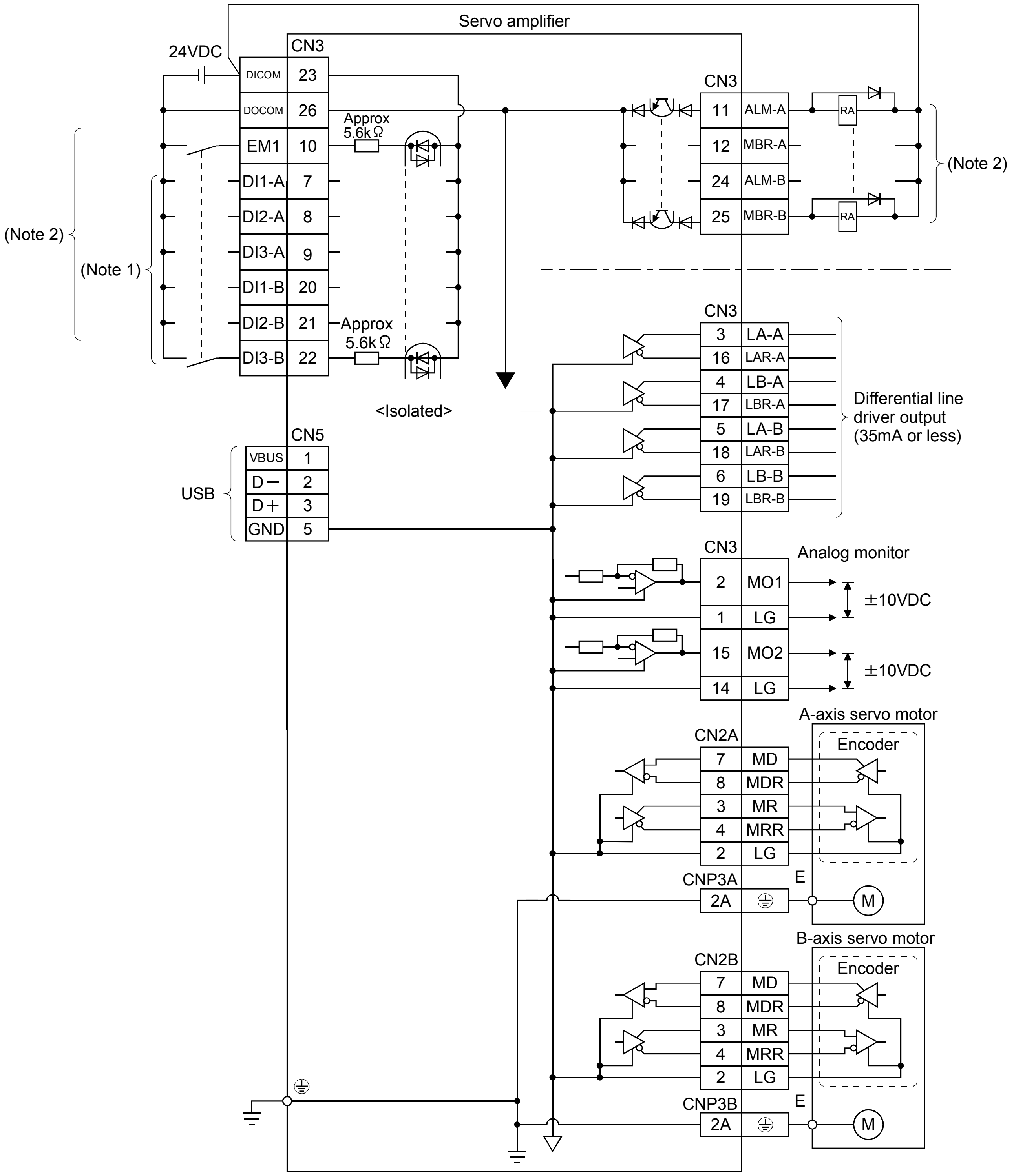
(3) Instantaneous power failure

Undervoltage (10.□) occurs when the input power is in either of the following statuses.

- Power failure of the control circuit power supply has continued for 60ms or longer, then the power restores.
- Bus voltage drops to 200VDC or less during the servo-on status.

3.7 Interfaces

3.7.1 Internal connection diagram



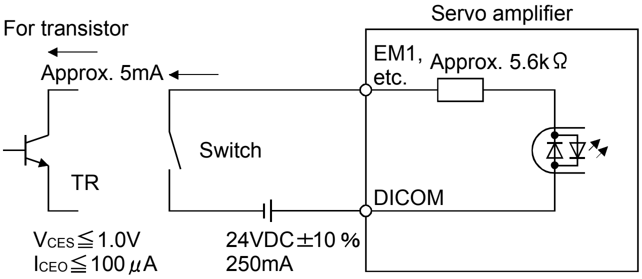
Note 1. Signal can be assigned for these pins with host controller setting.
For contents of signals, refer to the instruction manual of host controller.
2. For the sink I/O interface. For the source I/O interface, refer to section 3.7.3.

3.7.2 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.

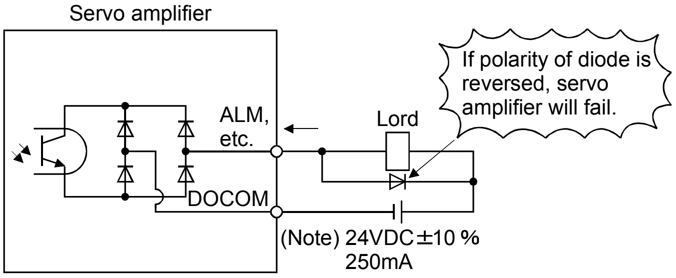
(1) Digital input interface DI-1

Give a signal with a relay or open collector transistor. Refer to section 3.7.3 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. (Rated current: 40mA or less, maximum current: 50mA or less, inrush current: 100mA or less) A maximum of 2.6V voltage drop occurs in the servo amplifier. Refer to section 3.7.3 for the source output.

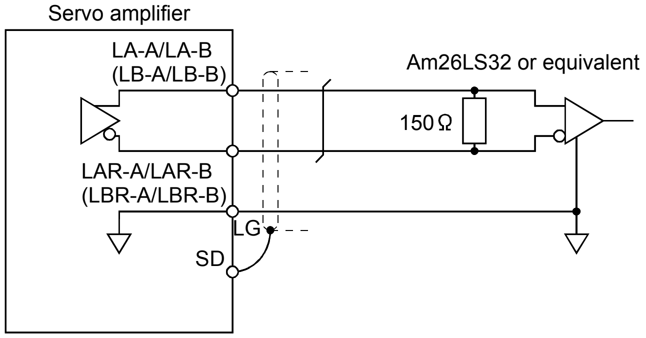


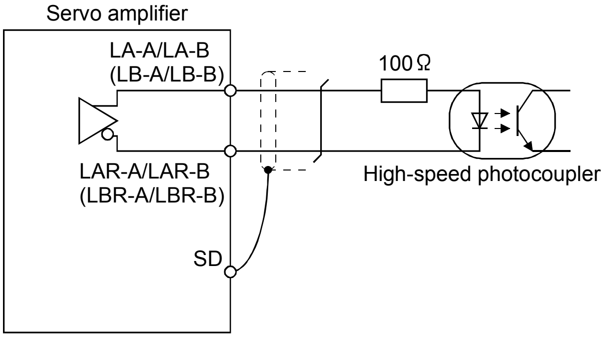
Note. If the voltage drop (maximum of 2.6V) interferes with the relay operation, apply high voltage (up to 26.4V) from external source.

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

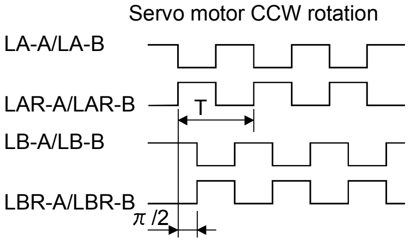
(a) Interface

Max. output current: 35mA



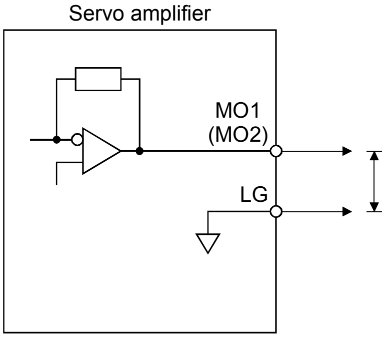


(b) Output pulse



Time cycle (T) is determined by the settings of parameter No.PA15, PA16 and PC03.

(4) Analog output



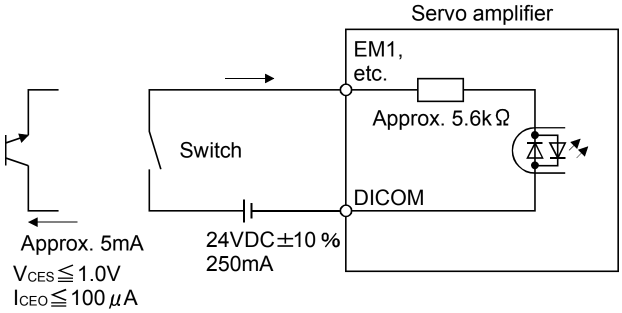
Output voltage: ±10V (Note)
Max. Output current: 1mA
Resolution: 10 bits or equivalent

Note. Output voltage range varies depending on the monitored signal. (Refer to section 5.3.3 or 13.8.4(3).)

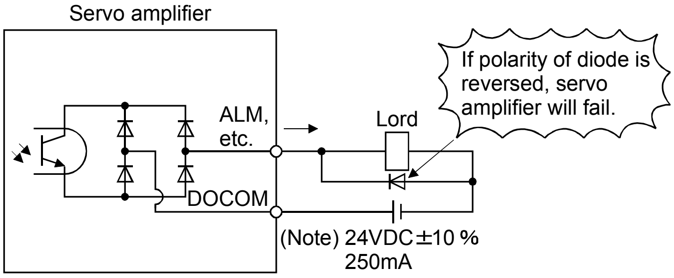
3.7.3 Source I/O interfaces

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



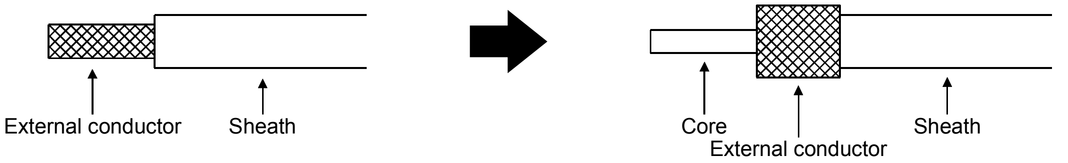
(2) Digital output interface DO-1
A maximum of 2.6V voltage drop occurs in the servo amplifier.



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

3.8 Treatment of cable shield external conductor

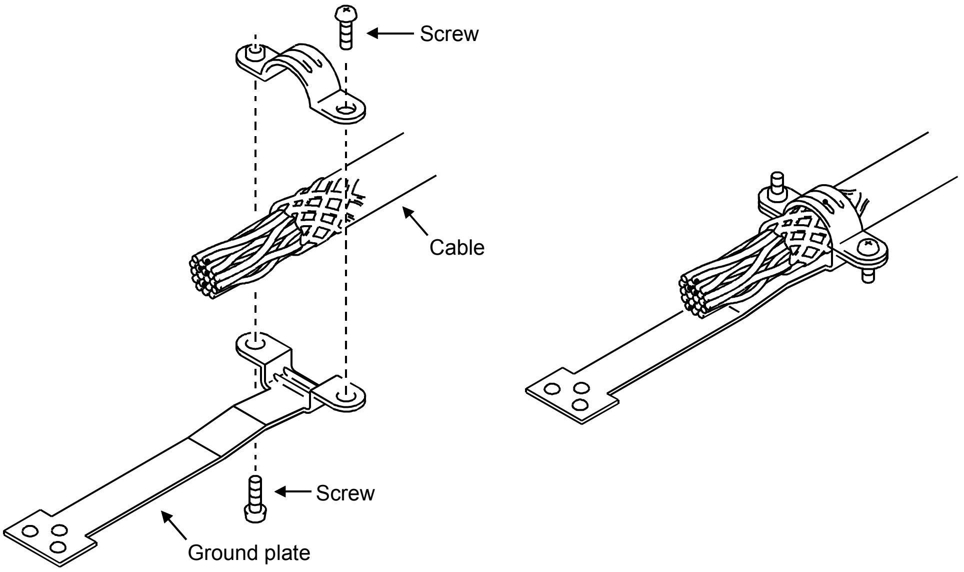
In the case of the CN2, CN2L and CN3 connectors, securely connect the shielded external conductor of the cable to the ground plate as shown in this section and fix it to the connector shell.



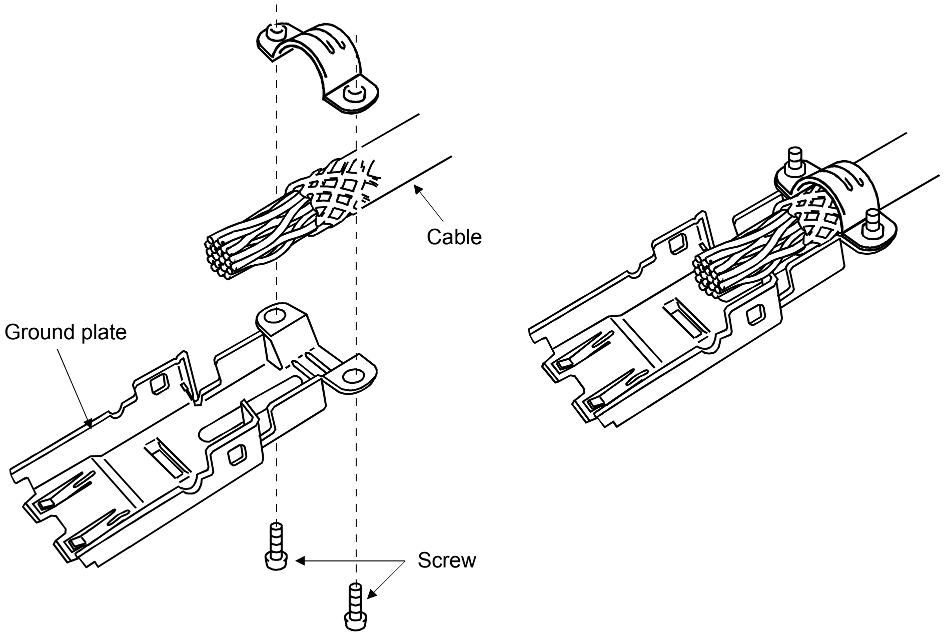
Strip the sheath.

Pull back the external conductor to cover the sheath

(1) For CN3 connector (3M connector)



(2) For CN2A and CN2B connector (3M or Molex connector)



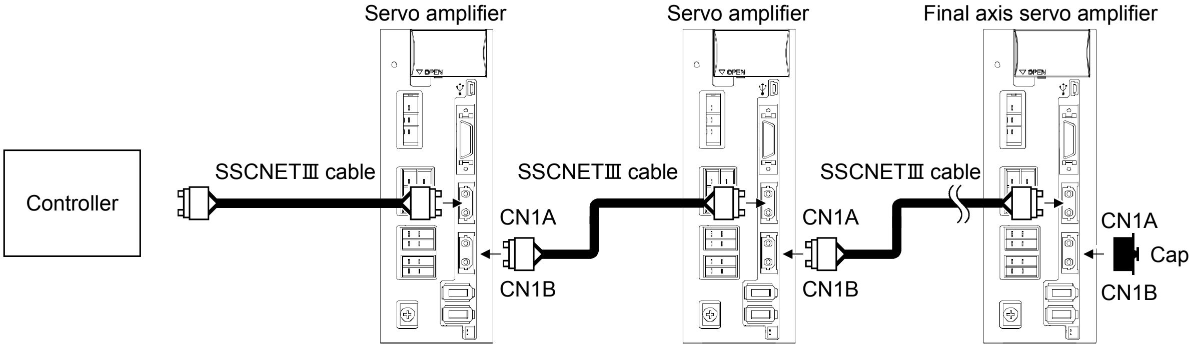
3.9 SSCNETⅢ cable connection

POINT

- Do not see directly the light generated from CN1A・CN1B connector of servo amplifier or the end of SSCNETⅢ cable.
  When the light gets into eye, may feel something is wrong for eye.
  (The light source of SSCNETⅢ complies with class1 defined in JIS C6802 or IEC 60825-1.)

(1) SSCNETⅢ cable connection

For CN1A connector, connect SSCNETⅢ cable connected to controller in host side or servo amplifier.
For CN1B connector, connect SSCNETⅢ cable connected to servo amplifier in lower side.
For CN1B connector of the final axis, put a cap came with servo amplifier.



(2) How to connect/disconnect cable.

POINT

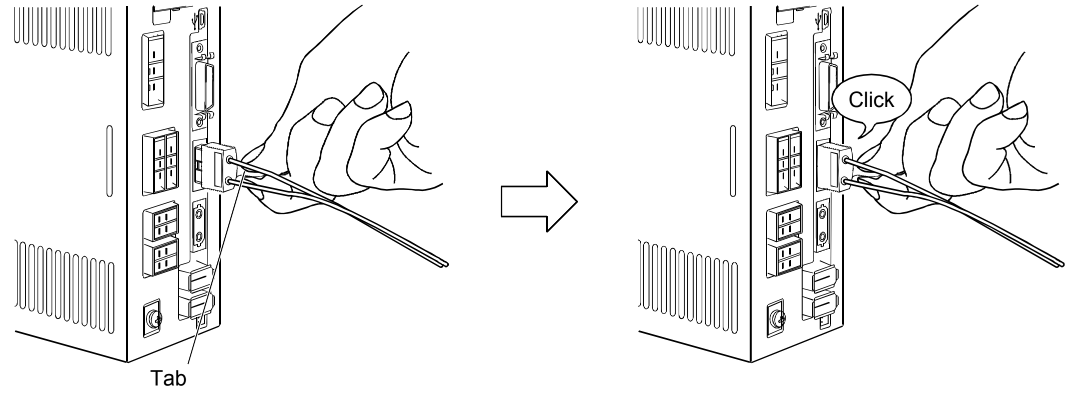
- CN1A・CN1B connector is put a cap to protect light device inside connector from dust.
  For this reason, do not remove a cap until just before mounting SSCNETⅢ cable.
  Then, when removing SSCNETⅢ cable, make sure to put a cap.
- Keep the cap for CN1A・CN1B connector and the tube for protecting optical cord end of SSCNETⅢ cable in a plastic bag with a zipper of SSCNETⅢ cable to prevent them from becoming dirty.
- When asking repair of servo amplifier for some troubles, make sure to put a cap on CN1A・CN1B connector.
  When the connector is not put a cap, the light device may be damaged at the transit.
  In this case, exchange and repair of light device is required.

(a) Mounting

1) For SSCNETⅢ cable in the shipping status, the tube for protect optical cord end is put on the end of connector. Remove this tube.

2) Remove the CN1A・CN1B connector cap of servo amplifier.

3) With holding a tab of SSCNETⅢ cable connector, make sure to insert it into CN1A・CN1B connector of servo amplifier until you hear the click.
If the end face of optical cord tip is dirty, optical transmission is interrupted and it may cause malfunctions.
If it becomes dirty, wipe with a bonded textile, etc.
Do not use solvent such as alcohol.



(b) Removal
With holding a tab of SSCNETⅢ cable connector, pull out the connector.
When pulling out the SSCNETⅢ cable from servo amplifier, be sure to put the cap on the connector parts of servo amplifier to prevent it from becoming dirty.
For SSCNETⅢ cable, attach the tube for protection optical cord's end face on the end of connector.

3.10 Connection of servo amplifier and servo motor

⚠CAUTION

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

POINT

- To use a rotary servo motor, turn SW3 off (factory setting).

3.10.1 Connection instructions

⚠WARNING

- Insulate the connections of the power supply terminals to prevent an electric shock.

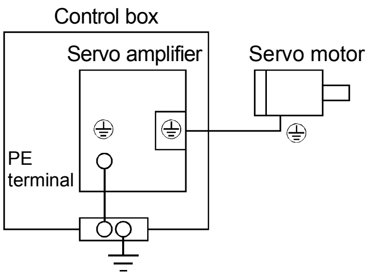
⚠CAUTION

- 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.
- Do not use the 24VDC interface power supply for the electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake. Otherwise, a fault may occur.

POINT

- Refer to section 11.1 for the selection of the encoder cable.
- Refer to section 11.13 for the selection of a surge absorber for the electromagnetic brake.

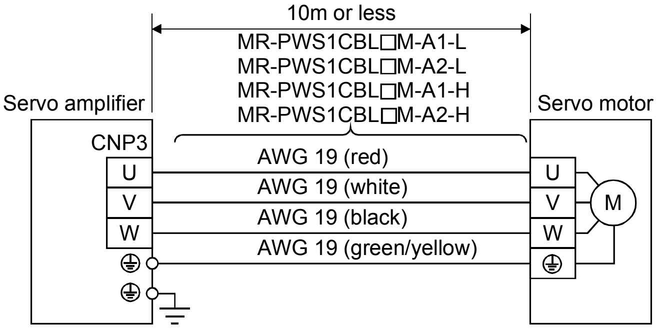
This section indicates the connection of the servo motor power (U, V, W). Use of the optional cable and connector set is recommended for connection between the servo amplifier and servo motor. When the options are not available, use the recommended products. Refer to section 11.1 for details of the options.
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.



3.10.2 Power supply cable wiring diagrams

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

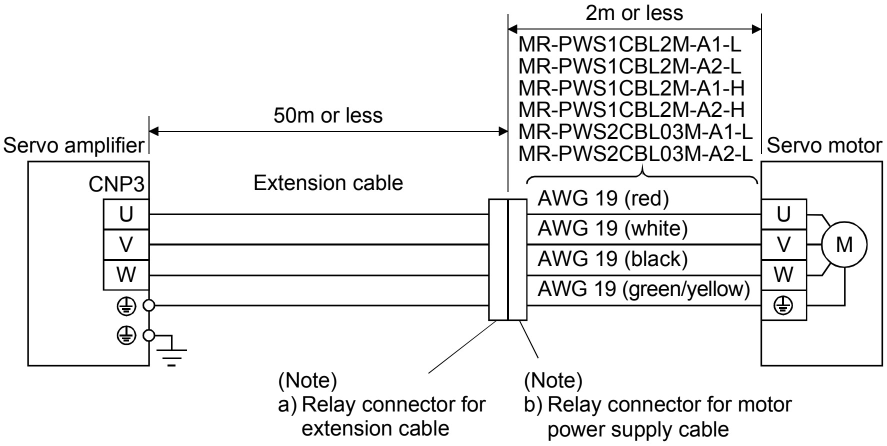
(a) When cable length is 10m or less



(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 11.5 for the wire used for the extension cable.



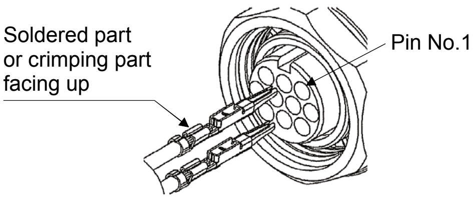
Note. Use of the following connectors is recommended when ingress protection (IP65) is necessary.

Relay connector	Description	IP rating
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

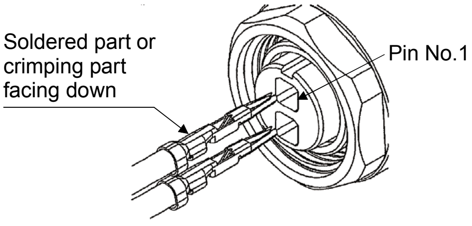
(2) HF-SP series・HC-UP series・HC-LP series servo motor

POINT

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



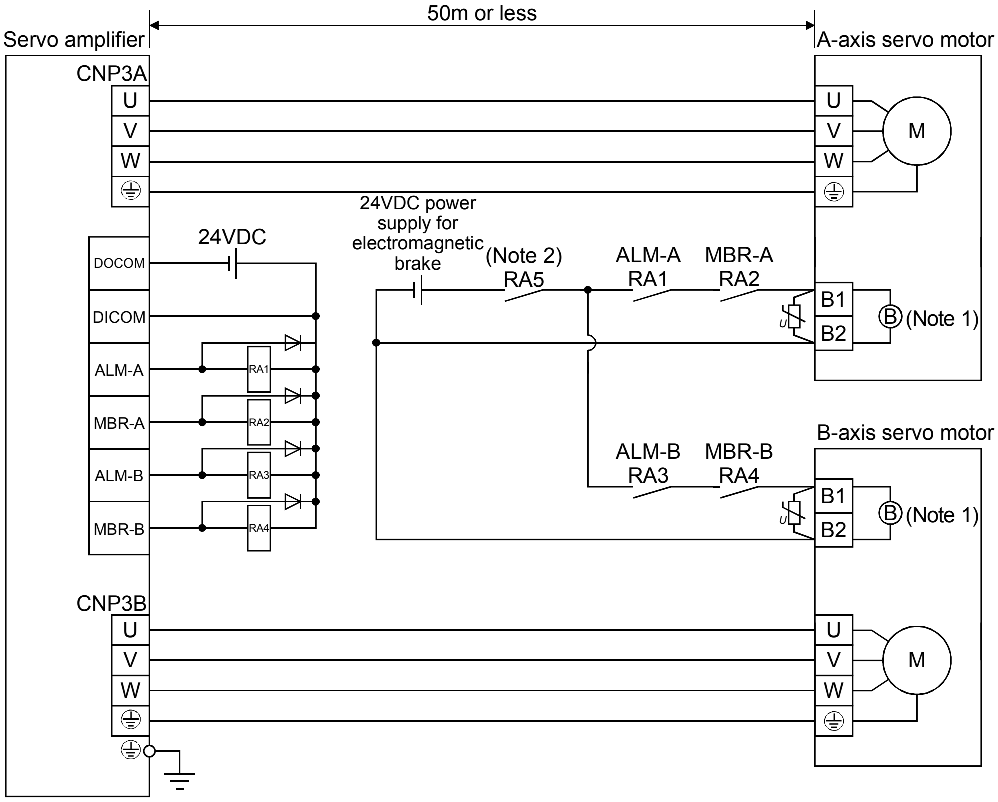
CM10-SP10S-☐(D6)
CM10-SP10S-VP-M
CM10-AP10S-☐(D6)
CM10-AP10S-VP-M



CM10-SP2S-☐(D6)
CM10-SP2S-VP-☐
CM10-AP2S-☐(D6)
CM10-AP2S-VP-☐

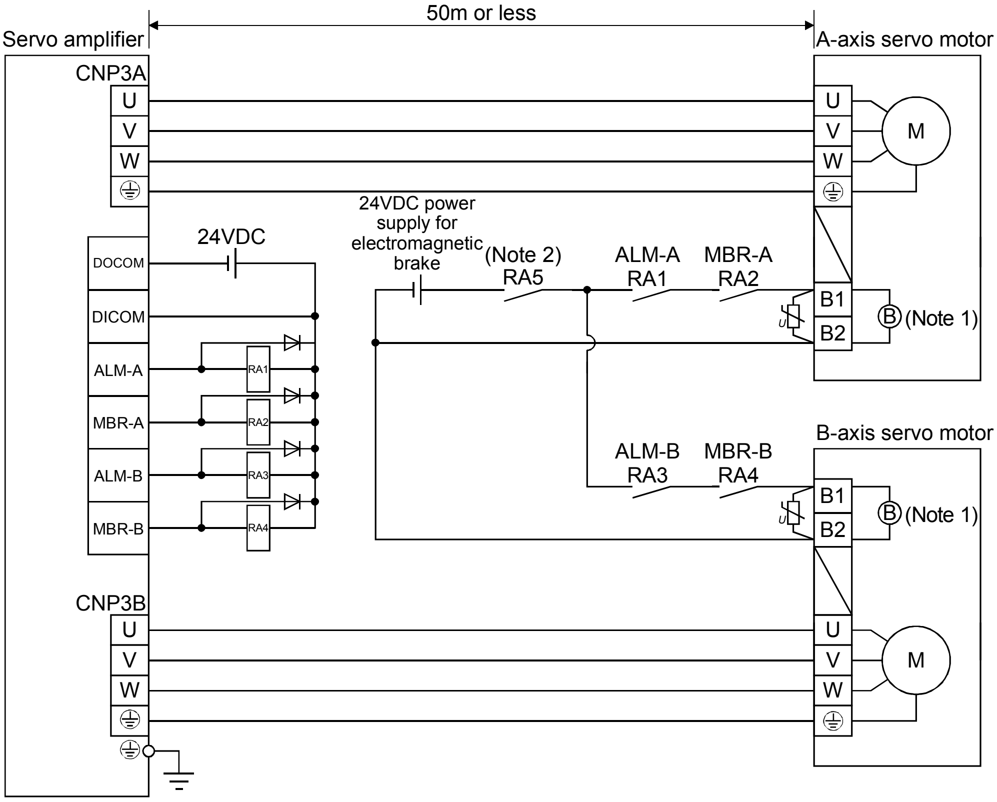
(a) Wiring diagrams
Refer to section 11.5 for the cables used for wiring.

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. Shut off the circuit by interlocking with the emergency stop switch.

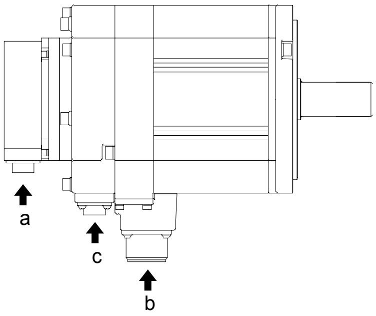
2) When the power supply connector and the electromagnetic brake connector are shared.



Note 1. There is no polarity in electromagnetic brake terminals B1 and B2.
2. Shut off the circuit by interlocking with the emergency stop switch.

(b) Connector and signal allotment

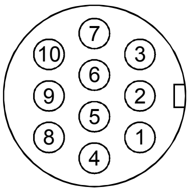
The connector fitting the servo motor is prepared as optional equipment. Refer to section 11.1. For types other than those prepared as optional equipment, refer to chapter 3 in Servo Motor Instruction Manual, (Vol. 2) to select.



Servo motor	Servo motor side connectors		
	Encoder	Power supply	Electromagnetic brake
HF-SP51・52	CM10-R10P (DDK)	MS3102A18-10P	CM10-R2P (DDK)
HC-UP72		CE05-2A22-23PD-B	Shared with the power supply
HC-LP52			

Encoder connector signal allotment

CM10-R10P

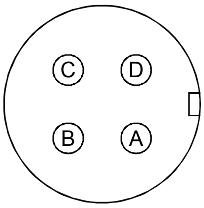


View a

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

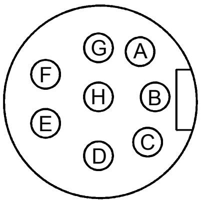


View b

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

Power supply connector signal allotment

CE05-2A22-23PD-B



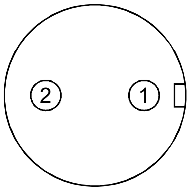
View b

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

Note. For the motor with an 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)

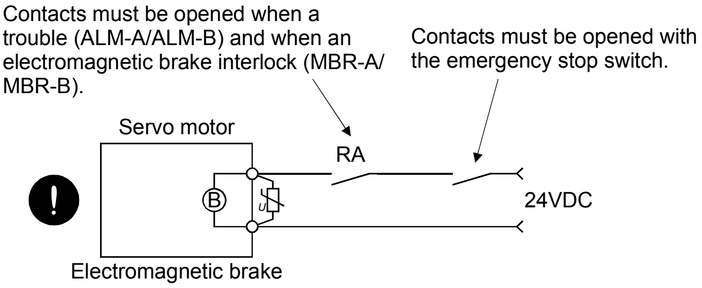
Note. For the motor with an electromagnetic brake, supply electromagnetic brake power (24VDC). There is no polarity.

3.11 Servo motor with an electromagnetic brake

3.11.1 Safety precautions

CAUTION

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



- 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.
- Do not use the 24VDC interface power supply for the electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake. Otherwise, a fault may occur.

POINT

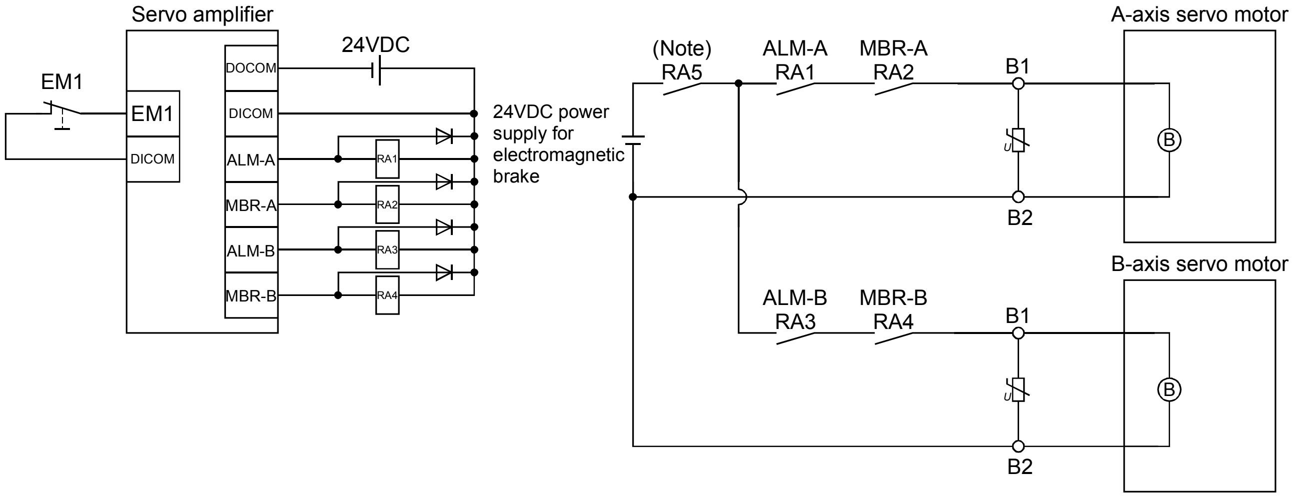
- Refer to the Servo Motor Instruction Manual (Vol.2) for specifications such as the power supply capacity and operation delay time of the electromagnetic brake.
- Refer to section 11.13 for the selection of a surge absorber for the electromagnetic brake.

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

1) The brake will operate when the power (24VDC) switches off.

2) Switch off the servo-on command after the servo motor has stopped.

(1) Connection diagram



Note. Shut off the circuit by interlocking with the emergency stop switch.

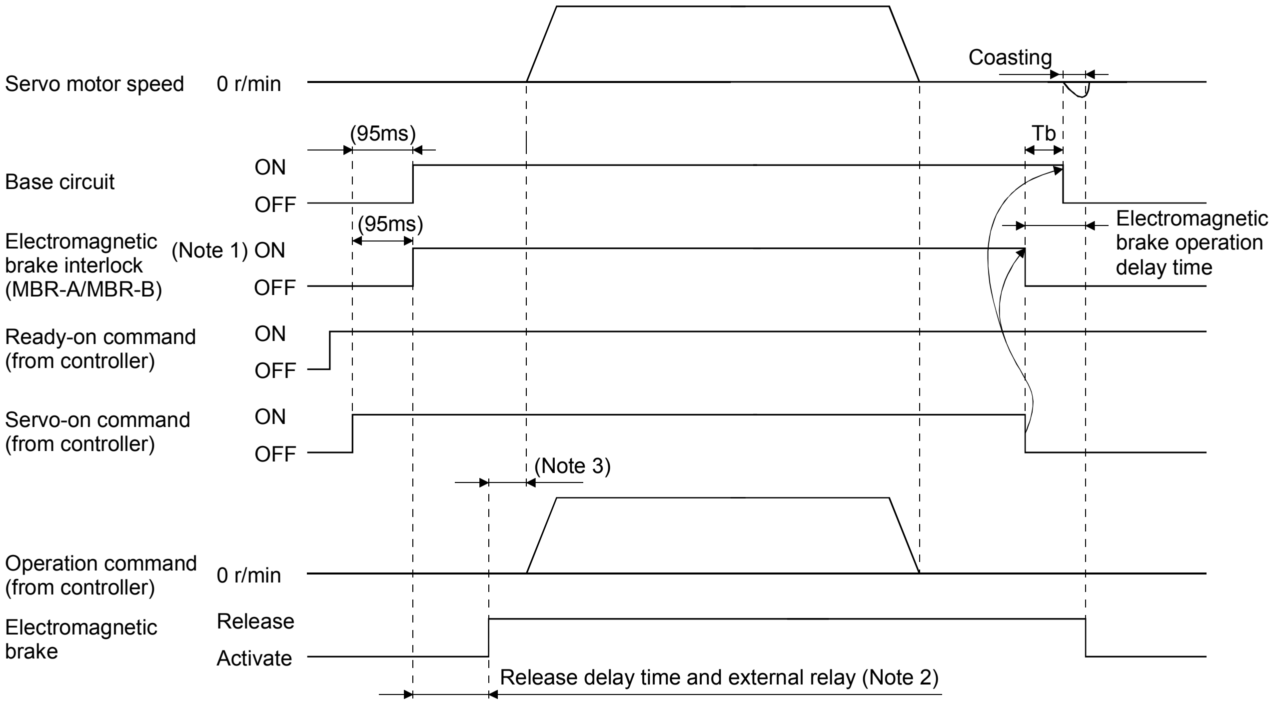
(2) Setting

In parameter No.PC02 (electromagnetic brake sequence output), set the time delay (Tb) from electromagnetic brake operation to base circuit shut-off at a servo off time as in the timing chart in section 3.11.2.

3.11.2 Timing charts

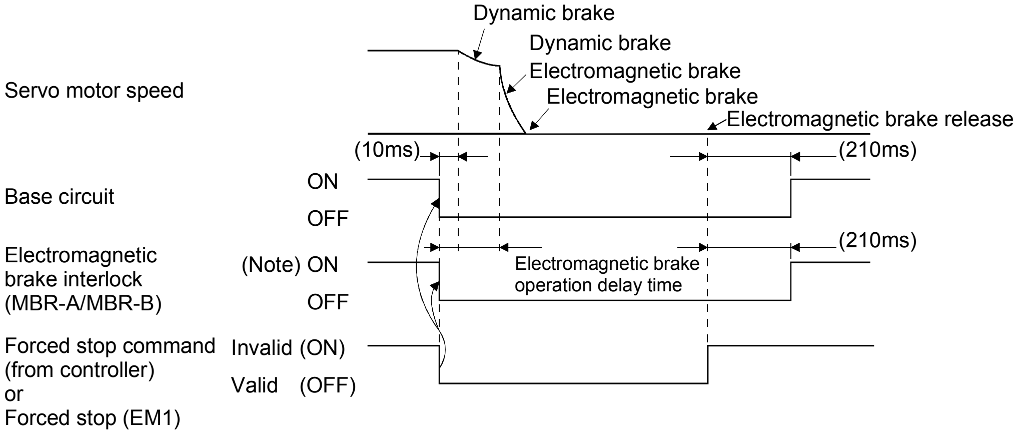
(1) Servo-on command (from controller) ON/OFF

Tb [ms] after the servo-on 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 delay time (Tb) to about the same as the electromagnetic brake operation delay time to prevent a drop.



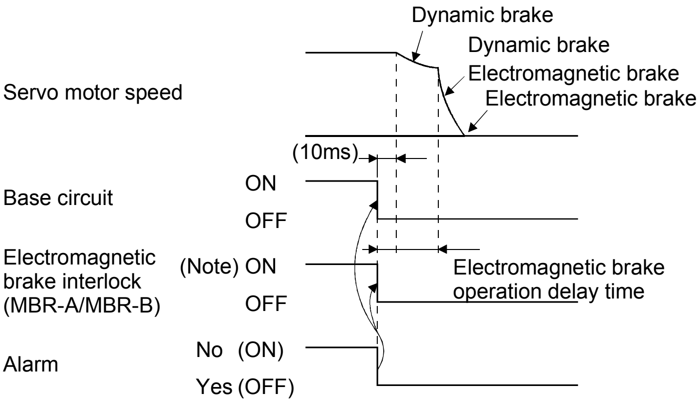
Note 1. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.
2. Electromagnetic brake is released after delaying for the release delay time of electromagnetic brake and operation time of external circuit relay. For the release delay time of electromagnetic brake, refer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

(2) Forced stop command (from controller) or forced stop (EM1) ON/OFF



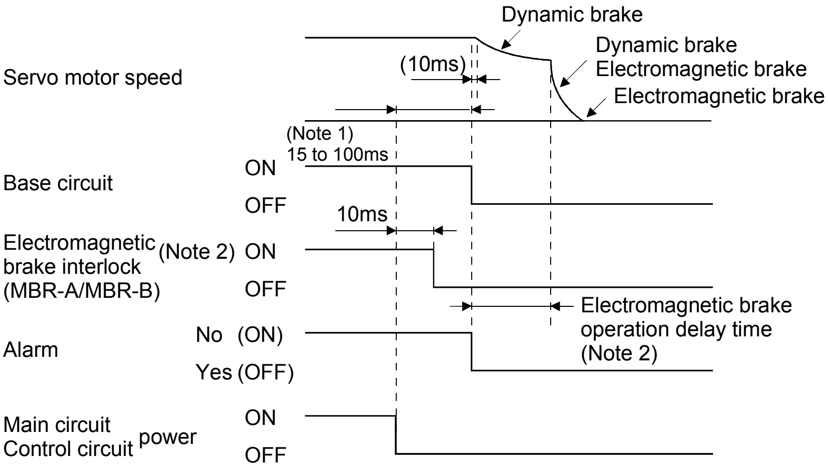
Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(3) Alarm occurrence



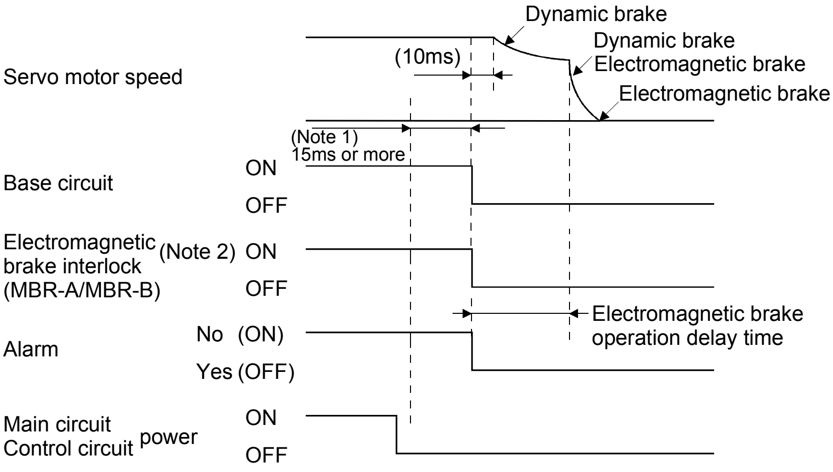
Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(4) Both main and control circuit power supplies off



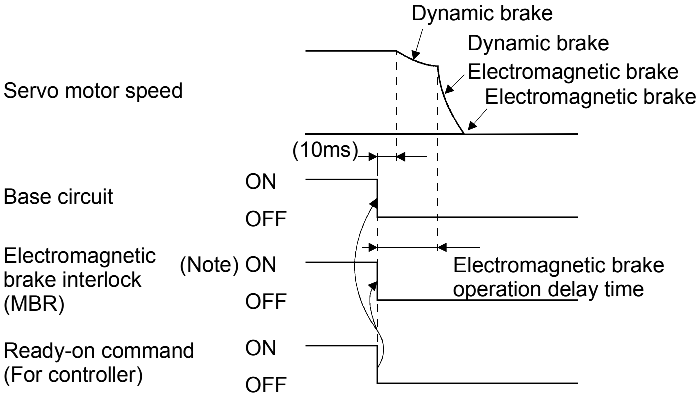
Note 1. Changes with the operating status.
2. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

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



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

(6) Ready off command from the controller

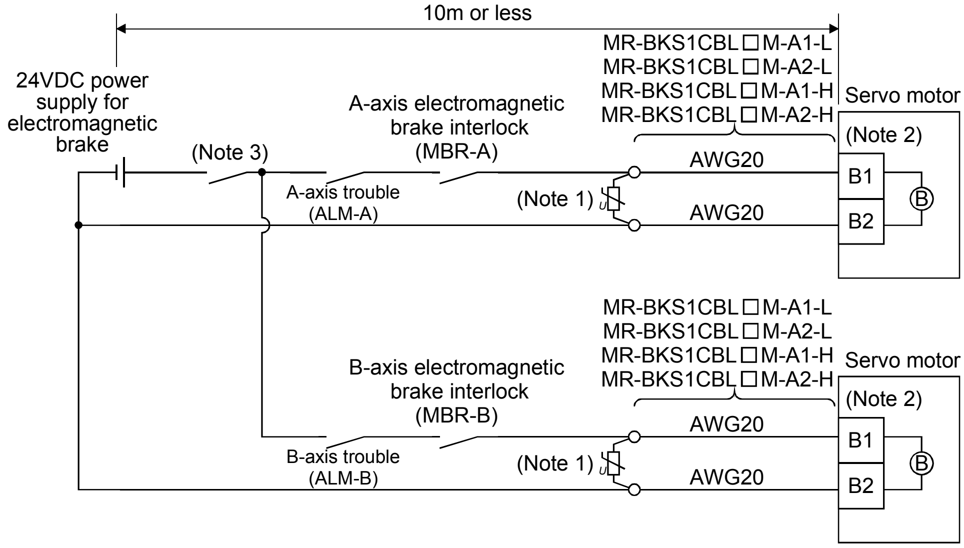


Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

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

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

(1) When cable length is 10m or less



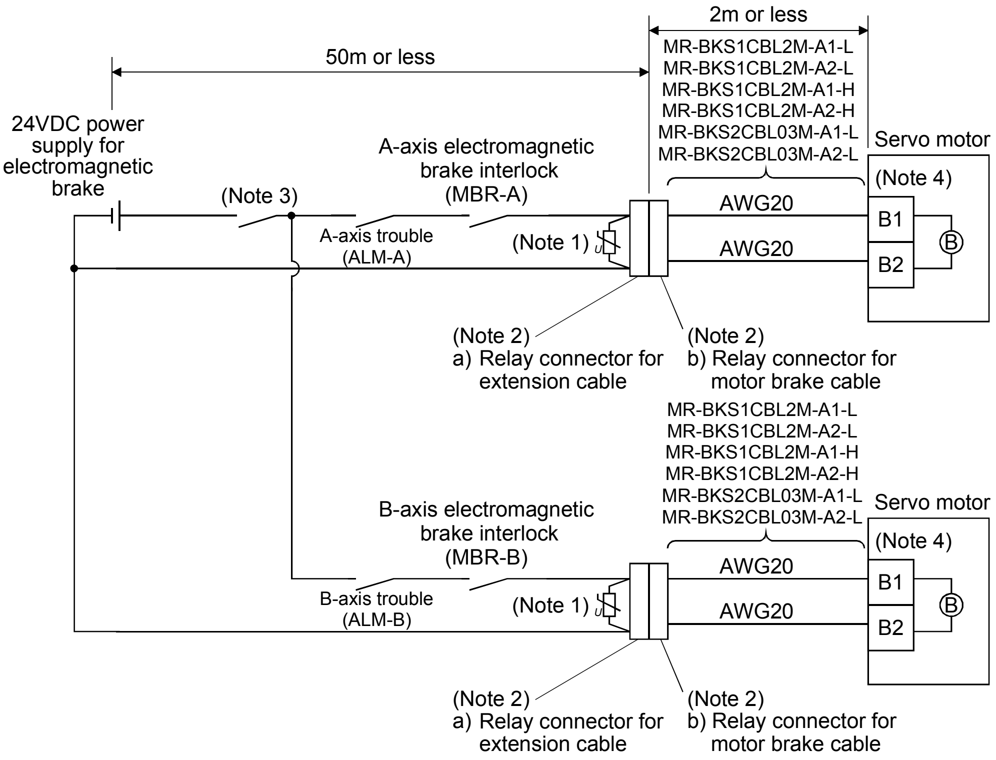
Note 1. Connect a surge absorber as close to the servo motor as possible.
2. There is no polarity in electromagnetic brake terminals (B1 and B2).
3. Shut off the circuit by interlocking with the emergency stop switch.

When fabricating the motor brake cable MR-BKS1CBL-□M-H, refer to section 11.1.4.

(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 11.5 for the wire used for the extension cable.



Note 1. Connect a surge absorber as close to the servo motor as possible.

2. 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-∗ (D6) (DDK) └ Wire size: S, M, L	IP65

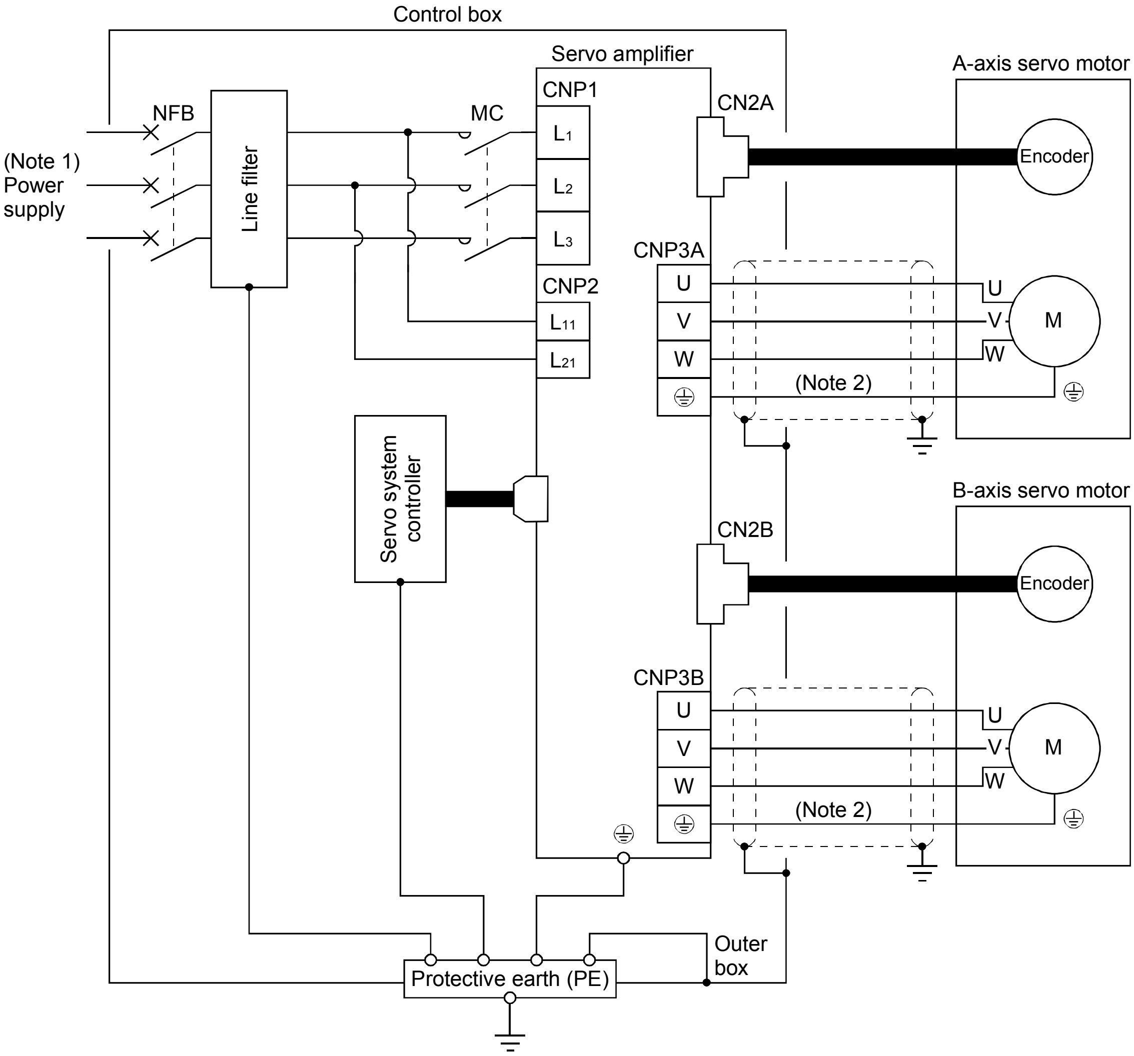
3. Shut off the circuit by interlocking with the emergency stop switch.

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

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 1. For 1-phase 200V to 230VAC, connect the power supply to L1 ▪ L2 and leave L3 open. Refer to section 1.3 for the power supply specification.

2. Ensure to connect it to ⏚ of a CN3A/CN3B connector. Do not connect it directly to the protective earth of the control panel.

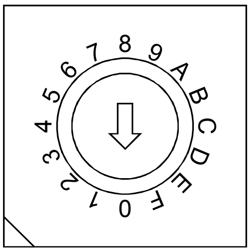
3.13 Control axis selection

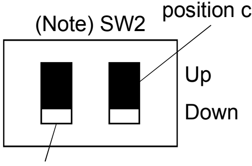
POINT

- The control axis number set to rotary axis setting switch (SW1) should be the same as the one set to the servo system controller.
- For changing the setting of the rotary switch, use a flat-blade screwdriver with the blade edge width of 2.1 to 2.3 [mm] and the blade edge thickness of 0.6 to 0.7 [mm].

Use the rotary axis setting switch (SW1) to set the control axis number for the servo. If the same numbers are set to different control axes in a single communication system, the system will not operate properly. The control axes may be set independently of the SSCNETⅢ cable connection sequence.

Rotary axis setting switch(SW1)





For manufacturer setting (Be sure to set to the "Down" position. Setting the switch to the "Up" position causes the switch setting error (11.2).)

Test operation select switch (SW2-1)
Set the test operation select switch to the "Up" position, when performing the test operation mode by using MR Configurator.

Note. This table indicates the status when the switch is set to "Down". (Default)

Manufacturer setting switch	Rotary axis setting switch (SW1)	(Note 2) A-axis	(Note 2) B-axis
Down (Be sure to set to the "Down" position.)	0	Axis No.1	Axis No.2
	1	Axis No.2	Axis No.3
	2	Axis No.3	Axis No.4
	3	Axis No.4	Axis No.5
	4	Axis No.5	Axis No.6
	5	Axis No.6	Axis No.7
	6	Axis No.7	Axis No.8
	7	Axis No.8	Axis No.9
	8	Axis No.9	Axis No.10
	9	Axis No.10	Axis No.11
	A	Axis No.11	Axis No.12
	B	Axis No.12	Axis No.13
	C	Axis No.13	Axis No.14
	D	Axis No.14	Axis No.15
	E	Axis No.15	Axis No.16
	F (Note 1)	Cannot be set	Cannot be set

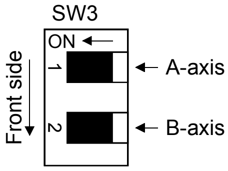
Note 1. Setting the switch to the "F" position causes the switch setting error (11.1).
2. An axis number is assigned even for the axis that is set as motor-less operation. Set SW1 so as to avoid overlapping the axis numbers.

3.14 Servo motor selection switch (SW3)

POINT

- To prevent an electric shock, wait at least 15 minutes after turning off the power and confirm that the charge lamp is off before changing the servo motor selection switch (SW3) setting. In addition, always confirm from the front of the servo amplifier whether the charge lamp is off or not.
- One servo amplifier can use rotary servo motors and linear servo motors in combination.
- If the connected servo motor does not match the SW3 setting, the switch setting error (11.3) occurs.

Select the servo motor type by using the servo motor selection switch (SW3) located on the bottom of the servo amplifier. A servo motor can be selected for each of the A-axis and the B-axis.
Make sure to confirm the power-off before changing the SW3 setting.



SW3 setting status	Servo motor type
OFF (factory setting)	Rotary servo motor
ON	Linear servo motor

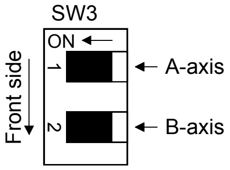
4. STARTUP

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.

POINT

- To use a rotary servo motor, turn SW3 off (factory setting).

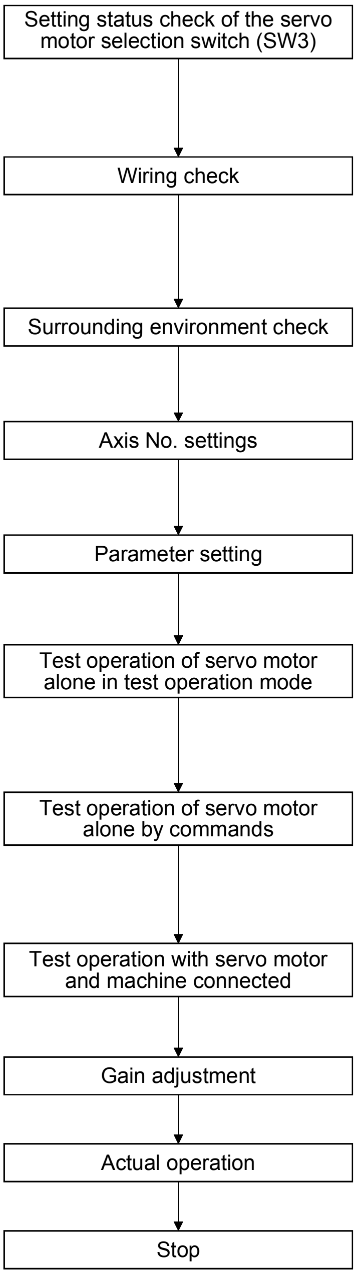


- When using only one of A-axis or B-axis, set "□□□1" in the parameter No.PC05 of the axis, which not connected to the servomotor, to select the motor-less operation.

4.1 Switching power on for the first time

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

4.1.1 Startup procedure



Check that the setting status matches the servo motor type to be used. (Refer to section 3.14.)

Check whether the servo amplifier and servo motor are wired correctly using visual inspection, DO forced output function (section 4.5.1), etc. (Refer to section 4.1.2.)

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

Confirm that the axis No. settings for rotary axis setting switch (SW1) and servo system controller are consistent. (Refer to section 3.13.)

Set the parameters as necessary, such as the used control mode and regenerative option selection. (Refer to chapter 5.)

For the test operation, with the servo motor disconnected from the machine and operated at the speed as low as possible, check whether the servo motor rotates correctly. (Refer to section 4.5.)

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

Connect the servo motor with the machine, give operation commands from the host command device, and check machine motions.

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

Stop giving commands and stop operation.

4.1.2 Wiring check

(1) Power supply system wiring

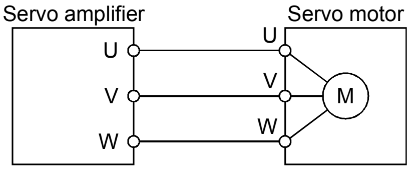
Before switching on the main circuit and control circuit power supplies, check the following items.

(a) Power supply system wiring

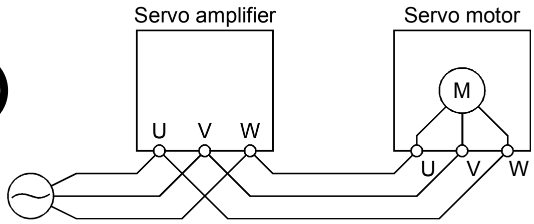
The power supplied to the power input terminals (L_1, L_2, L_3, L_{11}, L_{21}) of the servo amplifier should satisfy the defined specifications. (Refer to section 1.3.)

(b) Connection of servo amplifier and servo motor

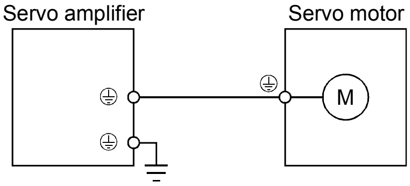
1) The servo motor power supply terminals (U, V, W) of the servo amplifier match in phase with the power input terminals (U, V, W) of the servo motor.



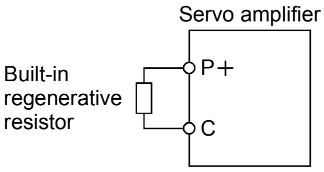
2) The power supplied to the servo amplifier should not be connected to the servo motor power supply terminals (U, V, W). To do so will fail the connected servo amplifier and servo motor.



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



4) The built-in regenerative resistor is connected to the P＋ terminal and the C terminal.



(c) When option and auxiliary equipment are used

When regenerative option is used

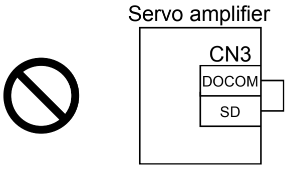
- The generative brake option should be connected to P＋ terminal and C terminal.
- A twisted cable should be used. (Refer to section 11.2.)

(2) I/O signal wiring

(a) The I/O signals should be connected correctly.
Use DO forced output to forcibly turn on/off the pins of the CN3 connector. This function can be used to perform a wiring check. In this case, switch on the control circuit power supply only.

(b) 24VDC or higher voltage is not applied to the pins of connectors CN3.

(c) SD and DOCOM of connector CN3 is 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 10.4.)

(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

POINT

- The controller recognizes MR-J3W-□B as two servo amplifiers. For this reason, select "MR-J3-B" for both of the A-axis and the B-axis. The following tables shows the servo amplifier setting in the controller when using the MR-J3W-□B servo amplifier.

Compatible controller	Servo amplifier selection
Motion controller (Q172HCPU, Q173HCPU, Q172DCPU, Q173DCPU, Q170MCPU)	Select "MR-J3-B" in the system setting screen.
Positioning module (QD75MH)	Select "MR-J3-B" in "Servo series" (Pr.100) of the servo parameter.

Connect the servo motor with a machine after confirming that the servo motor operates properly alone.

(1) Power on

When the main and control circuit power supplies are switched on, "b01" (for the first axis) appears on the servo amplifier display.

In the absolute position detection system, first power-on results in the absolute position lost (25.1) alarm and the servo system cannot be switched on.

The alarm can be deactivated by 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 2000r/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) Parameter setting

Set the parameters according to the structure and specifications of the machine. Refer to chapter 5 for the parameter definitions.

Parameter No.	Name	Setting	Description
PA14	Rotation direction setting	0	Increase in positioning address rotates the motor in the CCW direction.
PA08	Auto tuning mode	□□□1	Used.
PA09	Auto tuning response	12	Slow response (factory setting) is selected.

After setting the above parameters, switch power off once. Then switch power on again to make the set parameter values valid.

(3) Servo-on

Switch the servo-on in the following procedure.

1) Switch on main circuit/control circuit power supply.

2) The controller transmits the servo-on command.

When placed in the servo-on status, the servo amplifier is ready to operate and the servo motor is locked.

(4) Home position return

Always perform home position return before starting positioning operation.

(5) Stop

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

When the servo motor is with an electromagnetic brake, refer to section 3.11.

	Operation/command	Stopping condition
Servo system controller	Servo off command	The base circuit is shut off and the servo motor coasts.
	Ready off command	The base circuit is shut off and the dynamic brake operates to bring the servo motor to stop.
	Forced stop command	The base circuit is shut off and the dynamic brake operates to bring the servo motor to stop. The controller forced stop warning (E7.1) occurs.
Servo amplifier	Alarm occurrence	The base circuit is shut off and the dynamic brake operates to bring the servo motor to stop.
	Forced stop (EM1) OFF	The base circuit is shut off and the dynamic brake operates to bring the servo motor to stop. The servo forced stop warning (E6.1) occurs.

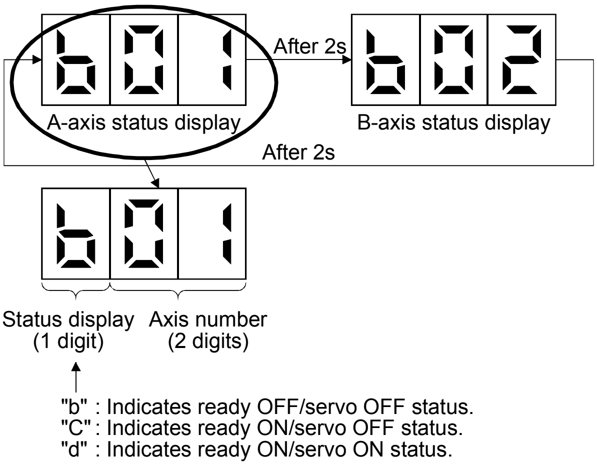
4.3 Servo amplifier display

On the servo amplifier display (3-digit, 7-segment display), check the status of communication with the servo system controller at power-on, check the axis number, and diagnose a fault at occurrence of an alarm.

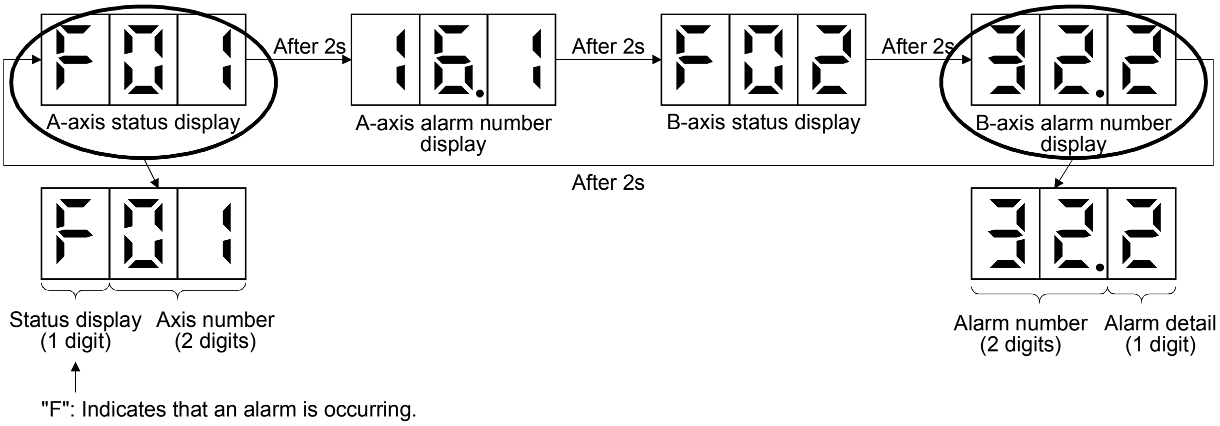
4.3.1 Scrolling display

The statuses of the A-axis and the B-axis are displayed alternately. The statuses of the both axes can be checked.

(1) Normal display
When there is no alarm, the statuses of the A-axis and the B-axis are displayed alternately. In this example, the A-axis is set as the first axis, and the B-axis as the second axis.

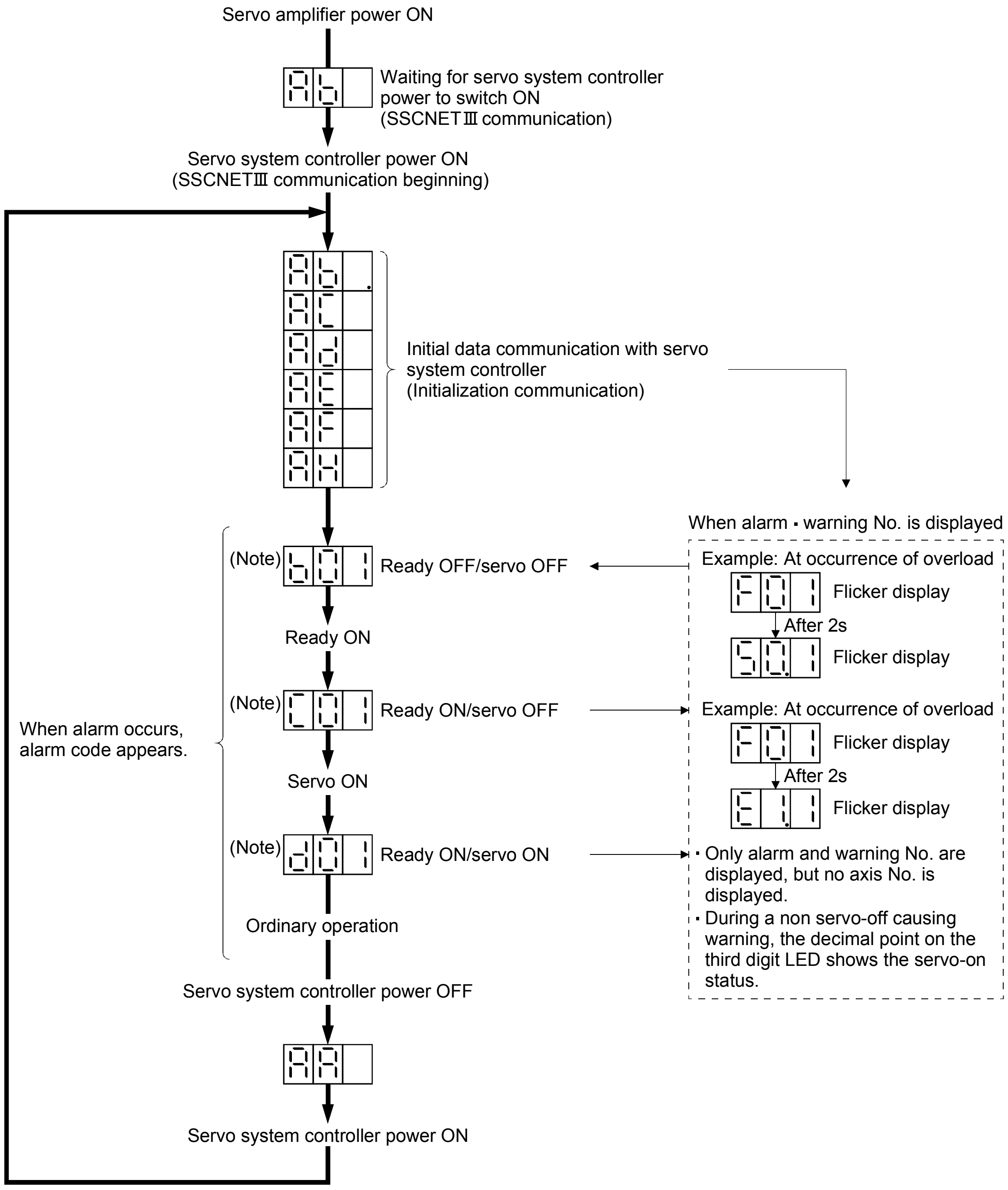


(2) Alarm display
When there is an alarm, the alarm number (two digits) and the alarm detail (one digit) are displayed following the status display. In this example, the encoder initial communication error 1 (16.1) is occurring in the A-axis, and the overcurrent (32.2) is occurring in the B-axis.



4.3.2 Status display of an axis

(1) Display sequence



Note. 01 02 ··· 16 The segment of the last 2 digits shows the axis number.
Axis 1 Axis 2 Axis 16 (Below example indicates Axis 1)

(2) Indication list

Indication	Status	Description
Ab	Initializing	・Power of the servo amplifier was switched on at the condition that the power of servo system controller is OFF. ・The axis No. set to the servo system controller does not match the axis No. set with the rotary axis setting switch (SW1) of the servo amplifier. ・A servo amplifier fault, or communication error with the servo system controller or the prior servo amplifier axis occured. In this case, the indication changes as follows: "Ab " → "AC " → "Ad " → "Ab " ・The servo system controller is faulty.
Ab.	Initializing	During initial setting for communication specifications
AC	Initializing	Initial setting for communication specifications completed, and then it synchronized with servo system controller.
Ad	Initializing	During initial parameter setting communication with servo system controller
AE	Initializing	During motor・encoder information and telecommunication with servo system controller
AF	Initializing	During initial signal data communication with servo system controller
AH	Initializing completion	During the completion process for initial data communication with servo system controller
AA	Initializing standby	The power supply of servo system controller is turned off during the power supply of servo amplifier is on.
(Note 1) b##	Ready OFF	The ready off signal from the servo system controller was received.
(Note 1) d##	Servo ON	The ready off signal from the servo system controller was received.
(Note 1) C##	Servo OFF	The ready off signal from the servo system controller was received.
(Note 2) ***	Alarm・Warning	The alarm No./warning No. that occurred is displayed. (Refer to section 8.1.)
888	CPU Error	CPU watchdog error has occurred.
(Note 3) b0A. b0b.	(Note 3) Test operation mode	JOG operation, positioning operation, programmed operation, DO forced output.
(Note 1) b##. d##. C##.		Motor-less operation

Note 1. ## denotes any of numerals 00 to 16 and what it means is listed below.

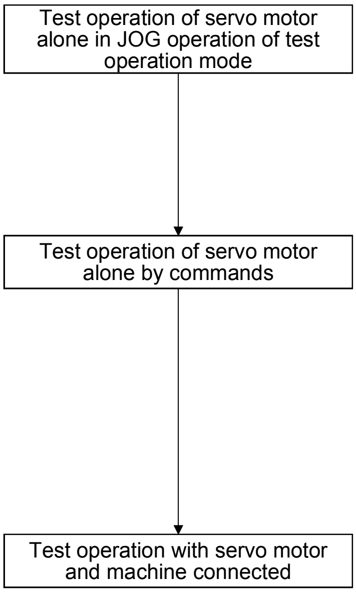
#	Description
0A/0B	Set to the test operation mode.
1	First axis
2	Second axis
3	Third axis
4	Fourth axis
5	Fifth axis
6	Sixth axis
7	Seventh axis
8	Eighth axis
9	Ninth axis
10	Tenth axis
11	Eleventh axis
12	Twelfth axis
13	Thirteenth axis
14	Fourteenth axis
15	Fifteenth axis
16	Sixteenth axis

2. ** indicates the warning/alarm No. "A" in the third digit indicates the A-axis, and the "B" indicates the B-axis.
3. Requires the MR Configurator.

4.4 Test operation

Before starting actual operation, perform test operation to make sure that the machine operates normally.
Refer to section 4.2 for the power on and off methods of the servo amplifier.

POINT
・If necessary, verify controller program by using motor-less operation. Refer to section 4.5.2 for the motor-less operation.



In this step, confirm that the servo amplifier and servo motor operate normally. With the servo motor disconnected from the machine, use the test operation mode and check whether the servo motor rotates correctly. Refer to section 4.5 for the test operation mode.

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

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.
Give a low speed command at first and check the operation direction, etc. of the machine. If the machine does not operate in the intended direction, check the input signal. In the status display, check for any problems of the servo motor speed, command pulse frequency, load ratio, etc.
Then, check automatic operation with the program of the command device.

4.5 Test operation mode

⚠CAUTION

- The test operation mode is designed for servo operation confirmation and not for machine operation confirmation. Do not use this mode with the machine. Always use the servo motor alone.
- If an operation fault occurred, use the forced stop (EM1) to make a stop.

POINT

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

By using a personal computer and the MR Configurator, you can execute jog operation, positioning operation, DO forced output program operation without connecting the servo system controller.

4.5.1 Test operation mode in MR Configurator

POINT

- When using MR-J3W-□B, both of the A-axis and the B-axis go into the test operation mode, but only one of them can be operated.

(1) Test operation mode

(a) Jog operation

Jog operation can be performed without using the servo system controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on or off and whether the servo system controller is connected or not.
Exercise control on the jog operation screen of the MR Configurator.

1) Operation pattern

Item	Factory setting	Setting range
Speed [r/min]	200	0 to max. speed
Acceleration/deceleration time constant [ms]	1000	0 to 50000

2) Operation method

- When the check box of "Rotation only while the button is being pushed" is checked.

Operation	Screen control
Forward rotation start	Keep pressing the "Forward" button.
Reverse rotation start	Keep pressing the "Reverse" button.
Stop	Release "Forward" or "Reverse" button.

- When the check box of "Rotation only while the button is being pushed" is not checked.

Operation	Screen control
Forward rotation start	Click the "Forward" button.
Reverse rotation start	Click the "Reverse" button.
Stop	Click the "Stop" button.

(b) Positioning operation

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

Exercise control on the positioning operation screen of the MR Configurator.

1) Operation pattern

Item	Factory setting	Setting range
Travel distance [pulse]	4000	0 to 99999999
Speed [r/min]	200	0 to max. speed
Acceleration/deceleration time constant [ms]	1000	0 to 50000
Repeat operation	Fwd. rot. (CCW) → Rev. rot. (CW)	Fwd. rot. (CCW) → Rev rot. (CW) Fwd. rot. (CCW) → Fwd. rot. (CCW) Rev rot. (CW) → Fwd. rot. (CCW) Rev rot. (CW) → Rev rot. (CW)
Dwell time [s]	2.0	0.5 to 50.0
Number of repeats [time]	1	1 to 9999

2) Operation method

Operation	Screen control
Forward rotation start	Click the "Forward" button.
Reverse rotation start	Click the "Reverse" button.
Pause	Click the "Pause" button.

(c) Program operation

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

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

Operation	Screen control
Start	Click the "Start" button.
Stop	Click the "Reset" button.

(d) Output signal (DO) forced output

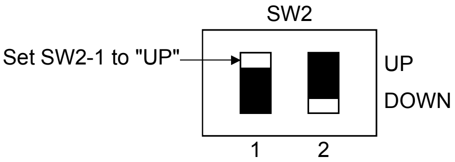
Output signals can be switched on/off forcibly independently of the servo status. Use this function for output signal wiring check, etc.

Exercise control on the DO forced output screen of the MR Configurator.

(2) Operation procedure

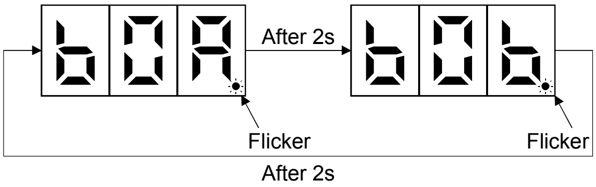
(a) Switch power off.

(b) Set SW2-1 to "UP".



Changing SW2-1 to "UP" while power is on will not start the test operation mode.

(c) Switch servo amplifier power on.
When initialization is over, the display shows the following screen.



(d) Perform operation with the personal computer.

4.5.2 Motor-less operation in controller

POINT

- Use motor-less operation which is available by making the servo system controller parameter setting.
- Motor-less operation is done while connected with the servo system controller.

(1) Motor-less operation

Without connecting the servo motor, output signals or status displays can be provided in response to the servo system controller commands as if the servo motor is actually running. This operation may be used to check the servo system controller sequence. Use this operation with the forced stop reset. Use this operation with the servo amplifier connected to the servo system controller.

For stopping the motor-less operation, set the selection of motor-less operation to [Invalid] in servo parameter setting of servo system controller. Motor-less operation will be invalid condition after switching on power supply next time.

(a) Load conditions

Load item	Condition
Load torque	0
Load inertia moment ratio	Same as servo motor inertia moment

(b) Alarms

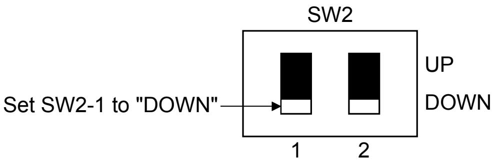
The following alarms and warning do not occur. However, the other alarms and warnings occur as when the servo motor is connected.

- Encoder initial communication error 1 (16)
- Encoder normal communication error 1 (20)
- Encoder normal communication error 2 (21)
- Absolute position erase (25)
- Battery cable disconnection warning (92)
- Battery warning (9F)
- Main circuit off warning (E9)

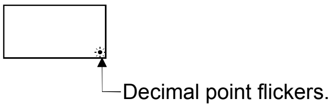
(2) Operating procedure

1) Switch off servo amplifier

2) Set parameter No.PC05 to "1", change test operation mode switch (SW2-1) to normal condition side "Down", and then turn on the power supply.



3) Perform motor-less operation with the personal computer.
The display shows the following screen.



MEMO

5. PARAMETERS

⚠ CAUTION

- Never adjust or change the parameter values extremely as it will make operation instable.

POINT

- When the servo amplifier is connected with the servo system controller, the parameters are set to the values of the servo system controller.
- Setting may not be made to some parameters and ranges depending on the model or version of the servo system controller. For details, refer to the servo system controller user's manual.

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□□)	When changing settings such as analog monitor output signal or encoder electromagnetic brake sequence output, use these parameters.
I/O setting parameters (No.PD□□)	Use these parameters when changing the I/O signals of the servo amplifier.
Extension control parameters (No.PE□□)	Use these parameters when selecting a function in the fully closed loop system.
Option setting parameters (No.Po□□)	These parameters are dedicated to MR-J3W.

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□□)

POINT

- The parameter whose symbol preceded by * can be validated with the following conditions.
  - * : Turn off the power and then on again, or reset the controller after setting the parameter.
  - **: Turn off the power and then on again after setting the parameter.
- Never change parameters for manufacturer setting.

5.1.1 Parameter list

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit
PA01	**STY	Control mode	Each axis	0000h	
PA02	**REG	Regenerative option	Common	0000h	
PA03	*ABS	Absolute position detection system	Each axis	0000h	
PA04	*AOP1	Function selection A-1	Common	0000h	
PA05		For manufacturer setting		0	
PA06				1	
PA07				1	
PA08	ATU	Auto tuning mode	Each axis	0001h	
PA09	RSP	Auto tuning response	Each axis	12	
PA10	INP	In-position range	Each axis	100	pulse
PA11		For manufacturer setting		1000.0	
PA12				1000.0	
PA13				0000h	
PA14	*POL	Rotation direction selection	Each axis	0	
PA15	*ENR	Encoder output pulses	Each axis	4000	pulse/rev
PA16	*ENR2	Encoder output pulses 2	Each axis	0	
PA17		For manufacturer setting		0000h	
PA18				0000h	
PA19	*BLK	Parameter write inhibit	Each axis	000Bh	

Note 1. Each axis: Set a value for each of the A-axis and the B-axis.

Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.

2. Valid for the A-axis and the B-axis.

5.1.2 Parameter write inhibit

Parameter			Setting	Factory setting	Unit	Setting range
No.	Symbol	Name				
PA19	*BLK	Parameter write inhibit	Each axis	000Bh		Refer to the text.

POINT

- Turn off the power and then on again, or reset the controller after setting the parameter to validate the parameter value.

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□□	(Note) Special setting parameters No.PS□□	Option setting parameters No.Po□□
0000h	Reference	○					
	Write	○					
000Bh (factory setting)	Reference	○	○	○			
	Write	○	○	○			
000Ch	Reference	○	○	○	○		
	Write	○	○	○	○		
000Dh	Reference	○	○	○	○	○	
	Write	○	○	○	○	○	
000Eh	Reference	○	○	○	○	○	○
	Write	○	○	○	○	○	○
100Bh	Reference	○					
	Write	No.PA19 only					
100Ch	Reference	○	○	○	○		
	Write	No.PA19 only					
100Dh	Reference	○	○	○	○	○	
	Write	No.PA19 only					
100Eh	Reference	○	○	○	○	○	○
	Write	No.PA19 only					

Note. Do not use this parameter when using a rotary servo motor.

5.1.3 Selection of control mode

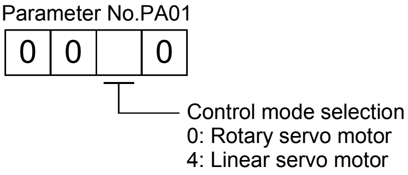
Parameter			Setting	Factory setting	Unit	Setting range
No.	Symbol	Name				
PA01	**STY	Control mode	Each axis	0000h		Refer to the text.

POINT

- Turn off the power and then on again after setting the parameter to validate the parameter value.

Select the control mode.

This parameter is set as "☐☐0☐" (rotary servo motor) in the initial setting.



Control mode selection
0: Rotary servo motor
4: Linear servo motor

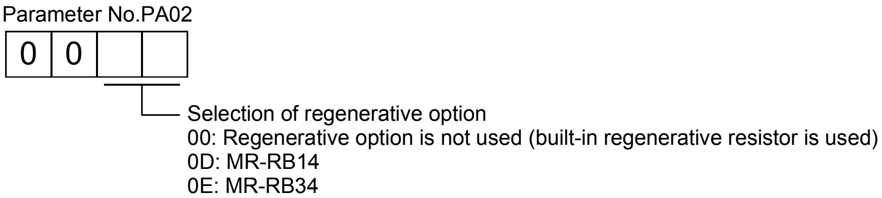
5.1.4 Selection of regenerative option

Parameter			Setting	Factory setting	Unit	Setting range
No.	Symbol	Name				
PA02	**REG	Regenerative option	Common	0000h		Refer to the text.

POINT

- Turn off the power and then on again after setting the parameter to validate the parameter value.
- Wrong setting may cause the regenerative option to burn.
- If the regenerative option selected is not for use with the servo amplifier, parameter error (37.2) occurs.

Set this parameter when using the regenerative option.



Selection of regenerative option
00: Regenerative option is not used (built-in regenerative resistor is used)
0D: MR-RB14
0E: MR-RB34

5.1.5 Using absolute position detection system

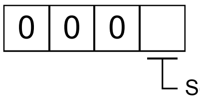
Parameter			Setting	Factory setting	Unit	Setting range
No.	Symbol	Name				
PA03	*ABS	Absolute position detection system	Each axis	0000h		Refer to the text.

POINT

- Turn off the power and then on again, or reset the controller after setting the parameter to validate the parameter value.
- This parameter cannot be used in the speed control mode.

Set this parameter when using the absolute position detection system in the position control mode.

Parameter No.PA03



Selection of absolute position detection system (refer to chapter 12)
0: Used in incremental system
1: Used in absolute position detection system

5.1.6 Forced stop input selection

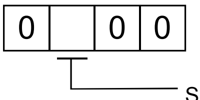
Parameter			Setting	Factory setting	Unit	Setting range
No.	Symbol	Name				
PA04	*AOP1	Function selection A-1	Common	0000h		Refer to the text.

POINT

- Turn off the power and then on again, or reset the controller after setting the parameter to validate the parameter value.

The servo forced stop function is avoidable.

Parameter No.PA04



Selection of servo forced stop
0: Valid (Forced stop (EM1) is used.)
1: Invalid (Forced stop (EM1) is not used.)

When not using the forced stop (EM1) of servo amplifier, set the selection of servo forced stop to Invalid (□1□□). At this time, the forced stop (EM1) automatically turns on inside the servo amplifier.

5.1.7 Auto tuning

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

Make gain adjustment using auto tuning. Refer to section 6.2 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	Load to motor inertia moment ratio
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	↓	52.9
16	Middle 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	↓	355.1
32	Middle response	400.0

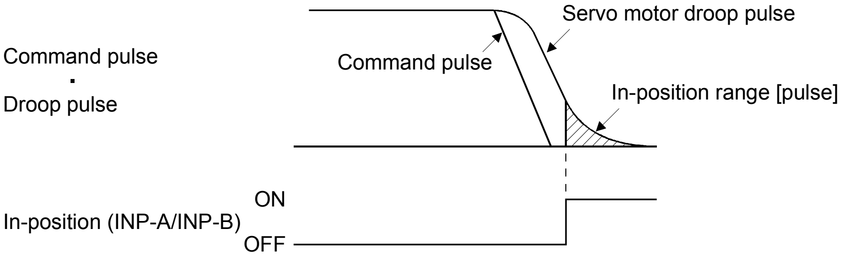
5.1.8 In-position range

Parameter			Setting	Factory setting	Unit	Setting range
No.	Symbol	Name				
PA10	INP	In-position range	Each axis	100	pulse	0 to 65535

POINT

- This parameter cannot be used in the speed control mode.

Set the range, where in position (INP-A/INP-B) is output, in the command pulse unit.



5.1.9 Selection of servo motor rotation direction

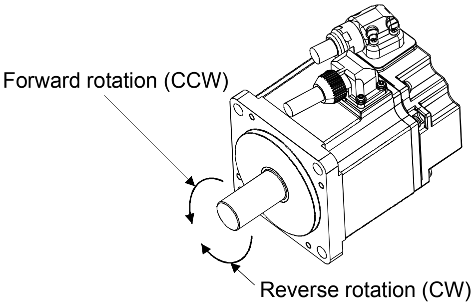
Parameter			Setting	Factory setting	Unit	Setting range
No.	Symbol	Name				
PA14	*POL	Rotation direction selection	Each axis	0		0・1

POINT

- Turn off the power and then on again, or reset the controller after setting the parameter to validate the parameter value.

Select servo motor rotation direction relative.

Parameter No.PA14 setting	Servo motor rotation direction	
	When positioning address increases	When positioning address decreases
0	CCW	CW
1	CW	CCW



5.1.10 Encoder output pulse

Parameter			Setting	Factory setting	Unit	Setting range
No.						
PA15	*ENR	Encoder output pulses	Each axis	4000	pulse/rev	1 to 65535
PA16	*ENR2	Encoder output pulses 2	Each axis	0		0 to 65535

POINT

- Turn off the power and then on again, or reset the controller after setting the parameter to validate the parameter value.

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.PC03 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□" in parameter No.PC03.
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.

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

(2) For output division ratio setting
Set "□□1□" in parameter No.PC03.
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.

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

(3) A/B phase pulse electronic gear setting
This parameter is made valid when parameter No.PC03 is set to "□□3□".
Set the encoder pulses (A phase, B phase) output by the servo amplifier.
Set the encoder pulses output by the servo amplifier by parameter No.PA15 and parameter No.PA16.
Travel distance [pulse] of the linear encoder is multiplied by the set value.

$$\text{Output pulse} = \text{Travel distance of linear encoder} \times \frac{\text{Set value of parameter No.PA15}}{\text{Set value of parameter No.PA16}} \text{ [pulse]}$$

The number of A/B phase pulses actually output is 1/4 times greater than the preset number of pulses. Also, the maximum output frequency is 4.6Mpps (after multiplication by 4). Use this parameter within the range. When the set value is "0 (factory setting)", it is internally treated as "1".

5.2 Gain/filter parameters (No.PB□□)

POINT

- The parameter whose symbol preceded by * can be validated with the following conditions.
  * : Turn off the power and then on again, or reset the controller after setting the parameter.

5.2.1 Parameter list

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

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit
PB35		For manufacturer setting		0.00	
PB36				0.00	
PB37				100	
PB38				0.0	
PB39				0.0	
PB40				0.0	
PB41				1125	
PB42				1125	
PB43				0004h	
PB44				0.0	
PB45				0000h	

Note 1. Each axis: Set a value for each of the A-axis and the B-axis.
Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.
2. Valid for the A-axis and the B-axis.

5.2.2 List of details

No.	Symbol	Name and function	Setting	Factory setting	Unit	Setting range
PB01	FILT	Adaptive tuning mode (Adaptive filter Ⅱ) Used to set the mode for the machine resonance suppression filter 1. 0 0 0 □ Filter tuning mode 0: Invalid 1: Cannot be set 2: Manual setting If "□□□1" is set for this parameter, it is automatically rewritten as "□□□0".	Each axis	0000h		Refer to Name and function column.
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control) Used to set the tuning mode for the vibration suppression control. 0 0 0 □ Vibration suppression control tuning mode 0: Invalid 1: Cannot be set 2: Manual setting If "□□□1" is set for this parameter, it is automatically rewritten as "□□□0".	Each axis	0000h		Refer to Name and function column.
PB03		For manufacturer setting Do not change this value by any means.		0		
PB04	FFC	Feed forward gain This parameter cannot be used in the speed control mode. 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.	Each axis	0	%	0 to 100

No.	Symbol	Name and function	Setting	Factory setting	Unit	Setting range
PB05		For manufacturer setting Do not change this value by any means.		500		
PB06	GD2	Load to motor inertia moment ratio 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 6.1.1) In this case, it varies between 0 and 100.0. When parameter No.PA08 is set to "□□□2" or "□□□3", this parameter can be set manually.	Each axis	7.0	Multiplier (×1)	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. When parameter No.PA08 is set to "□□□0" or "□□□3", this parameter can be set manually.	Each axis	24	rad/s	1 to 2000
PB08	PG2	Position loop gain This parameter cannot be used in the speed control mode. 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. When parameter No.PA08 is set to "□□□3", this parameter can be set manually.	Each axis	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 and interpolation mode is selected, the result of auto tuning is automatically used. When parameter No.PA08 is set to "□□□3", this parameter can be set manually.	Each axis	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. When parameter No.PA08 is set to "□□□3", this parameter can be set manually.	Each axis	33.7	ms	0.1 to 1000.0
PB11	VDC	Speed differential compensation Used to set the differential compensation. When parameter No.PB24 is set to "□□3□", this parameter is made valid. When parameter No.PA08 is set to "□□0□", this parameter is made valid by instructions of controller.	Each axis	980		0 to 1000
PB12		For manufacturer setting Do not change this value by any means.		0		

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Setting</th><th>Factory setting</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PB13</td><td>NH1</td><td>Machine resonance suppression filter 1
Set the notch frequency of the machine resonance suppression filter 1.
When the parameter No.PB01 setting is "□□□0", the setting of this parameter is ignored.
If a value exceeding "3000" is set for this parameter, it is automatically rewritten as "3000".</td><td>Each axis</td><td>4500</td><td>Hz</td><td>100 to 4500</td></tr>
<tr><td>PB14</td><td>NHQ1</td><td>Notch shape selection 1
Select the shape of 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>
When the parameter No.PB01 setting is "□□□0", the setting of this parameter is ignored.</td><td>Each axis</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.
If a value exceeding "3000" is set for this parameter, it is automatically rewritten as "3000".</td><td>Each axis</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>Each axis</td><td>0000h</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

No.	Symbol	Name and function	Setting	Factory setting	Unit	Setting range
PB17		Automatic setting parameter The value of this parameter is set according to a set value of parameter No.PB06 (Load to motor inertia moment ratio).				
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.	Each axis	3141	rad/s	100 to 9000
PB19	VRF1	Vibration suppression control vibration frequency setting This parameter cannot be used in the speed control mode. Set the vibration frequency for vibration suppression control to suppress low-frequency machine vibration, such as enclosure vibration. (Refer to section 7.3.) When parameter No.PB02 is set to "□□□2", this parameter can be set manually.	Each axis	100.0	Hz	0.1 to 100.0
PB20	VRF2	Vibration suppression control resonance frequency setting This parameter cannot be used in the speed control mode. Set the resonance frequency for vibration suppression control to suppress low-frequency machine vibration, such as enclosure vibration. (Refer to section 7.3.) When parameter No.PB02 is set to "□□□2", this parameter can be set manually.	Each axis	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]	Each axis	0000h		Refer to Name and function column.
PB24	*MVS	Slight vibration suppression control selection Select the slight vibration suppression control and PI-PID change. When parameter No.PA08 (auto tuning mode) is set to "□□□3", this parameter is made valid. (Slight vibration suppression control cannot be used in the speed control mode.) 0 0 □ □ Slight vibration suppression control selection 0: Invalid 1: Valid PI-PID control switch over selection 0: PI control is valid. (Switching to PID control is possible with instructions of controller.) 3: PID control is always valid.	Each axis	0000h		Refer to Name and function column.
PB25		For manufacturer setting Do not change this value by any means.		0000h		

No.	Symbol	Name and function	Setting	Factory setting	Unit	Setting range
PB26	*CDP	Gain changing selection Select the gain changing condition. (Refer to section 7.5.) 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: Control instructions from a controller. 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 when the control instruction from a controller is ON Valid at equal to or more than the value set in parameter No.PB27 1: Valid when the control instruction from a controller is OFF Valid at equal to or less than the value set in parameter No.PB27	Each axis	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 7.5.)	Each axis	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 7.5.)	Each axis	1	ms	0 to 100
PB29	GD2B	Gain changing load to motor inertia moment ratio Used to set the load to motor inertia moment ratio when gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No.PA08: □□□3).	Each axis	7.0	Multiplier (×1)	0 to 300.0
PB30	PG2B	Gain changing position loop gain This parameter cannot be used in the speed control mode. 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).	Each axis	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).	Each axis	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).	Each axis	33.7	ms	0.1 to 5000.0
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting This parameter cannot be used in the speed control mode. 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.	Each axis	100.0	Hz	0.1 to 100.0

No.	Symbol	Name and function	Setting	Factory setting	Unit	Setting range
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting This parameter cannot be used in the speed control mode. 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.	Each axis	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				0.0		
PB39				0.0		
PB40				0.0		
PB41				1125		
PB42				1125		
PB43				0004h		
PB44				0.0		
PB45				0000h		

5.3 Extension setting parameters (No.PC□□)

POINT

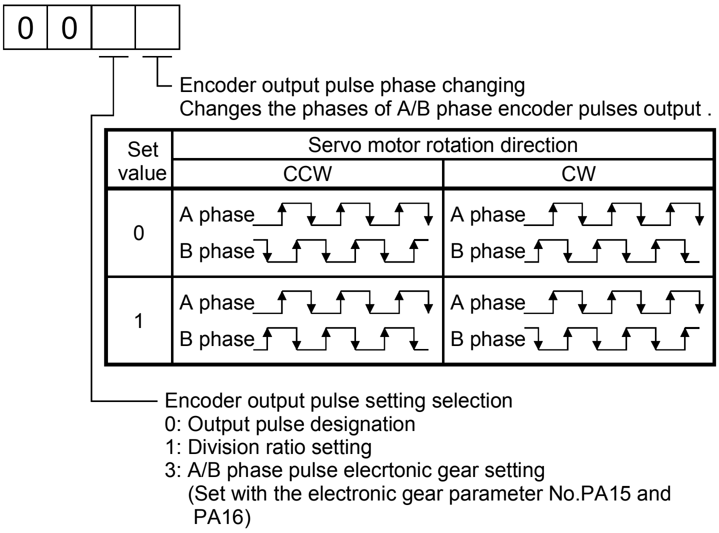
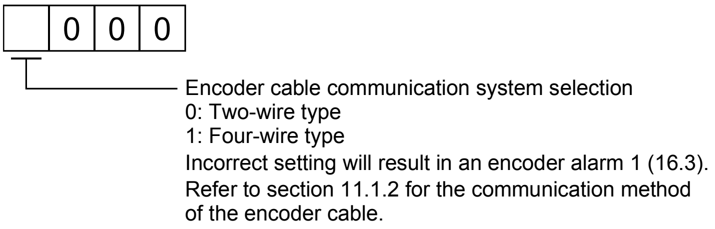
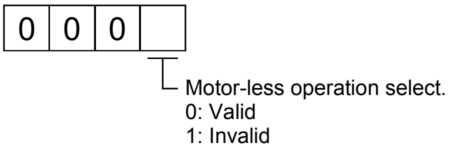
- The parameter whose symbol preceded by * can be validated with the following conditions.
  - * : Turn off the power and then on again, or reset the controller after setting the parameter.
  - **: Turn off the power and then on again after setting the parameter.

5.3.1 Parameter list

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit
PC01	ERZ	Error excessive alarm level	Each axis	0	rev
PC02	MBR	Electromagnetic brake sequence output	Each axis	0	ms
PC03	*ENRS	Encoder output pulses selection	Each axis	0010h	
PC04	**COP1	Function selection C-1	Each axis	0000h	
PC05	**COP2	Function selection C-2	Each axis	0000h	
PC06	*COP3	Function selection C-3	Each axis	0000h	
PC07	ZSP	Zero speed	Each axis	50	r/min
PC08		For manufacturer setting		0	
PC09	MOD1	Analog monitor 1 output	Common	0000h	
PC10	MOD2	Analog monitor 2 output	Common	0001h	
PC11	MO1	Analog monitor 1 offset	Common	0	mV
PC12	MO2	Analog monitor 2 offset	Common	0	mV
PC13		For manufacturer setting		0	
PC14				0	
PC15	SNO	Station number selection	Common	0	
PC16		For manufacturer setting		0000h	
PC17	**COP4	Function selection C-4	Each axis	0000h	
PC18		For manufacturer setting		0000h	
PC19				0000h	
PC20				0000h	
PC21	*BPS	Alarm history clear	Each axis	0000h	
PC22		For manufacturer setting		0000h	
PC23				0000h	
PC24				0000h	
PC25				0000h	
PC26				0000h	
PC27				0000h	
PC28				0000h	
PC29				0000h	
PC30				0000h	
PC31				0000h	
PC32				0000h	

Note 1. Each axis: Set a value for each of the A-axis and the B-axis.
Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.
2. Valid for the A-axis and the B-axis.

5.3.2 List of details

No.	Symbol	Name and function	Setting	Factory setting	Unit	Setting range
PC01	ERZ	Error excessive alarm level This parameter cannot be used in the speed control mode. Used to set the error excessive alarm level with rotation amount of servo motor. When "0" is set in this parameter, the alarm level is three rotations. When a value other than "0" is set, the alarm level is the rotation number of the set value. However, the alarm level stays at 200 rotations even if a value exceeding "200" is set. Note. Setting can be changed in parameter No.PC06.	Each axis	0	rev (Note 1)	0 to 1000
PC02	MBR	Electromagnetic brake sequence output Used to set the delay time (Tb) between electronic brake interlock (MBR-A/ MBR-B) and the base drive circuit is shut-off.	Each axis	0	ms	
PC03	*ENRS	Encoder output pulse selection Use to select the encoder output pulse direction and encoder output pulse setting.  Encoder output pulse phase changing Changes the phases of A/B phase encoder pulses output . Encoder output pulse setting selection 0: Output pulse designation 1: Division ratio setting 3: A/B phase pulse elecrtonic gear setting (Set with the electronic gear parameter No.PA15 and PA16)	Each axis	0010h		Refer to Name and function column.
PC04	**COP1	Function selection C-1 Select the encoder cable communication system selection.  Encoder cable communication system selection 0: Two-wire type 1: Four-wire type Incorrect setting will result in an encoder alarm 1 (16.3). Refer to section 11.1.2 for the communication method of the encoder cable.	Each axis	0000h		Refer to Name and function column.
PC05	**COP2	Function selection C-2 Motor-less operation select.  Motor-less operation select. 0: Valid 1: Invalid	Each axis	0000h		Refer to Name and function column.

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Setting</th><th>Factory setting</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PC06</td><td>*COP3</td><td>Function selection C-3
Select the error excessive alarm level setting for parameter No.PC01.
□ 0 0 0
Error excessive alarm level setting selection
0: 1 [rev]unit
1: 0.1 [rev]unit
2: 0.01 [rev]unit
3: 0.001[rev]unit</td><td>Each axis</td><td>0000h</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>PC07</td><td>ZSP</td><td>Zero speed
Used to set the output range of the zero speed (ZSP-A/ZSP-B).
Zero speed (ZSP-A/ZSP-B) detection has hysteresis width of 20r/min (Refer to section 3.5 (2) (b))</td><td>Each axis</td><td>50</td><td>r/min</td><td>0 to 10000</td></tr>
<tr><td>PC08</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td></td><td>0</td><td></td><td></td></tr>
<tr><td>PC09</td><td>MOD1</td><td>Analog monitor 1 output
Used to selection the signal provided to the analog monitor 1 (MO1) output. (Refer to section 5.3.3)
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)</td></tr>
<tr><td>2</td><td>Servo motor speed (+8V/max. speed)</td></tr>
<tr><td>3</td><td>Torque (+8V/max. torque)</td></tr>
<tr><td>4</td><td>Current command (±8V/max. current command)</td></tr>
<tr><td>5</td><td>Speed command (±8V/max. current command)</td></tr>
<tr><td>6</td><td>Droop pulses (±10V/100 pulses) (Note)</td></tr>
<tr><td>7</td><td>Droop pulses (±10V/1000 pulses) (Note)</td></tr>
<tr><td>8</td><td>Droop pulses (±10V/10000 pulses) (Note)</td></tr>
<tr><td>9</td><td>Droop pulses (±10V/100000 pulses) (Note)</td></tr>
<tr><td>D</td><td>Bus voltage (±8V/400V)</td></tr>
</table>
Note. Encoder pulse unit.
Analog monitor 1 (MO1) output axis selection
0: A-axis
1: B-axis</td><td>Common</td><td>0000h</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>PC10</td><td>MOD2</td><td>Analog monitor 2 output
Used to selection the signal provided to the analog monitor 2 (MO2) output. (Refer to section 5.3.3)
□ 0 0 □
Analog monitor 2 (MO2) output selection
The settings are the same as those of parameter No.PC09.
Analog monitor 2 (MO2) output axis selection
The settings are the same as those of parameter No.PC09.</td><td>Common</td><td>0001h</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

No.	Symbol	Name and function	Setting	Factory setting	Unit	Setting range
PC11	MO1	Analog monitor 1 offset Used to set the offset voltage of the analog monitor 1 (MO1) output.	Common	0	mV	−9999 to 9999
PC12	MO2	Analog monitor 2 offset Used to set the offset voltage of the analog monitor 2 (MO2) output.	Common	0	mV	−999 to 999
PC13		For manufacturer setting Do not change this value by any means.		0		
PC14				0		
PC15	SNO	Station number selection Used to select the axis to communicate with MR Configurator. 0: A-axis 1: B-axis	Common	0		
PC16		For manufacturer setting Do not change this value by any means.		0000h		
PC17	**COP4	Function Selection C-4 Home position setting condition in the absolute position detection system can be selected. 0 0 0 ☐ Selection of home position setting condition 0: Need to pass motor Z phase after the power supply is switched on. 1: Not need to pass motor Z phase after the power supply is switched on.	Each axis	0000h		Refer to Name and function column.
PC18		For manufacturer setting Do not change this value by any means.		0000h		
PC19				0000h		
PC20				0000h		
PC21	*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).	Each axis	0000h		Refer to Name and function column.
PC22		For manufacturer setting Do not change this value by any means.		0000h		
PC23				0000h		
PC24				0000h		
PC25				0000h		
PC26				0000h		
PC27				0000h		
PC28				0000h		
PC29				0000h		
PC30				0000h		
PC31				0000h		
PC32				0000h		

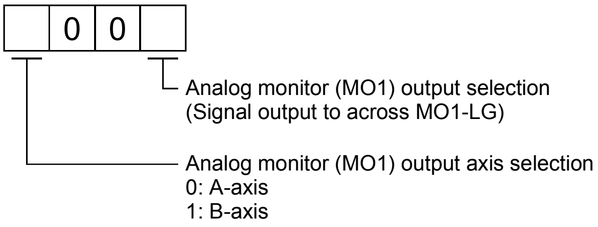
5.3.3 Analog monitor

The servo status can be output to two channels in terms of voltage.

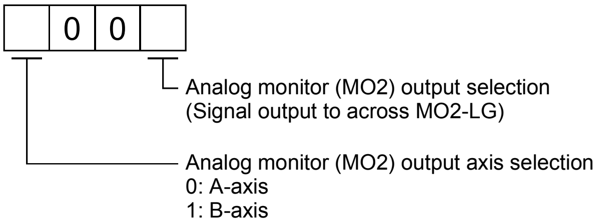
(1) Setting

Change the following digits of parameter No.PC09, PC10.

Parameter No.PC09



Parameter No.PC10



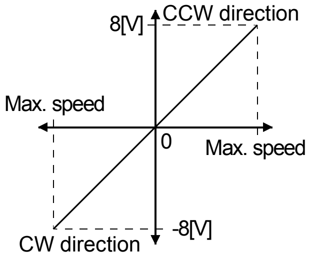
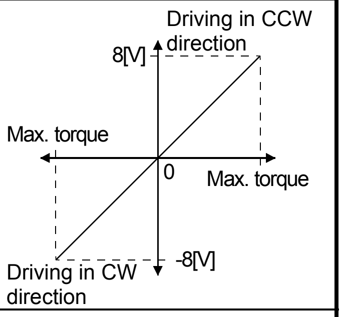
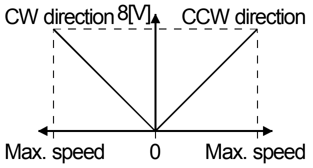
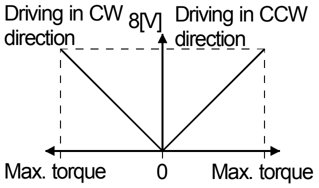
Parameters No.PC11 and PC12 can be used to set the offset voltages to the analog output voltages. The setting range is between −999 and 999mV.

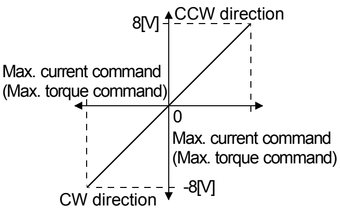
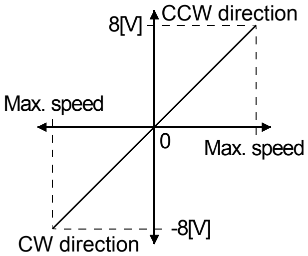
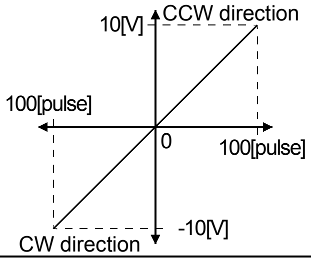
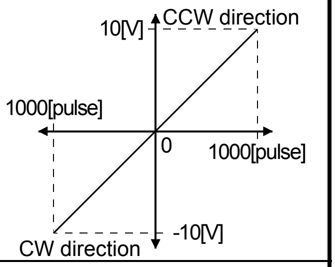
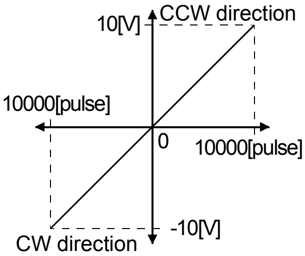
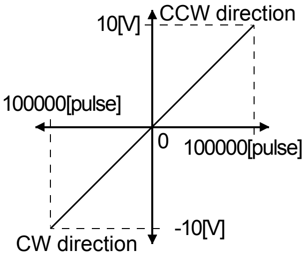
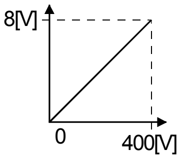
Parameter No.	Description	Setting range [mV]
PC11	Used to set the offset voltage for the analog monitor 1 (MO1).	−999 to 999
PC12	Used to set the offset voltage for the analog monitor 2 (MO2).	

(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.PC09 and PC10 value.

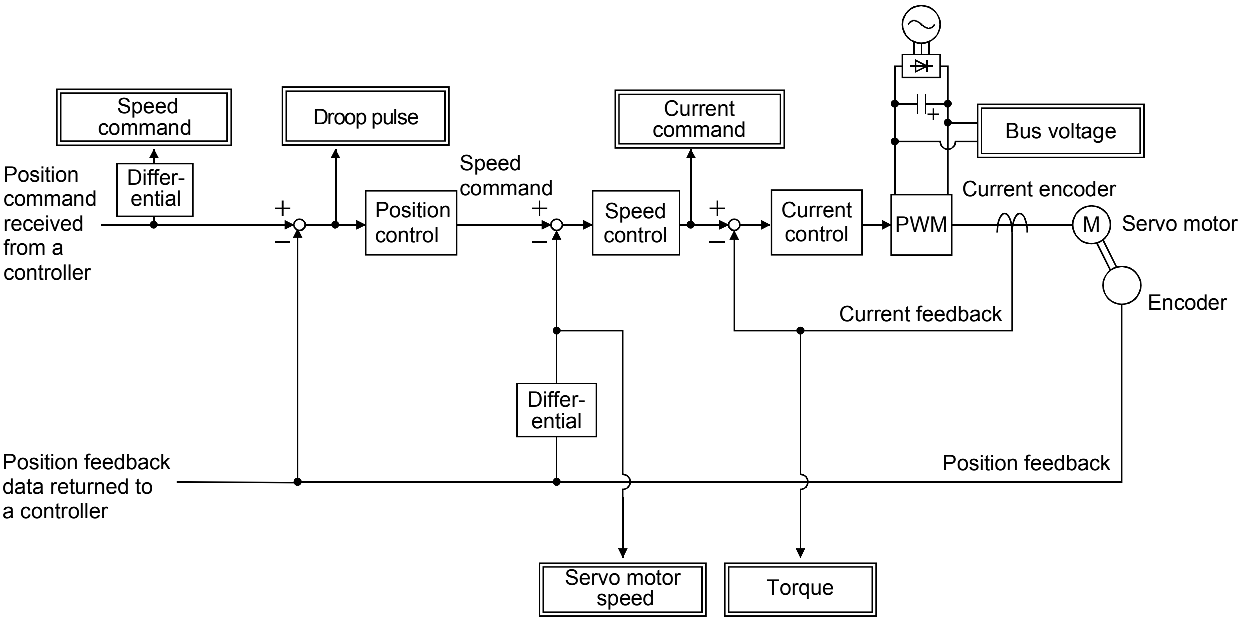
Refer to (3) for the measurement point.

Setting	Output item	Description	Setting	Output item	Description
0	Servo motor speed		1	Torque	
2	Servo motor speed		3	Torque	

Setting	Output item	Description	Setting	Output item	Description
4	Current command		5	Speed command	
6	Droop pulses (Note) (±10V/100 pulses)		7	Droop pulses (Note) (±10V/1000 pulses)	
8	Droop pulses (Note) (±10V/10000 pulses)		9	Droop pulses (Note) (±10V/100000 pulses)	
D	Bus voltage				

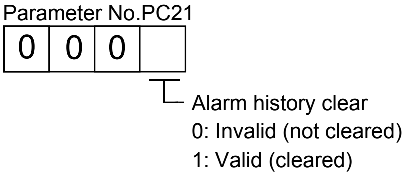
Note. Encoder pulse unit.

(3) Analog monitor block diagram



5.3.4 Alarm history clear

The servo amplifier stores six 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.PC21 before starting operation.
Clearing the alarm history automatically returns to "□□□0".
After setting, this parameter is made valid by switch power from OFF to ON.



5.4 I/O setting parameters (No.PD□□)

POINT

- The parameter whose symbol preceded by * can be validated with the following conditions.
  * : Turn off the power and then on again, or reset the controller after setting the parameter.

5.4.1 Parameter list

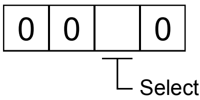
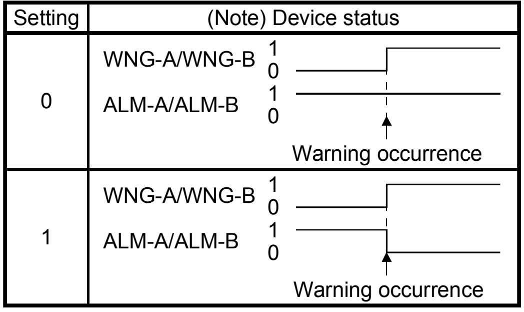
No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit
PD01		For manufacturer setting		0000h	
PD02				0000h	
PD03				0020h	
PD04				0021h	
PD05				0022h	
PD06				0000h	
PD07	*DO1	Output signal device selection 1 (CN3-12 for A-axis and CN3-25 for B-axis)	Each axis	0005h	
PD08		For manufacturer setting		0004h	
PD09	*DO3	Output signal device selection 3 (CN3-11 for A-axis and CN3-24 for B-axis)	Each axis	0003h	
PD10		For manufacturer setting		0000h	
PD11				0004h	
PD12				0000h	
PD13				0000h	
PD14	*DOP3	Function selection D-3	Each axis	0000h	
PD15		For manufacturer setting		0000h	
PD16				0000h	
PD17				0000h	
PD18				0000h	
PD19				0000h	
PD20				0000h	
PD21				0000h	
PD22				0000h	
PD23				0000h	
PD24				0000h	
PD25				0000h	
PD26				0000h	
PD27				0000h	
PD28				0000h	
PD29				0000h	
PD30				0000h	
PD31				0000h	
PD32				0000h	

Note 1. Each axis: Set a value for each of the A-axis and the B-axis.
Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.
2. Valid for the A-axis and the B-axis.

5.4.2 List of details

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Setting</th><th>Factory setting</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD01</td><td rowspan="6"></td><td rowspan="6">For manufacturer setting
Do not change this value by any means.</td><td rowspan="6"></td><td>0000h</td><td rowspan="6"></td><td rowspan="6"></td></tr>
<tr><td>PD02</td><td>0000h</td></tr>
<tr><td>PD03</td><td>0020h</td></tr>
<tr><td>PD04</td><td>0021h</td></tr>
<tr><td>PD05</td><td>0022h</td></tr>
<tr><td>PD06</td><td>0000h</td></tr>
<tr><td>PD07</td><td>*DO1</td><td>Output signal device selection 1 (CN3-12 for A-axis and CN3-25 for B-axis)
Any input signal can be assigned to the CN3-12 pin for A-axis and CN3-25 pin for B-axis. In the factory setting, MBR-A/MBR-B is assigned.
0 0 □ □
Select the output device of the CN3-12 pin for A-axis and CN3-25 pin for B-axis.

The devices that can be assigned in each control mode are those that have the symbols indicated in the following table.
<table>
<tr><th>Setting</th><th>Device</th><th>Setting</th><th>Device</th></tr>
<tr><td>00</td><td>Always OFF</td><td>0A</td><td>Always OFF (Note 2)</td></tr>
<tr><td>01</td><td>For manufacturer setting (Note 3)</td><td>0B</td><td>For manufacturer setting (Note 3)</td></tr>
<tr><td>02</td><td>RD-A/RD-B</td><td>0C</td><td>ZSP-A/ZSP-B</td></tr>
<tr><td>03</td><td>ALM-A/ALM-B</td><td>0D</td><td>For manufacturer setting (Note 3)</td></tr>
<tr><td>04</td><td>INP-A/INP-B (Note 1)</td><td>0E</td><td>For manufacturer setting (Note 3)</td></tr>
<tr><td>05</td><td>MBR-A/MBR-B</td><td>0F</td><td>CDPS-A/CDPS-B</td></tr>
<tr><td>06</td><td>For manufacturer setting (Note 3)</td><td>10</td><td>For manufacturer setting (Note 3)</td></tr>
<tr><td>07</td><td>TLC-A/TLC-B</td><td>11</td><td>ABSV-A/ABSV-B (Note 1)</td></tr>
<tr><td>08</td><td>WNG-A/WNG-B</td><td>12 to 1F</td><td>For manufacturer setting (Note 3)</td></tr>
<tr><td>09</td><td>BWNG-A/BWNG-B</td><td>20 to 3F</td><td>For manufacturer setting (Note 3)</td></tr>
</table>
Note 1. It becomes always OFF in speed control mode.
2. It becomes SA-A/SA-B in speed control mode.
3. For manufacturer setting
Never change this setting.</td><td>Each axis</td><td>0005h</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>PD08</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td></td><td>0004h</td><td></td><td></td></tr>
<tr><td>PD09</td><td>*DO3</td><td>Output signal device selection 3 (CN3-11 for A-axis and CN3-24 for B-axis)
Any input signal can be assigned to the CN3-11 pin for A-axis and CN3-24 pin for B-axis. In the factory setting, ALM-A/ALM-B is assigned.
The devices that can be assigned and the setting method are the same as in parameter No.PD07.
0 0 □ □
Select the output device of the CN3-11 pin for A-axis and CN3-24 pin for B-axis.</td><td>Each axis</td><td>0003h</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

No.	Symbol	Name and function	Setting	Factory setting	Unit	Setting range
PD10		For manufacturer setting Do not change this value by any means.		0000h		
PD11				0004h		
PD12				0000h		
PD13				0000h		
PD14	*DOP3	Function selection D-3 Set the ALM-A/ALM-B output signal at warning occurrence.  Selection of output device at warning occurrence Select the warning (WNG-A/WNG-B) and trouble (ALM-A/ ALM-B) output status at warning occurrence. Output of Servo amplifier  Note. 0: OFF 1: ON	Each axis	0000h		Refer to Name and function column.
PD15		For manufacturer setting Do not change this value by any means.		0000h		
PD16				0000h		
PD17				0000h		
PD18				0000h		
PD19				0000h		
PD20				0000h		
PD21				0000h		
PD22				0000h		
PD23				0000h		
PD24				0000h		
PD25				0000h		
PD26				0000h		
PD27				0000h		
PD28				0000h		
PD29				0000h		
PD30				0000h		
PD31				0000h		
PD32				0000h		

5.5 Option setting parameters (No.Po□□)

POINT

- The parameter whose symbol preceded by * can be validated with the following conditions.
  - * : Turn off the power and then on again, or reset the controller after setting the parameter.
  - **: Turn off the power and then on again after setting the parameter.

5.5.1 List of parameters

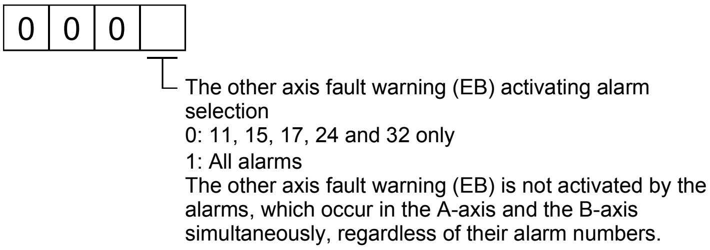
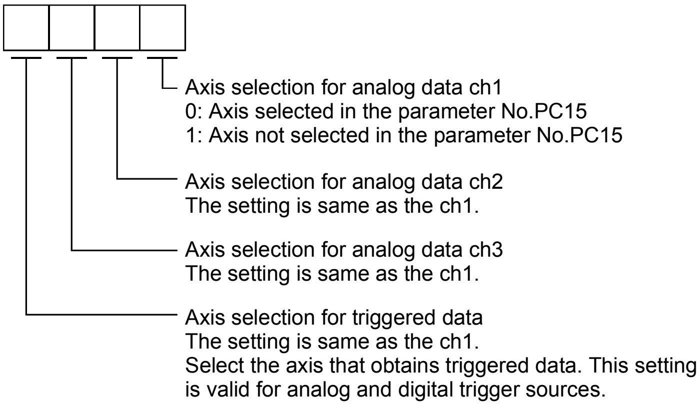
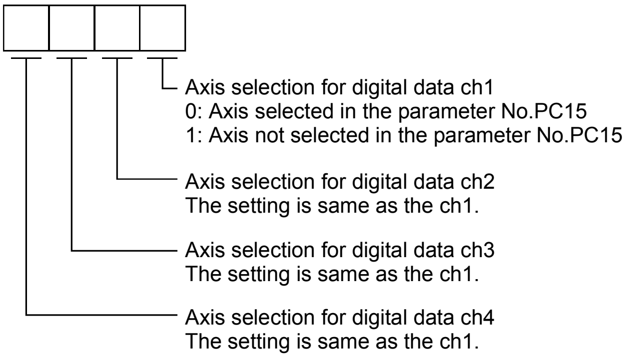
No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit
Po01	*OOP1	Function selection O-1	Common	0000h	
Po02	SGRA	Axis selection for graphing analog deta (MR Configurator)	Common	0000h	
Po03	SGRD	Axis selection for graphing digtal deta (MR Configurator)	Common	0000h	
Po04	**OOP2	Function selection O-2	Common	0000h	
Po05		For manufacturer setting		0000h	
Po06				0000h	
Po07				0000h	
Po08				0000h	
Po09				0000h	
Po10				0000h	
Po11				0000h	
Po12				0000h	
Po13				0000h	
Po14				0000h	
Po15				0000h	
Po16				0000h	

Note 1. Each axis: Set a value for each of the A-axis and the B-axis.

Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.

2. Valid for the A-axis and the B-axis.

5.5.2 List of details

No.	Symbol	Name and function	Setting	Factory setting	Unit	Setting range
Po01	*OOP1	Function selection O-1 Used to set alarms that activate the other axis fault warning (EB).  0 0 0 The other axis fault warning (EB) activating alarm selection 0: 11, 15, 17, 24 and 32 only 1: All alarms The other axis fault warning (EB) is not activated by the alarms, which occur in the A-axis and the B-axis simultaneously, regardless of their alarm numbers.	Common	0000h		Refer to Name and function column.
Po02	SGRA	Axis selection for graphing analog data (MR Configurator) Used to select axes that obtain analog data and triggered data in the MR Configurator's graph function.  Axis selection for analog data ch1 0: Axis selected in the parameter No.PC15 1: Axis not selected in the parameter No.PC15 Axis selection for analog data ch2 The setting is same as the ch1. Axis selection for analog data ch3 The setting is same as the ch1. Axis selection for triggered data The setting is same as the ch1. Select the axis that obtains triggered data. This setting is valid for analog and digital trigger sources.	Common	0000h		Refer to Name and function column.
Po03	SGRD	Axis selection for graphing digtal deta (MR Configurator) Used to select the axes that obtain digital data in the MR Configurator's graph function.  Axis selection for digital data ch1 0: Axis selected in the parameter No.PC15 1: Axis not selected in the parameter No.PC15 Axis selection for digital data ch2 The setting is same as the ch1. Axis selection for digital data ch3 The setting is same as the ch1. Axis selection for digital data ch4 The setting is same as the ch1.	Common	0000h		Refer to Name and function column.

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Setting</th><th>Factory setting</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>Po04</td><td>**OOP2</td><td>Function selection O-2
<table><tr><td>0</td><td>0</td><td></td><td>0</td></tr></table>
Special servo motor combination
0: Normal combination
1: When using the following servo amplifiers and servo motors in combination.

Rotary servo motor
<table>
<tr><th rowspan="2">Servo amplifier</th><th colspan="5">Rotary servo motor</th></tr>
<tr><th>HF-MP</th><th>HF-KP</th><th>HF-SP</th><th>HC-LP</th><th>HC-UP</th></tr>
<tr><td>MR-J3W-44B</td><td>053・13</td><td>053・13</td><td></td><td></td><td></td></tr>
<tr><td>MR-J3W-77B</td><td>43</td><td>43</td><td>51・52</td><td>52</td><td>72</td></tr>
</table>
Linear servo motor
<table>
<tr><th rowspan="2">Servo amplifier</th><th colspan="2">Linear servo motor</th></tr>
<tr><th>Primary side(Coil)</th><th>Secondary side (Magnet)</th></tr>
<tr><td rowspan="4">MR-J3W-77B</td><td>LM-H2P1A-06M-4SS0</td><td>LM-H2S10-288-4SS0
LM-H2S10-384-4SS0
LM-H2S10-480-4SS0
LM-H2S10-768-4SS0</td></tr>
<tr><td>LM-H2P2A-12M-1SS0</td><td>LM-H2S20-288-1SS0
LM-H2S20-384-1SS0
LM-H2S20-480-1SS0
LM-H2S20-768-1SS0</td></tr>
<tr><td>LM-U2PAD-10M-0SS0</td><td rowspan="2">LM-U2SA0-240-0SS0
LM-U2SA0-300-0SS0
LM-U2SA0-420-0SS0</td></tr>
<tr><td>LM-U2PAF-15M-0SS0</td></tr>
</table>
</td><td>Common</td><td>0000h</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>Po05</td><td rowspan="12"></td><td rowspan="12">For manufacturer setting
Do not change this value by any means.</td><td rowspan="12"></td><td>0000h</td><td rowspan="12"></td><td rowspan="12"></td></tr>
<tr><td>Po06</td><td>0000h</td></tr>
<tr><td>Po07</td><td>0000h</td></tr>
<tr><td>Po08</td><td>0000h</td></tr>
<tr><td>Po09</td><td>0000h</td></tr>
<tr><td>Po10</td><td>0000h</td></tr>
<tr><td>Po11</td><td>0000h</td></tr>
<tr><td>Po12</td><td>0000h</td></tr>
<tr><td>Po13</td><td>0000h</td></tr>
<tr><td>Po14</td><td>0000h</td></tr>
<tr><td>Po15</td><td>0000h</td></tr>
<tr><td>Po16</td><td>0000h</td></tr>
</table>

MEMO

6. GENERAL GAIN ADJUSTMENT

POINT

- Before performing the gain adjustment, check that the machine is not driven with the maximum torque of the servo motor. If the machine is driven with the torque larger than the maximum torque, unexpected motion such as machine vibration may occur. Consider individual machine differences, and do not adjust too strictly. It is recommended to keep the servo motor torque to 90% or less of the maximum torque of the servo motor during the operation.

6.1 Different adjustment methods

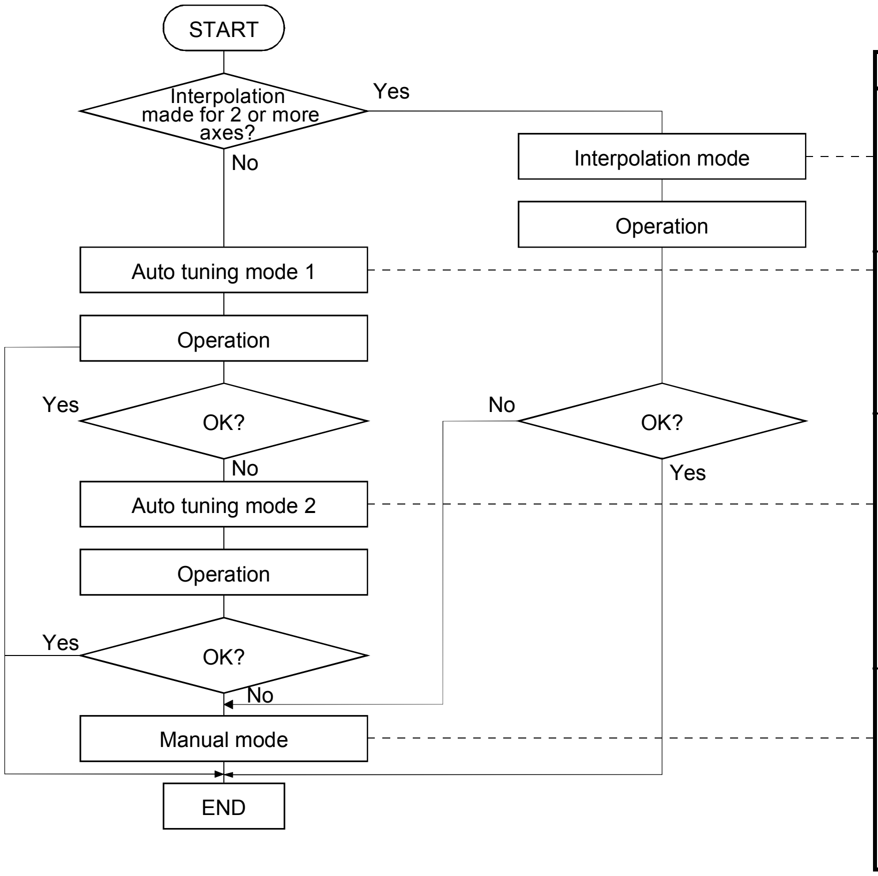
6.1.1 Adjustment on a single servo amplifier

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 (factory setting)	0001	Always estimated	GD2 (parameter No.PB06) PG1 (parameter No.PB07) PG2 (parameter No.PB08) VG2 (parameter No.PB09) VIC (parameter No.PB10)	RSP (parameter No.PA09)
Auto tuning mode 2	0002	Fixed to parameter No. PB06 value	PG1 (parameter No.PB07) PG2 (parameter No.PB08) VG2 (parameter No.PB09) VIC (parameter No.PB10)	GD2 (parameter No.PB06) RSP (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) RSP (parameter No.PA09)

(2) Adjustment sequence and mode usage



Usage
Used when you want to match the position gain (PG1) between 2 or more axes. Normally not used for other purposes.
Allows adjustment by merely changing the response level setting. First use this mode to make adjustment.
Used when the conditions of auto tuning mode 1 are not met and the load inertia moment ratio could not be estimated properly, for example.
You can adjust all gains manually when you want to do fast settling or the like.

6.1.2 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.

6.2 Auto tuning

6.2.1 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	Load to motor inertia moment ratio
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

POINT

- The auto tuning mode 1 may not be performed properly if 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 Load to motor inertia moment ratio is 100 times or less.
- The acceleration/deceleration torque is 10% or more of the rated torque.
- Under operating conditions which will impose sudden disturbance torque during acceleration/deceleration or on a machine which is extremely loose, auto tuning may not function properly, either. In such cases, use the auto tuning mode 2 or manual mode to make gain adjustment.

(2) Auto tuning mode 2

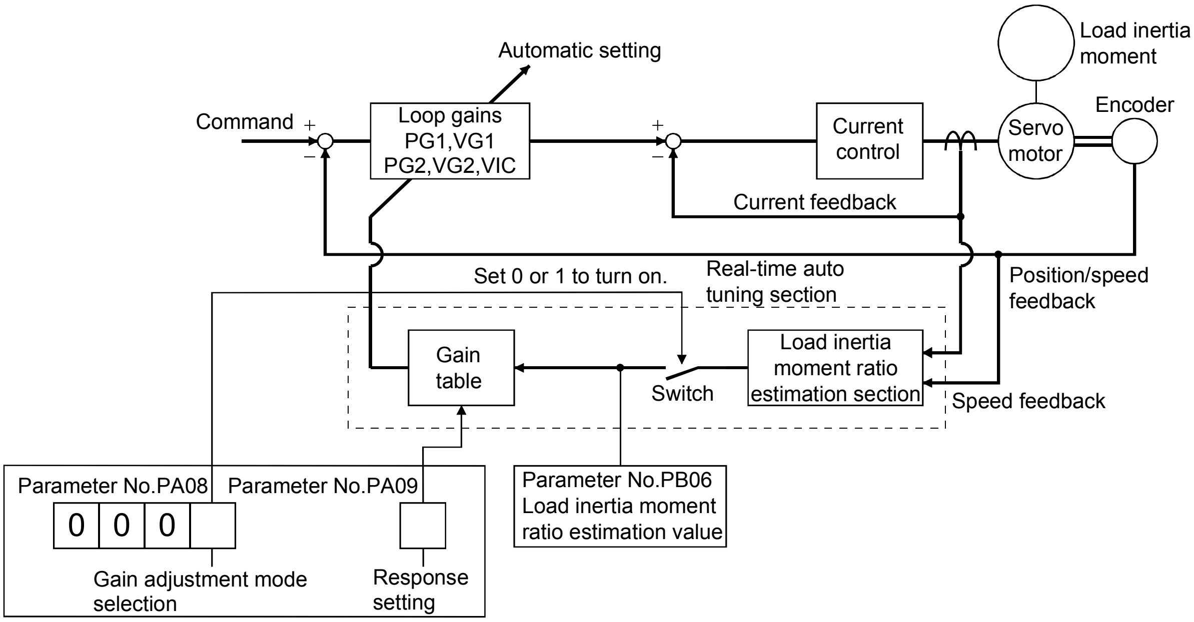
Use the auto tuning mode 2 when proper gain adjustment cannot be made by auto tuning mode 1. Since the load inertia moment ratio is not estimated in this mode, set the value of a correct load inertia moment ratio (parameter No.PB06).

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

6.2.2 Auto tuning mode basis

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



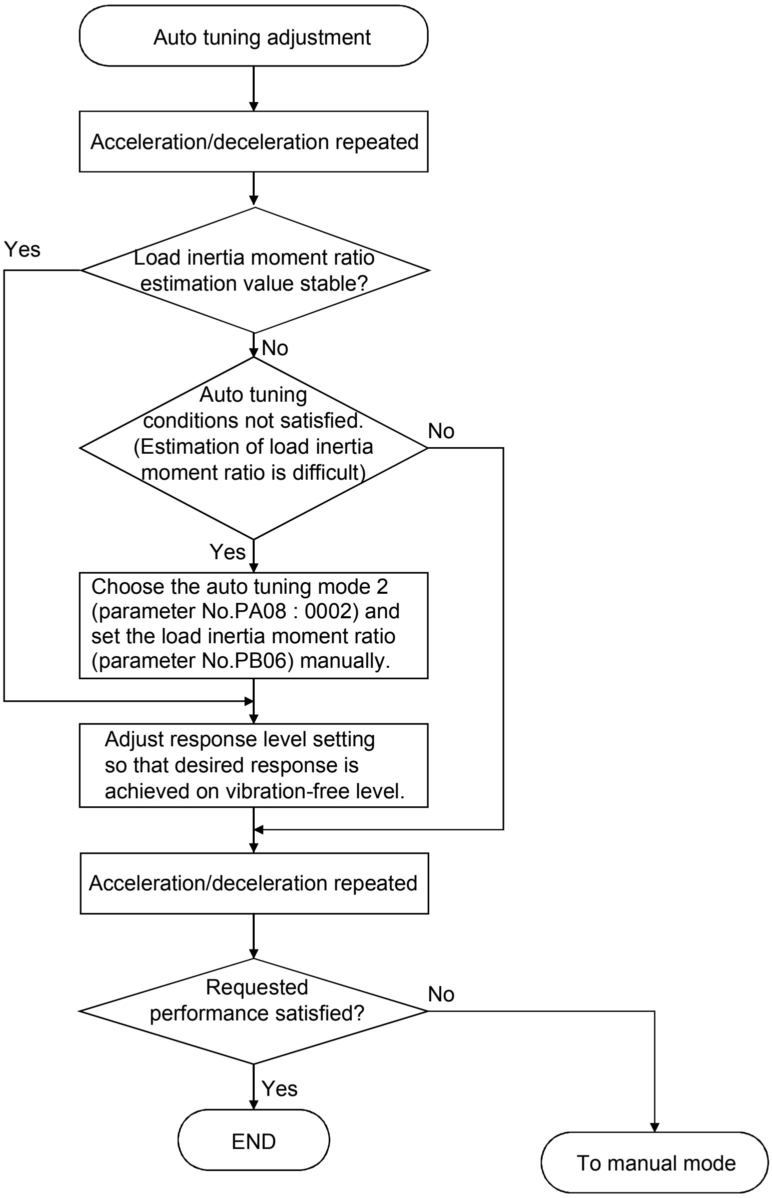
When a servo motor is accelerated/decelerated, the load inertia moment ratio estimation section always estimates the load inertia moment ratio from the current and speed of the servo motor. The results of estimation are written to parameter No.PB06 (the ratio of load inertia moment to servo motor). These results can be confirmed on the status display screen of the MR Configurator.
If the value of the load inertia moment ratio is already known or if estimation cannot be made properly, choose 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.PB06) 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 a factory setting.

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.

6.2.3 Adjustment procedure by auto tuning

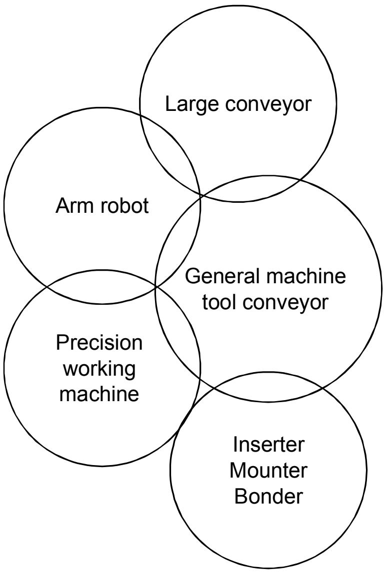
Since auto tuning is made valid before shipment from the factory, simply running the servo motor automatically sets the optimum gains that match the machine. Merely changing the response level setting value as required completes the adjustment. The adjustment procedure is as follows.



6.2.4 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, machine resonance suppression filter (parameter No.PB01, PB13 to PB16) may be used to suppress machine resonance. Suppressing machine resonance may allow the response level setting to increase. Refer to section 7.2 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	

6.3 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, machine resonance suppression filter (parameter No.PB01, PB13 to PB16) may be used to suppress machine resonance. (Refer to section 7.2.)

(1) For speed control

(a) Parameters

The following parameters are used for gain adjustment.

Parameter No.	Abbreviation	Name
PB06	GD2	Load to motor inertia moment ratio
PB07	PG1	Model loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 6.2.3.	
2	Change the setting of auto tuning to the manual mode (Parameter No.PA08: 0003).	
3	Set an estimated value to the load to motor inertia moment ratio. (If the estimate value with auto tuning is correct, setting change is not required.)	
4	Set a slightly smaller value to the model loop gain Set a slightly larger value to the speed integral compensation.	
5	Increase the speed loop gain within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the speed integral compensation within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the model loop gain, and return slightly if 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 machine resonance suppression filter and then executing steps 2 and 3.	Suppression of machine resonance. Refer to section 7.2.
9	While checking the 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.

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

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.

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

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.

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

(2) For position control

(a) Parameters

The following parameters are used for gain adjustment.

Parameter No.	Abbreviation	Name
PB06	GD2	Load to motor inertia moment ratio
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 6.2.3.	
2	Change the setting of auto tuning to the manual mode (Parameter No.PA08: 0003).	
3	Set an estimated value to the load to motor inertia moment ratio. (If the estimate value with auto tuning is correct, setting change is not required.)	
4	Set a slightly smaller value to the model loop gain and the position loop gain. Set a slightly larger value to the speed integral compensation.	
5	Increase the speed loop gain within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the speed integral compensation within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the position loop gain, and return slightly if vibration takes place.	Increase the position loop gain.
8	Increase the model loop gain, and return slightly if 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 machine resonance suppression filter and then executing steps 3 to 5.	Suppression of machine resonance. Refer to section 7.2.
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.

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

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.

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

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.

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

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.

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

6.4 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	Load to motor inertia moment ratio
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 to a position command. 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.

$$\text{Droop pulse value (pulse)} = \frac{\frac{\text{Rotation speed (r/min)}}{60} \times 262144\text{(pulse)}}{\text{Model loop gain setting}}$$

MEMO

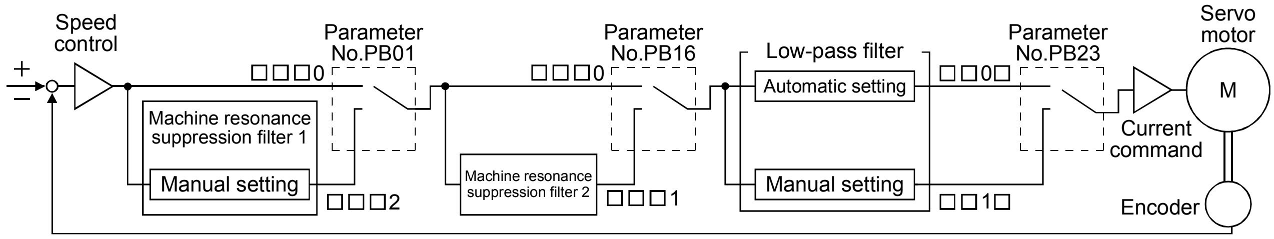
7. SPECIAL ADJUSTMENT FUNCTIONS

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 6.

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 can suppress the resonance of the mechanical system.

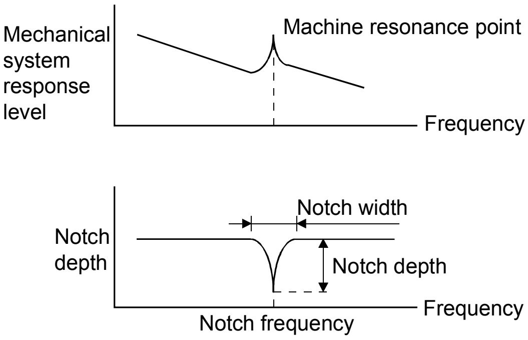
7.1 Function block diagram



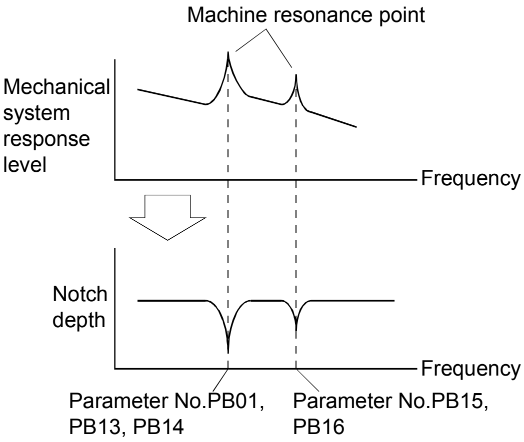
7.2 Machine resonance suppression filter

(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.



(2) Parameters

(a) Machine resonance suppression filter 1 (parameter No.PB13, PB14)
Set parameter No.PB01 to "□□□2".
Set the notch frequency, notch depth and notch width of the machine resonance suppression filter 1 (parameter No.PB13, PB14)

(b) Machine resonance suppression filter 2 (parameter No.PB15, PB16)
Set parameter No.PB16 to "□□□1".
Setting method for the machine resonance suppression filter 2 (parameter No.PB15, PB16) is same as for the machine resonance suppression filter 1 (parameter No.PB13, PB14).

POINT

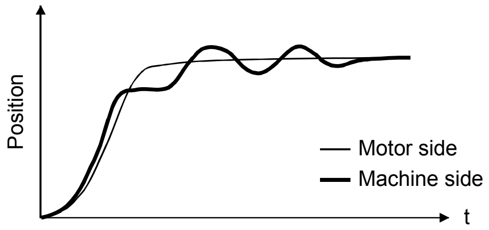
- The machine resonance suppression filter is a delay factor for the servo system. Hence, vibration may increase if you set a wrong resonance frequency or a too deep notch.
- If the frequency of machine resonance is unknown, decrease the notch frequency from higher to lower ones in order. The optimum 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.

7.3 Vibration suppression control manual mode

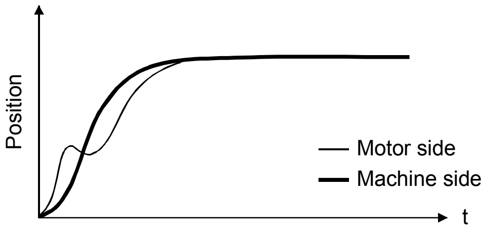
Measure work side vibration and device shake with the machine analyzer or external measuring instrument, and set the vibration suppression control vibration frequency (parameter No.PB19) and vibration suppression control resonance frequency (parameter No.PB20) to set vibration suppression control manually.

(1) Operation

Vibration suppression control is used to further suppress machine side 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
(Nomal control)



Vibration suppression control ON

(2) Parameter

Set parameter No.PB02 (Vibration suppression control tuning mode) as shown below.

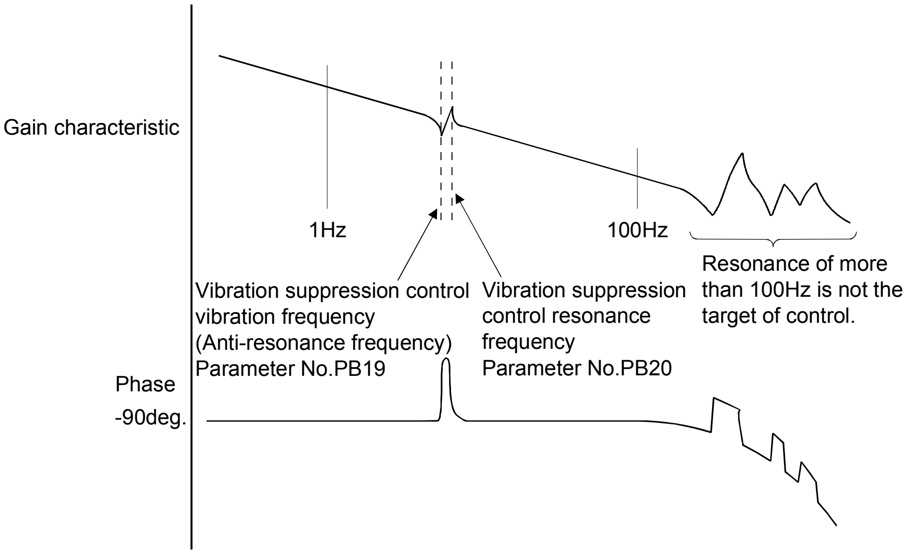
Parameter No.PB02

0	0	0	2

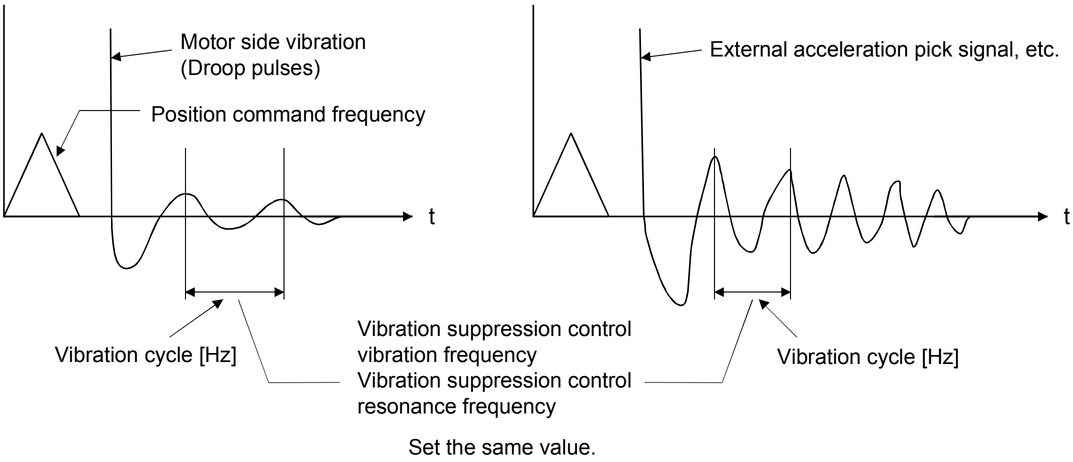
Manual setting

(3) Checking the vibration frequency and the resonance frequency

(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 side vibration does not show up in motor side vibration, the setting of the motor side vibration frequency does not produce an effect.
- When the anti-resonance frequency and resonance frequency can be confirmed using the machine analyzer or external 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.

$$\frac{1}{2\pi}(1.5\times PG1) > \text{vibration frequency}$$

7.4 Low-pass filter

(1) Function

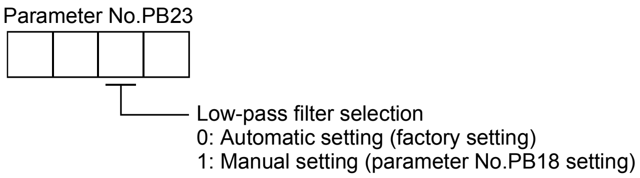
When a ball screw or the like is used, resonance of high frequency may occur as the response level of the servo system is increased. To prevent this, the low-pass filter is factory-set to be valid for a torque command. The filter frequency of this low-pass filter is automatically adjusted to the value 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 low-pass filter selection (parameter No.PB23.)



Low-pass filter selection
0: Automatic setting (factory setting)
1: Manual setting (parameter No.PB18 setting)

7.5 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.

7.5.1 Applications

This function is used when.

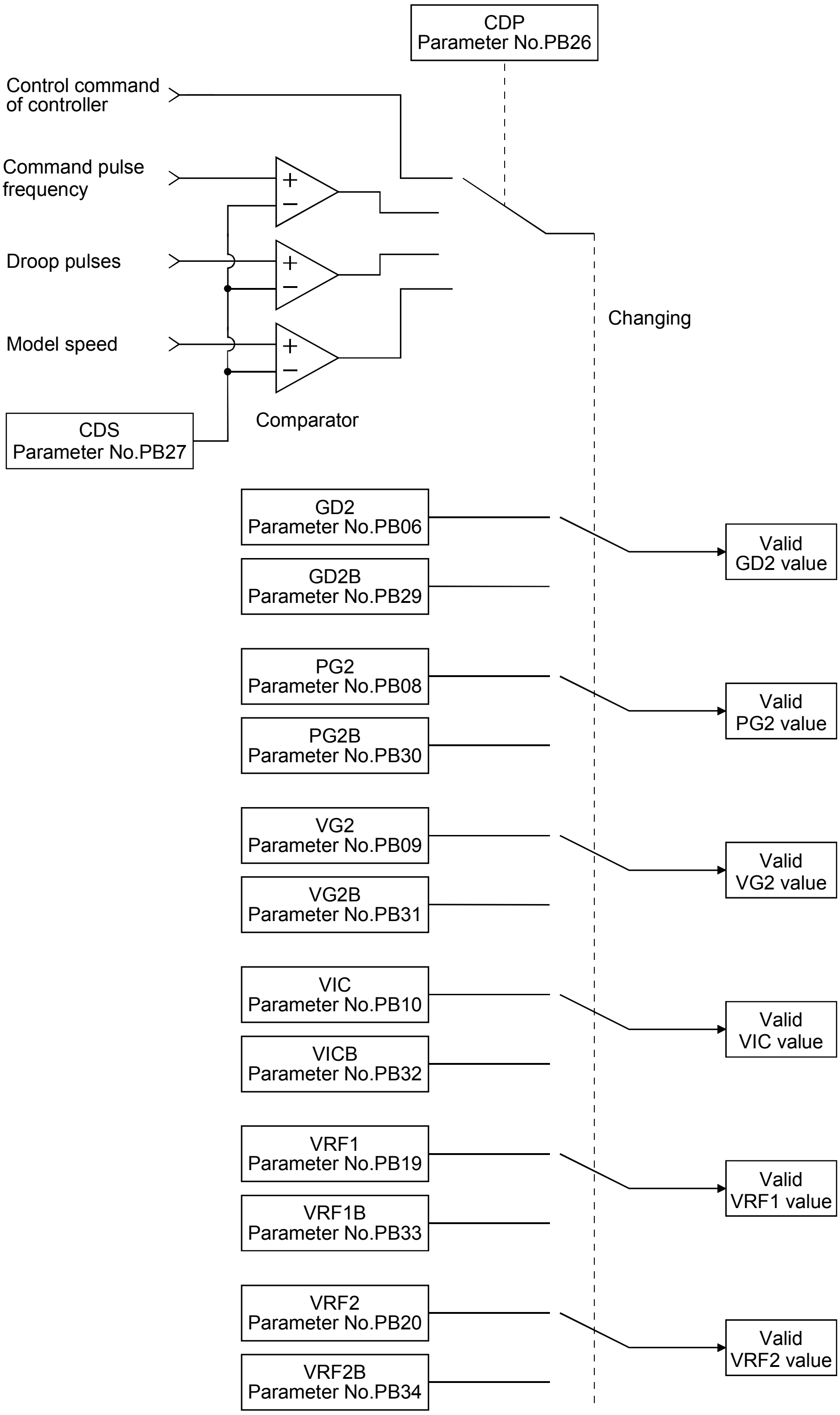
(1) You want to increase the gains during servo lock but decrease the gains to reduce noise during rotation.

(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).

7.5.2 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).



7.5.3 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.

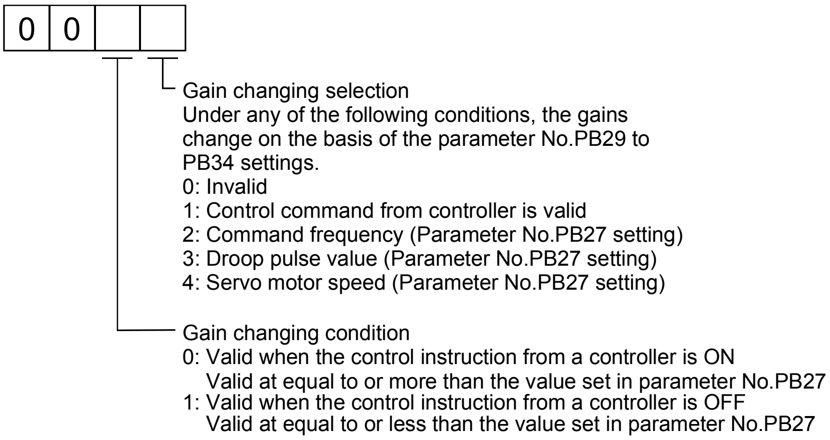
Parameter No.	Abbreviation	Name	Unit	Description
PB06	GD2	Load to motor inertia moment ratio	Multiplier (×1)	Control parameters before changing
PB07	PG1	Model loop gain	rad/s	Position and speed gains of a model used to set the response level to a command. Always valid.
PB08	PG2	Position loop gain	rad/s	
PB09	VG2	Speed loop gain	rad/s	
PB10	VIC	Speed integral compensation	ms	
PB29	GD2B	Gain changing load to motor inertia moment ratio	Multiplier (×1)	Used to set the load to motor inertia moment ratio 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 load to motor inertia moment ratio, position loop gain, speed loop gain and speed integral compensation to be changed.

(2) Gain changing load to motor inertia moment ratio (GD2B: parameter No.PB29)
Set the load to motor inertia moment ratio after changing. If the load inertia moment ratio does not change, set it to the same value as load to motor inertia moment ratio (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 control command from controller is valid for gain changing.



Gain changing selection
Under any of the following conditions, the gains change on the basis of the parameter No.PB29 to PB34 settings.
0: Invalid
1: Control command from controller is valid
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 when the control instruction from a controller is ON
Valid at equal to or more than the value set in parameter No.PB27
1: Valid when the control instruction from a controller is OFF
Valid at equal to or less than the value set in parameter No.PB27

(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.

(7) Gain changing vibration suppression control
Control command from the controller is the only command for the gain changing vibration suppression control.

7.5.4 Gain changing procedure

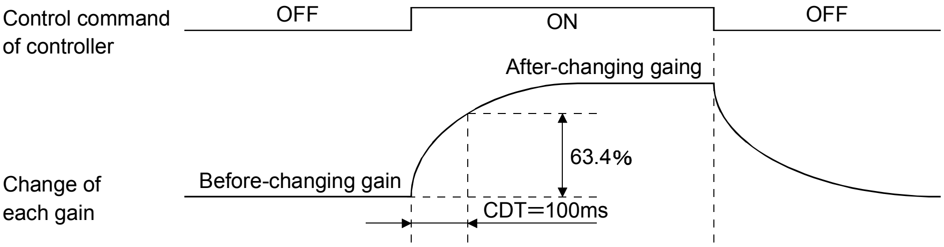
This operation will be described by way of setting examples.

(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	Load to motor inertia moment ratio	4.0	Multiplier (×1)
PB08	PG2	Position loop gain	120	rad/s
PB09	VG2	Speed loop gain	3000	rad/s
PB10	VIC	Speed integral compensation	20	Ms
PB19	VRF1	Vibration suppression control vibration frequency setting	50	Hz
PB20	VRF2	Vibration suppression control resonance frequency setting	50	Hz
PB29	GD2B	Gain changing load to motor inertia moment ratio	10.0	Multiplier (×1)
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 timing chart



Model loop gain 1			100		
Load to motor inertia moment ratio	4.0	→	10.0	→	4.0
Position loop gain	120	→	84	→	120
Speed loop gain	3000	→	4000	→	3000
Speed integral compensation	20	→	50	→	20
Vibration suppression control vibration frequency setting	50	→	60	→	50
Vibration suppression control resonance frequency setting	50	→	60	→	50

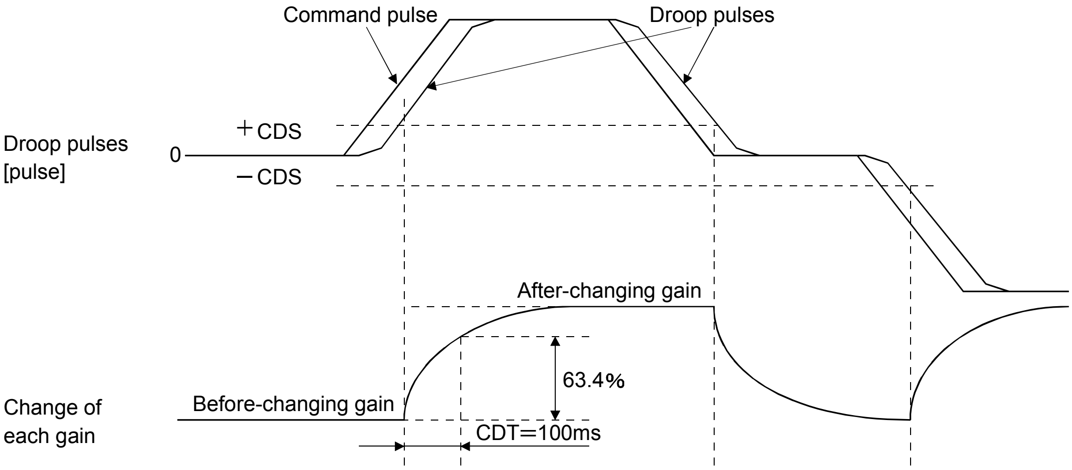
(2) When you choose changing by droop pulses

In this case, gain changing vibration suppression control cannot be used.

(a) Setting

Parameter No.	Abbreviation	Name	Setting	Unit
PB07	PG1	Model loop gain	100	rad/s
PB06	GD2	Load to motor inertia moment ratio	4.0	Multiplier (×1)
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 load to motor inertia moment ratio	10.0	Multiplier (×1)
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 timing chart



Model loop gain	100						
Load to motor inertia moment ratio	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

8. TROUBLESHOOTING

POINT

- When an each axis stop alarm occurs, the servo motor in the non-alarm-occurring axis can continue running.

If an alarm/warning has occurred, refer to this chapter and remove its cause.

8.1 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 8.3 or 8.4 and take the appropriate action. When an alarm occurs, the ALM-A/LM-B turns OFF.
After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column. The alarm is automatically canceled after removing the cause of occurrence.

	Display	Name	Alarm deactivation			Detection method (Note 3)	Stop method (Note 4)
			Power OFF→ON	Error reset	CPU reset		
Alarms	10	Undervoltage	○	○	○	Common	All axis
	11	Switch setting error	○			Common	All axis
	12	Memory error 1 (RAM)	○			Common	All axis
	13	Clock error	○			Common	All axis
	15	Memory error 2 (EEP-ROM)	○			Common	All axis
	16	Encoder initial communication error 1	○			Each axis	Each axis
	17	Board error	○			Common	All axis
	19	Memory error 3 (Flash-ROM)	○			Common	All axis
	1A	Motor combination error	○			Each axis	Each axis
	1E	Encoder initial communication error 2	○			Each axis	Each axis
	1F	Encoder initial communication error 3	○			Each axis	Each axis
	20	Encoder normal communication error 1	○			Each axis	Each axis
	21	Encoder normal communication error 2	○			Each axis	Each axis
	24	Main circuit error	○	○	○	Each axis	All axis
	25	Absolute position erase	○			Each axis	Each axis
	30	Regenerative error	(Note 1) ○	(Note 1) ○	(Note 1) ○	Common	All axis
	31	Overspeed	○	○	○	Each axis	Each axis
	32	Overcurrent	○			Each axis	All axis
	33	Overvoltage	○	○	○	Common	All axis
	34	SSCNET receive error 1	○	(Note 2) ○	○	Each axis	Each axis
	35	Command frequency error	○	○	○	Each axis	Each axis
	36	SSCNET receive error 2	○	○	○	Each axis	Each axis
	37	Parameter error	○			Each axis	Each axis
	45	Main circuit device overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○	Common	All axis
	46	Servo motor overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each axis	Each axis
	47	Cooling fan error	○			Common	All axis
	50	Overload 1	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each axis	Each axis
	51	Overload 2	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each axis	Each axis
	52	Error excessive	○	○	○	Each axis	Each axis
	8A	USB communication time-out error	○	○	○	Common	All axis
	8E	USB communication error	○	○	○	Common	All axis
	888	Watchdog	○			Common	All axis

	Display	Name	Alarm deactivation			Detection method (Note 3)	Stop method (Note 4)
			Power OFF→ON	Error reset	CPU reset		
Warnings	91	Main circuit device overheat warning				Common	
	92	Battery cable disconnection warning				Each axis	
	96	Home position setting warning				Each axis	
	9F	Battery warning				Each axis	
	E0	Excessive regeneration warning				Common	
	E1	Overload warning 1				Each axis	
	E3	Absolute position counter warning				Each axis	
	E4	Parameter warning				Each axis	
	E6	Servo forced stop warning				Common	All axis
	E7	Controller forced stop warning				Common	All axis
	E8	Cooling fan speed reduction warning				Common	
	E9	Main circuit off warning				Common	All axis
	EB	The other axis fault warning				Each axis	All axis
	EC	Overload warning 2				Each axis	
	ED	Output watt excess warning				Each axis	

Note 1. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.

2. In some controller communication status, the alarm factor may not be removed.

3. Alarms and warnings are detected in the following axes.
Each axis: Alarms and warnings are detected in the A-axis and the B-axis separately.
Common: Alarms and warnings are detected in the A-axis and the B-axis together.

4. When an alarm or a warning occurs, the axes stop as below.
Each axis: Only the axis that detected the alarm or warning stops.
All axis: All axes stop.

8.2 Troubleshooting at power on

When the servo system does not boot and system error occurs at power on of the servo system controller, improper boot of the servo amplifier might be the cause. Check the display of the servo amplifier, and take actions according to this section.

Display	Description	Cause	Checkpoint	Action
AA	Communication with the servo system controller is disconnected.	The power of the servo system controller is turned off.	Check the power of the servo system controller.	Switch on the power of the servo system controller.
		SSCNETⅢ cable has breakage.	"AA" is displayed in the corresponding axis and following axes.	Replace the SSCNETⅢ cable of the corresponding axis.
			Check if the connectors (CNIA, CNIB) are unplugged.	Connect properly.
		The power of the servo amplifier is turned off.	"AA" is displayed in an axis and the following axes.	Check the power of the servo amplifier.
				Replace the servo amplifier of the corresponding axis.
AB	Initialization communication with the servo system controller is not completed.	Axis No. is set incorrectly.	Check that the other servo amplifier is not assigned to the same axis No.	Correct the setting.
		Axis No. does not match with the axis No. set to the servo system controller.	Check the setting and axis No. of the servo system controller.	Correct the setting.
		Information about the servo series is not set in the positioning module.	Check the value set in Servo series (Pr.100) in the positioning module.	Correct the setting.
		One axis setting is selected when using MR-J3W.	Check that 2 axes setting is selected in the servo system controller.	Correct the setting.
		Communication cycle does not match.	Check the communication cycle at the servo system controller side. When using 8 axes or less: 0.444ms When using 16 axes or less: 0.888ms	Correct the setting.
		SSCNETⅢ cable has breakage.	"AB" is displayed in the corresponding axis and following axes.	Replace the SSCNETⅢ cable of the corresponding axis.
			Check if the connectors (CNIA, CNIB) are unplugged.	Connect properly.
		The power of the servo amplifier is turned off.	"AB" is displayed in an axis and the following axes.	Check the power of the servo amplifier.
		The servo amplifier is faulty.	"AB" is displayed in an axis and the following axes.	Replace the servo amplifier of the corresponding axis.
BOA BOB	The system is in the test operation mode.	Test operation mode is active.	Test operation setting switch (SW2-1) is turned on.	Turn off the test operation setting switch (SW2-1).

8.3 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 (25.1) occurred, always make home position setting again. Not doing so may cause unexpected operation.
- Shut off the main circuit power supply when alarms are occurring in both of the A-axis and the B-axis. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

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. To protect the main circuit elements, any of these servo alarms cannot be deactivated from the servo system controller until the specified time elapses after its occurrence. Judging the load changing condition until the alarm occurs, the servo amplifier calculates this specified time automatically.
  - Regenerative error (30.□)
  - Main circuit device overheat (45.□)
  - Servo motor overheat (46.1)
  - Overload 1 (50.□)
  - Overload 2 (51.□)
- The alarm can be deactivated by switching power off, then on or by the error reset command · CPU reset from the servo system controller. For details, refer to section 8.1.

When an alarm occurs, the trouble (ALM-A/ALM-B) 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.

Alarm No.10		Name: Undervoltage			Stop method: All axes stop	
Alarm description		・Voltage of the control power has dropped. ・Voltage of the main circuit power has dropped.				
Display	Name	Cause		Checkpoint	Finding	Action
10.1	Voltage drop in the control power	(1)	Connector for the control power is disconnected or poorly connected.	Check the connector of the control power.	Disconnected or poorly connected.	Connect properly.
					No problem found.	Check (2).
		(2)	Voltage of control power is low.	Check if the control power voltage is 160VAC or less.	160VAC or less.	Increase the voltage in the control power.
					Over 160VAC.	Check (3).
		(3)	Instantaneous control power failure of 60ms or longer.	Check the power supply for a problem.	Problem found.	Check the power supply.
10.2	Voltage drop in the main circuit power	(1)	Connector for the main circuit power is disconnected.	Check the connector of the main circuit power.	Disconnected.	Connect properly.
					No problem found.	Check (2).
		(2)	Voltage of main circuit power is low.	Check if the main circuit power voltage is 160VAC or less.	160VAC or less.	Increase the voltage in the main circuit power.
					Over 160VAC.	Check (3) and (4).
		(3)	Voltage drops during acceleration.	Check if the bus voltage is 200VDC or more during acceleration.	Below 200VDC.	Set acceleration time longer or increase the power supply capacity.
		(4)	Servo amplifier is faulty.	Check the bus voltage using MR Configurator.	The main circuit power supply voltage is 160VAC, but the bus voltage measured using MR Configurator is less than 200VDC.	Replace the servo amplifier.

Alarm No.11		Name: Switch setting error			Stop method: All axis stop	
Alarm description		・Rotary axis setting switch is incorrectly set. ・DIP switch is incorrectly set. ・Servo motor selection switch is incorrect set.				
Display	Name	Cause		Checkpoint	Finding	Action
11.1	Rotary switch setting error	(1)	Rotary switch for axis selection is set to "F".	Check the rotary switch setting.	Setting is "F".	Set to the correct axis No.
11.2	DIP switch setting error	(1)	Setting of manufacturer setting DIP switch (SW2-2) is incorrect.	Check if manufacturer setting DIP switch (SW2-2) is turned on.	DIP switch is on.	Turn off the manufacturer setting DIP switch (SW2-2).
11.3	Servo motor selection switch setting error	(1)	Setting of servo motor selection switch is incorrect.	Check the DIP switch (SW3) setting. Rotary servo motor: off Linear servo motor: on	DIP switch is incorrectly set.	Correct the setting.
					Setting is correct.	Check (2).
		(2)	Control mode is incorrectly set by the parameter.	Check the parameter No. PA01 setting. Rotary servo motor: "□□0□" Linear servo motor: "□□4□"	Parameter setting is incorrect.	Correct the setting.
11.4	Servo motor selection switch setting error 2	(1)	Wrong encoder is connected.	Check the servo motor/ linear encoder connection. Rotary servo motor: servo motor Linear servo motor: linear encoder	Wrong motor/encoder is connected.	Correct the setting.
					Right motor/encoder is connected.	Check (2).
		(2)	Setting of servo motor selection switch is incorrect.	Check the DIP switch (SW3) setting. Rotary servo motor: off Linear servo motor: on	Set value is incorrect.	Correct the setting.

Alarm No.12		Name: Memory error 1 (RAM)			Stop method: All axes stop	
Alarm description		・Interior part of the servo amplifier (CPU) is faulty. ・Interior part of the servo amplifier (custom IC) is faulty.				
Display	Name	Cause		Checkpoint	Finding	Action
12.1	CPU built-in RAM error	(1)	Part in the servo amplifier is faulty.	Unplug all cables except the control circuit power supply cable, and check the reproducibility of the error.	Reproduced.	Replace the servo amplifier.
					Not reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check the power supply for noise. Check that the connector is not shorted.	Problem found.	Take countermeasure according to the cause.
12.2	CPU data RAM error	(1)	Part in the servo amplifier is faulty.	Examine checkpoints described in the alarm display "12.1".		
		(2)	Fault is generated from the surrounding environment of the unit.			
12.3	Custom IC RAM error	(1)	Part in the servo amplifier is faulty.			
		(2)	Fault is generated from the surrounding environment of the unit.			

Alarm No.13		Name: Clock error			Stop method: All axes stop	
Alarm description		・Fault is found in the printed board. ・There is a clock error transmitted from the controller.				
Display	Name	Cause		Checkpoint	Finding	Action
13.1	Clock error	(1)	Printed board is faulty.	Unplug all cables except the power supply cable, and check the reproducibility of the error.	Reproduced.	Replace the servo amplifier.
		(2)	Parts are faulty.		Not reproduced.	Check (3).
		(3)	Clock error transmitted from the controller.	Error occurs when connected with the controller.	Error occurs.	Replace the controller.
					Error does not occur.	Check (4).
		(4)	Fault is generated from the surrounding environment of the unit.	Check the power supply for noise. Check that the connector is not shorted. Check for the fault of the rear axis amplifier.	Problem found.	Take countermeasure according to the cause.

Alarm No.15		Name: Memory error 2 (EEP-ROM)			Stop method: All axes stop	
Alarm description		・Interior part of the servo amplifier (EEP-ROM) is faulty.				
Display	Name	Cause		Checkpoint	Finding	Action
15.1	EEP-ROM error at power on	(1)	EEP-ROM operates abnormally at power on	Unplug all cables except the power supply cable, and check the reproducibility of the error.	Reproduced.	Replace the servo amplifier.
					Not reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check that the power supply does not have noise. Check that the connector is not shorted.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	The number of parameter write times is more than 100,000 times.	Check if parameter settings are changed frequently.	Changed.	Change parameters less frequently.
15.2	EEP-ROM error during operation	(1)	EEP-ROM operates abnormally during normal operation.	Check if the error occurs when parameter is changed during normal operation.	Error occurs.	Replace the servo amplifier.

Alarm No.16		Name: Encoder initial communication error 1			Stop method: Corresponding axis stops	
Alarm description		・Error occurs in the communication between the encoder and the servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
16.1	Encoder receive data error 1	(1)	Encoder cable is faulty.	Check the shield.	Problem found.	Repair the cable.
					No problem found.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise, surrounding air temperature, and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Servo amplifier is faulty.	Check the reproducibility of the error.	Reproduced.	Replace the servo amplifier.
					Not reproduced.	Examine checkpoints described in the alarm display "16.3".
16.2	Encoder receive data error 2	(1)	Encoder cable is faulty.	Examine checkpoints described in the alarm display "16.1".		
		(2)	Fault is generated from the surrounding environment of the unit.			
		(3)	Replace the servo amplifier.			
16.3	Encoder receive data error 3	(1)	The encoder cable is unplugged.	Check if the encoder cable is connected properly.	Not connected properly.	Connect properly.
					Connected properly.	Check (2).
		(2)	Encoder cable is faulty.	Check for breakage and short of the encoder cable. Check the shield.	Problem found.	Repair or replace the cable.
					No problem found.	Check (3).
		(3)	Two-wire/four-wire type parameter setting is incorrect.	Check the parameter No. PC04 setting. Two-wire type: "00□□" Four-wire type: "10□□"	Setting is incorrect.	Correct the setting.
					Normal.	Check (4).
		(4)	When using only one axis, select the motor-less operation for the axis to which the servo motor is not connected.	Check if parameter No. PC05 is set to motor-less operation for the unused axis.	Motor-less operation is not set.	Select motor-less operation
					Motor-less operation is set.	Check (5).
		(5)	Signal from the encoder cannot be received.	Connect to a properly operating servo motor.	Alarm does not occur.	Replace the servo motor.
					Alarm occurs.	Check (6).
		(6)	Servo amplifier is faulty.	Replace the servo amplifier and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
					Reproduced.	Check (7).
		(7)	Fault is generated from the surrounding environment of the unit.	Check for noise, and other factors.	Problem found.	Take countermeasure according to the cause.
16.5	Encoder transmission data error 1	(1)	Encoder cable is faulty.	Check the shield.	Problem found.	Repair the cable.
					No problem found.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise, and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Encoder is faulty.	Replace to a properly operating servo motor.	Error is not reproduced.	Replace the servo motor.
16.6	Encoder transmission data error 2	(1)	Encoder cable is faulty.	Examine checkpoints described in the alarm display "16.5".		
		(2)	Fault is generated from the surrounding environment of the unit.			
		(3)	Encoder is faulty.			

Display	Name	Cause	Checkpoint	Finding	Action
16.7	Encoder transmission data error 3	(1) Encoder cable is faulty.	Examine checkpoints described in the alarm display "16.5".		
		(2) Fault is generated from the surrounding environment of the unit.			
		(3) Encoder is faulty.			

Alarm No.17	Name: Board error	Stop method: All axes stop
Alarm description	・Interior part of the servo amplifier is faulty.	

Display	Name	Cause	Checkpoint	Finding	Action
17.1	AD converter error	(1) Current detection circuit error	Check the reproducibility of error at power on of the servo.	Reproduced.	Replace the servo amplifier.
				Not reproduced.	Check (2).
		(2) Fault is generated from the surrounding environment of the unit.	Check for noise, surrounding air temperature, and other factors.	Problem found.	Take countermeasure according to the cause.
17.2	Current feedback data error	(1) Current detection circuit error.	Examine checkpoints described in the alarm display "17.1".		
		(2) Fault is generated from the surrounding environment of the unit.			
17.3	Custom IC error	(1) Current detection circuit error.			
		(2) Fault is generated from the surrounding environment of the unit.			
17.4	Amplifier detection signal error	(1) Amplifier detection signal cannot be read properly.	Unplug all cables except the control circuit power supply cable, and check the reproducibility of the error.	Reproduced.	Replace the servo amplifier.
17.5	Rotary switch error	(1) Rotary switch setting cannot be read properly.	Examine checkpoints described in the alarm display "17.4".		
17.6	DIP switch error	(1) DIP switch (SW2 and SW3) setting cannot be read properly.	Examine checkpoints described in the alarm display "17.4".		

Alarm No.19	Name: Memory error 3 (Flash-ROM)	Stop method: All axes stop
Alarm description	・Interior part of the servo amplifier (FLASH-ROM) is faulty.	

Display	Name	Cause	Checkpoint	Finding	Action
19.1	Flash-ROM error 1	(1) Flash-ROM is faulty.	Unplug all cables except the control circuit power supply cable, and check the reproducibility of the error.	Reproduced.	Replace the servo amplifier.
19.2	Flash-ROM error 2	(1) Flash-ROM is faulty.	Examine checkpoints described in the alarm display "19.1".		

Alarm No.1A		Name: Motor combination error			Stop method: Corresponding axis stops	
Alarm description		・Combination of servo amplifier and servo motor is incorrect.				
Display	Name	Cause		Checkpoint	Finding	Action
1A.1	Motor combination error	(1)	Servo amplifier is connected to an incorrect servo motor or vice versa.	Check the model name of the servo motor and its combination with the servo amplifier.	Combination is incorrect.	Use in the right combination.
					Combination is correct.	Check (2).
		(2)	Linear servo setting is selected in the parameter.	Check the parameter No. PA01 setting. Rotary servo motor: "□□0□" Linear servo motor: "□□4□"	Rotary servo motor is selected.	Check the combination, then check (3).
					Linear servo motor is selected.	Select a rotary servo motor.
		(3)	A servo motor that needs parameter No.Po04 setting is being used.	Check the parameter No.Po04 setting.	The setting is incorrect.	Correct the setting.

Alarm No.1E		Name: Encoder initial communication error 2			Stop method: Corresponding axis stops	
Alarm description		・Encoder is faulty.				
Display	Name	Cause		Checkpoint	Finding	Action
1E.1	Encoder failure	(1)	Encoder is faulty.	Connect the encoder cable to the control power, and check the reproducibility of the error.	Reproduced.	Replace the servo motor.
					Not reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise and surrounding air temperature.	Problem found.	Take countermeasure according to the cause.

Alarm No.1F		Name: Encoder initial communication error 3			Stop method: Corresponding axis stops	
Alarm description		・Connected encoder is not compatible.				
Display	Name	Cause		Checkpoint	Finding	Action
1F.1	Incompatible encoder	(1)	Incompatible servo motor (linear encoder) is connected to the servo amplifier.	Check the model name of the servo motor (linear encoder).	Incompatible servo motor (linear encoder).	Replace the servo motor (linear encoder).

Alarm No.20		Name: Encoder normal communication error 1			Stop method: Corresponding axis stops	
Alarm description		・Error is found in the communication between the encoder and the servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
20.1	Encoder receive data error 1	(1)	Encoder cable is faulty.	Check the shield.	Problem found.	Repair the cable.
					No problem found.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise, surrounding air temperature, and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Servo amplifier is faulty.	Replace the servo amplifier and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
					Reproduced.	Examine checkpoints described in the alarm display "20.3".
20.2	Encoder receive data error 2	(1)	Encoder cable is faulty.	Examine checkpoints described in the alarm display "20.1".		
		(2)	Fault is generated from the surrounding environment of the unit.			
		(3)	Servo amplifier is faulty.			
20.3	Encoder receive data error 3	(1)	The encoder cable is unplugged.	Check if the encoder cable is connected properly.	Not connected properly.	Connect properly.
					Connected properly.	Check (2).
		(2)	Encoder cable is faulty.	Check for breakage and short of the encoder cable.	Problem found.	Repair or replace the cable.
					No problem found.	Check (3).
		(3)	Improper shield treatment of encoder cable.	Check the shield treatment.	Problem found.	Take measures against noise.
					No problem found.	Check (4).
		(4)	Servo amplifier is faulty.	Replace the servo amplifier and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
					Reproduced.	Check (5).
		(5)	Fault is generated from the surrounding environment of the unit.	Check for external noise, surrounding air temperature, and other factors.	Problem found.	Take countermeasure according to the cause.
20.5	Encoder transmission data error 1	(1)	Improper shield treatment of encoder cable.	Check the shield treatment.	Problem found.	Repair the cable.
					No problem found.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise, and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Encoder is faulty.	Replace to a properly operating axis.	Error is not reproduced.	Replace the servo motor.
20.6	Encoder transmission data error 2	(1)	Improper shield treatment of encoder cable.	Examine checkpoints described in the alarm display "20.5".		
		(2)	Fault is generated from the surrounding environment of the unit.			
		(3)	Encoder is faulty.			
20.7	Encoder transmission data error 3	(1)	Improper shield treatment of encoder cable.	Examine checkpoints described in the alarm display "20.5".		
		(2)	Fault is generated from the surrounding environment of the unit.			
		(3)	Encoder is faulty.			

Alarm No.21		Name: Encoder normal communication error 2			Stop method: Corresponding axis stops	
Alarm description		・Error is found in the encoder data.				
Display	Name	Cause		Checkpoint	Finding	Action
21.1	Encoder data error	(1)	High acceleration rate is detected in the encoder because of oscillation and other factors.	Decrease the loop gain, and check the reproducibility of the error.	Not reproduced.	Use the encoder with low loop gain.
					Reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Encoder is faulty.	Replace to a properly operating axis.	Error is not reproduced.	Replace the servo motor.
					Error is reproduced.	Contact your local sales office.
21.2	Encoder data update error	(1)	Encoder is faulty.	Check if rotation motor is used.	Rotation motor.	Replace the servo motor.

Alarm No.24		Name: Main circuit error			Stop method: All axes stop	
Alarm description		・Ground fault occurs at servo motor power cable of the servo amplifier. ・Ground fault occurs at servo motor.				
Display	Name	Cause		Checkpoint	Finding	Action
24.1	Ground fault detected at hardware detection circuit	(1)	Servo amplifier is faulty.	Check this alarm appears even when power cable (U, V and W) is disconnected.	Appears.	Replace the servo amplifier.
					Does not appear.	Check (2).
		(2)	Short or ground fault occurs at servo motor power cable.	Check if only the power cable is shorted (among U, V, W and ⏚).	Shorted.	Replace the power cable.
					Not shorted.	Check (3).
		(3)	Ground fault occurs at servo motor.	Disconnect power cables on motor side, and check insulation of the motor (among U, V, W and ⏚).	Shorted.	Replace the servo motor.
					Not shorted.	Check (4).
		(4)	Power input cable and servo motor power cable are shorted.	Shut off the power, and check if power input cable and servo motor power cable are in contact.	In contact.	Modify the wiring.
					Not in contact.	Check (5).
		(5)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
24.2	Ground fault detected at software detection function	(1)	Servo amplifier is faulty.	Examine checkpoints described in the alarm display "24.1".		
		(2)	Short or ground fault occurs at servo motor power cable.			
		(3)	Ground fault occurs at servo motor.			
		(4)	Power input cable and servo motor power cable are shorted.			
		(5)	Fault is generated from the surrounding environment of the unit.			

Alarm No.25		Name: Absolute position erase			Stop method: Corresponding axis stops	
Alarm description		・Error is found in absolute position data. ・Power is switched on for the first time in the absolute position detection system.				
Display	Name	Cause		Checkpoint	Finding	Action
25.1	Absolute position data erase	(1)	Power is switched on for the first time in the absolute position detection system.	Check if the action stated in the left is performed.	Performed.	Check the battery is installed and make home position return.
					Not performed.	Check (2).
		(2)	Battery is removed (replaced) when the control power is off.	Check if the action stated in the left is performed.	Performed.	Check the battery is installed and make home position return.
					Not performed.	Check (3).
		(3)	Battery voltage is low. (Battery is consumed.)	Check the battery voltage using a tester.	Below 3.0VDC.	Contact your local sales office.
					3.0VDC or more.	Check (4).
		(4)	The battery cable is faulty.	Check for poor contact using a tester.	Problem found.	Replace the battery cable.
					No problem found.	Check (5).
		(5)	Encoder cable is faulty.	Check for poor contact using a tester. Check the voltage on the motor side.	Problem found.	Repair or replace encoder cable.
					No problem found.	Check (6).
		(6)	Encoder is faulty.	Check if the voltage drops even when new battery is connected.	Drops.	Replace the servo motor.

Alarm No.30		Name: Regenerative error			Stop method: All axes stop	
Alarm description		・Permissible regenerative power of the built-in regenerative resistor or regenerative option is exceeded. ・Regenerative transistor in the servo amplifier is faulty.				
Display	Name	Cause		Checkpoint	Finding	Action
30.1	Regeneration heat error	(1)	Regenerative resistor (regenerative option) setting is incorrect.	Check the regenerative resistor (regenerative option) in use and PA02 setting.	The setting is incorrect.	Correct the setting.
					Correct the setting.	Check (2).
		(2)	Regenerative resistor (regenerative option) is not connected.	Check if the regenerative resistor (regenerative option) is properly connected.	Not connected properly.	Connect properly.
					Connected properly.	Check (3).
		(3)	Power supply voltage is high.	Check the input power supply voltage.	230VAC or more.	Lower the power supply voltage.
					Below 230VAC.	Check (4).
		(4)	Regenerative load ratio is over 100%.	Check the regenerative load ratio with MR Configurator when alarm occurs.	Over 100%.	Reduce the frequency of positioning. Increase the deceleration time constant. Reduce the load. Use a regenerative option if not being used.
30.2	Regenerative transistor error	(1)	Regenerative transistor is faulty.	Check if the regenerative resistor (regenerative option) is overheated abnormally.	Overheated abnormally.	Replace the servo amplifier.
					Not overheated abnormally.	Contact your local sales office.
30.3	Regenerative transistor feedback data error	(1)	Detection circuit of the servo amplifier is faulty.	Disconnect wires that are connected to P＋ and N, and then drive the servo amplifier.	Alarm occurs.	Replace the servo amplifier.

Alarm No.31		Name: Overspeed			Stop method: Corresponding axis stops	
Alarm description		・Servo motor speed exceeds the instantaneous permissible speed.				
Display	Name	Cause		Checkpoint	Finding	Action
31.1	Abnormal motor speed	(1)	The command from the controller is excessive.	The command from the controller is over the permissible speed range.	Permissible rotation speed or larger.	Review the operation pattern.
					Within the permissible rotation speed.	Check (2).
		(2)	Overshoot of speed occurs as the motor starts in the maximum torque.	Acceleration torque is clamped to the maximum torque.	Operating at maximum torque.	Set acceleration time longer or reduce the load.
					Operating below maximum torque.	Check (3).
		(3)	Servo system is instable and causing oscillation.	Check for oscillation in motor.	Oscillation is occurring.	Execute auto tuning to adjust the servo system, or reduce the load.
					Oscillation is not occurring.	Set acceleration time constant longer.
						Check (4).
		(4)	Overshoot of velocity waveform occurs.	Acceleration time constant is too short causing overshoot.	Overshoot occurs.	Set acceleration time constant longer.
					Overshoot does not occur.	Check (5).
		(5)	Encoder is faulty.	Check if alarm occurs when the actual speed is lower than instantaneous permissible speed.	Alarm occurs.	Replace the servo motor.

Alarm No.32		Name: Overcurrent			Stop method: All axes stop	
Alarm description		・Current that flew is the permissible current of the servo amplifier or higher.				
Display	Name	Cause		Checkpoint	Finding	Action
32.1	Overcurrent detected at hardware detection circuit (during operation).	(1)	Servo amplifier is faulty.	Check if this alarm appears even when power cable (UVW) is disconnected.	Appears.	Replace the servo amplifier.
					Does not appear.	Check (2).
		(2)	Short or ground fault occurs at servo motor power cable.	Check if only the power cable is shorted.	Shorted.	Replace the power cable.
					Not shorted.	Check (3).
		(3)	Servo motor is faulty.	Disconnect power cables on the servo motor side, and check insulation of the motor (among U, V, W, FG).	Ground fault occurs at the servo motor.	Replace the servo motor.
					Ground fault does not occur at the servo motor.	Check (4).
		(4)	Overcurrent is mistakenly detected from the surge noise in the dynamic brake operation.	Check if the dynamic brake is applied once in 10 minutes or more frequently while the servo motor is running.	Applied.	Apply the dynamic brake less frequently than once in 10 minutes.
					Not applied.	Check (5).
		(5)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
32.2	Overcurrent detected at software detection function (during operation).	(1)	Servo gain is high.	Check for vibration.	Vibration is occurring.	Set speed loop gain smaller.
					Vibration is not occurring.	Check (2).
		(2)	Servo amplifier is faulty.	Examine checkpoints described in the alarm display "32.1".		
		(3)	Short or ground fault occurs at servo motor power cable.			
		(4)	Servo motor is faulty.			
		(5)	Fault is generated from the surrounding environment of the unit.			
32.3	Overcurrent detected at hardware detection circuit (during a stop).	(1)	Servo amplifier is faulty.	Examine checkpoints described in the alarm display "32.1".		
		(2)	Short or ground fault occurs at servo motor power cable.			
		(3)	Servo motor is faulty.			
		(4)	Fault is generated from the surrounding environment of the unit.			
32.4	Overcurrent detected at software detection function (during a stop).	(1)	Servo gain is high.	Examine checkpoints described in the alarm display "32.2".		
		(2)	Servo amplifier is faulty.			
		(3)	Short or ground fault occurs at servo motor power cable.			
		(4)	Servo motor is faulty.			
		(5)	Fault is generated from the surrounding environment of the unit.			

Alarm No.33		Name: Overvoltage			Stop method: All axes stop	
Alarm description		・Bus voltage exceeds 400VDC.				
Display	Name	Cause		Checkpoint	Finding	Action
33.1	Main circuit voltage error	(1)	Although the regenerative option is used, the parameter setting is incorrect.	Check the parameter No. PA02 setting.	Setting is incorrect.	Correct the setting.
					Setting is correct.	Check (2).
		(2)	Lead of built-in regenerative resistor or regenerative option has breakage or disconnected.	Check the wiring and the lead of regenerative resistor (regenerative option).	Has breakage or disconnected.	Connect properly.
					Normal.	Check (3).
		(3)	Check the status of regenerative resistor (regenerative option).	Check the resistance.	Regenerative resistor (regenerative option) is abnormal.	When using built-in regenerative resistor, replace the servo amplifier. When using a regenerative option, replace the regenerative option.
					Normal.	Check (4).
		(4)	Regeneration capacity shortage.	Increase the deceleration time constant, and check the reproducibility of the error.	Not reproduced.	Use a regenerative option if not being used.
					Reproduced.	Check (5).
		(5)	Power supply voltage is high.	Check the input power supply voltage.	253VAC or more.	Make input voltage smaller.

Alarm No.34		Name: SSCNET receive error 1			Stop method: Corresponding axis stops	
Alarm description		・SSCNETⅢ communication error (Continuous communication error for 3.5ms)				
Display	Name	Cause		Checkpoint	Finding	Action
34.1	SSCNET receive data error	(1)	SSCNETⅢ cable is disconnected.	Check the SSCNETⅢ cable connection.	Disconnected.	Turn off the control power of servo amplifier, and connect the cable.
					Connected.	Check (2).
		(2)	Tip of SSCNETⅢ cable has dirt.	Wipe off the dirt from the cable tip, and check the reproducibility of the error.	Not reproduced.	Take measure to keep cable tip clean.
					Reproduced.	Check (3).
		(3)	SSCNETⅢ cable is broken or cut off.	Check the cable.	Problem found.	Replace the cable.
					No problem found.	Check (4).
		(4)	Vinyl tape is stacked to SSCNETⅢ cable, or cable containing migrating plasticizer is adhered to the cable.	Check if the condition stated in the left meets.	It meets.	Take countermeasure.
					It does not meet.	Check (5).
		(5)	Servo amplifier is faulty.	Replace to a servo amplifier without any alarm, and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
					Reproduced.	Check (6).
		(6)	Servo amplifier in front or rear axis of alarm occurring axis is faulty.	Replace the servo amplifier and front/rear axes of the alarm occurring axis, and check the reproducibility of the error.	Reproduced in the rear axis of the corresponding axis.	Replace the servo amplifier.
					Not reproduced.	Check (7).
		(7)	Check the surrounding environment of the unit for fault.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
34.2	SSCNET communication connector connection error	(1)	SSCNETⅢ cable is disconnected.	Examine checkpoints described in the alarm display "34.1".		
		(2)	Tip of SSCNETⅢ cable has dirt.			
		(3)	SSCNETⅢ cable is broken or cut off.			
		(4)	Vinyl tape is stacked to SSCNETⅢ cable, or cable containing migrating plasticizer is adhered to the cable.			
		(5)	Servo amplifier is faulty.			
		(6)	Servo amplifier in front or rear axis of alarm occurring axis is faulty.			
		(7)	Fault is generated from the surrounding environment of the unit.			

Alarm No.34		Name: SSCNET receive error 1			Stop method: Corresponding axis stops	
Alarm description		・SSCNETⅢ communication error (Continuous communication error for 3.5ms)				
Display	Name	Cause		Checkpoint	Finding	Action
34.3	Communication data error	(1)	SSCNETⅢ cable is disconnected.	Examine checkpoints described in the alarm display "34.1".		
		(2)	Tip of SSCNETⅢ cable has dirt.			
		(3)	SSCNETⅢ cable is broken or cut off.			
		(4)	Vinyl tape is stacked to SSCNETⅢ cable, or cable containing migrating plasticizer is adhered to the cable.			
		(5)	Servo amplifier is faulty.			
		(6)	Servo amplifier in front or rear axis of alarm occurring axis is faulty.			
		(7)	Fault is generated from the surrounding environment of the unit.			
34.4	Hardware error signal detection	(1)	SSCNETⅢ cable is disconnected.	Examine checkpoints described in the alarm display "34.1".		
		(2)	Tip of SSCNETⅢ cable has dirt.			
		(3)	SSCNETⅢ cable is broken or cut off.			
		(4)	Vinyl tape is stacked to SSCNETⅢ cable, or cable containing migrating plasticizer is adhered to the cable.			
		(5)	Servo amplifier is faulty.			
		(6)	Servo amplifier in front or rear axis of alarm occurring axis is faulty.			
		(7)	Fault is generated from the surrounding environment of the unit.			

Alarm No.35		Name: Command frequency error			Stop method: Corresponding axis stops	
Alarm description		・Input pulse frequency of command pulse is too high.				
Display	Name	Cause		Checkpoint	Finding	Action
35.1	Command frequency error	(1)	Command given is the maximum speed of the servo motor or higher.	Check the speed command.	Speed command is too high.	Review the operation pattern.
					Speed command is within the setting range.	Check (2).
		(2)	Servo amplifier is faulty.	Replace the servo amplifier, and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
					Reproduced.	Check (3).
		(3)	Servo system controller is faulty.	Replace the servo system controller, and check the reproducibility of the error.	Not reproduced.	Replace the servo system controller.
					Reproduced.	Check (4).
		(4)	Fault is generated from the surrounding environment of the unit.	Check for noise, surrounding air temperature, and other factors.	Problem found.	Take countermeasure according to the cause.

Alarm No.36		Name: SSCNET receive error 2			Stop method: Corresponding axis stops	
Alarm description		・SSCNETⅢ communication error (Continuous communication error for about 70ms.)				
Display	Name	Cause		Checkpoint	Finding	Action
36.1	Continuous communication data error	(1)	SSCNETⅢ cable is disconnected.	Check the cable connection.	Disconnected.	Turn off the power of servo amplifier, and connect the cable.
					Connected properly.	Check (2).
		(2)	Tip of SSCNETⅢ cable has dirt.	Wipe off the dirt from the cable tip, and check reproducibility.	Not reproduced.	Take measure to keep cable tip clean.
					Reproduced.	Check (3).
		(3)	SSCNETⅢ cable is broken or cut off.	Check the cable.	Problem found.	Replace the cable.
					No problem found.	Check (4).
		(4)	Vinyl tape is stacked to SSCNETⅢ cable, or cable containing migrating plasticizer is adhered to the cable.	Check if the condition stated in the left meets.	Meets.	Take countermeasure.
					Does not meet.	Check (5).
		(5)	Servo amplifier is faulty.	Replace to a servo amplifier without any alarm, and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
					Reproduced.	Check (6).
		(6)	Servo amplifier in front or rear axis of alarm occurring axis is faulty.	Replace front and rear axes of alarm occurring axis, and check the reproducibility of the error.	Reproduced in the rear axis of the corresponding axis.	Replace the servo amplifier.
					Not reproduced.	Check (7).
		(7)	Fault is generated from the surrounding environment of the unit.	Check for noise, etc.	Problem found.	Take countermeasure according to the cause.

Alarm No.37		Name: Parameter error			Stop method: Corresponding axis stops	
Alarm description		・Settings in the servo amplifier are incorrect.				
Display	Name	Cause		Checkpoint	Finding	Action
37.1	Parameter setting range error	(1)	There is a parameter of which value is set outside of the setting range.	Check the parameter number, and check the setting of the controller.	Outside of the range.	Change parameter value to within the setting range.
					Within the range.	Check (2).
		(2)	EEP-ROM fault caused by parameter write times over.	Write parameter values within the setting range, and check that values are written correctly.	Abnormal values are written.	Replace the servo amplifier.
					Values are written correctly.	Check (3).
		(3)	Servo amplifier fault caused the parameter setting to be rewritten.	Replace to a properly operating servo amplifier and check the reproducibility of the error.	Not reproduced.	Use the newly replaced servo amplifier.
37.2	Parameter combination error	(1)	One parameter setting contradicts another.	Check parameter numbers, and check the setting values.	Problem found in the setting values.	Correct the setting value.

Alarm No.45		Name: Main circuit device overheat			Stop method: All axes stop	
Alarm description		・Inside of the servo amplifier overheats.				
Display	Name	Cause		Checkpoint	Finding	Action
45.1	Main circuit abnormal temperature	(1)	Surrounding air temperature is over 55°C.	Check that surrounding air temperature is 55°C or less.	Surrounding air temperature is over 55°C.	Lower the surrounding air temperature.
					Surrounding air temperature is 55°C or less.	Check (2).
		(2)	Specification of close mounting is not met.	Check the specification of close mounting.	Specification not met.	Use according to the specification.
					Specification met.	Check (3).
		(3)	The power supply was turned on and off continuously by overloaded status.	Check if overloaded status occurred many times.	Occurred many times.	Review the operation method.
					Did not occur.	Check (4).
		(4)	Foreign matter caught in cooling fan or cooling fin.	Clean the cooling fan and cooling fin, and check the reproducibility of the error.	Not reproduced.	Clean periodically.
					Reproduced.	Check (5).
		(5)	Servo amplifier is faulty.	Replace to a properly operating servo amplifier and check the reproducibility of the error.	Not reproduced.	Use a properly operating servo amplifier.
45.2	Board temperature error	(1)	Surrounding air temperature is over 55°C.	Examine checkpoints described in the alarm display "45.2".		
		(2)	Specification of close mounting is not met.			
		(3)	The power supply was turned on and off continuously by overloaded status.			
		(4)	Foreign matter caught in cooling fan or cooling fin.			
		(5)	Servo amplifier is faulty.			

Alarm No.46		Name: Servo motor overheat			Stop method: Corresponding axis stops	
Alarm description		・Servo motor overheats abnormally.				
Display	Name	Cause		Checkpoint	Finding	Action
46.1	Abnormal temperature of servo motor	(1)	Surrounding air temperature of the servo motor is over 40°C.	Check the surrounding air temperature of the servo motor.	Surrounding air temperature is over 40°C.	Lower the surrounding air temperature of the servo motor.
					Surrounding air temperature is 40°C or less.	Check (2).
		(2)	Servo motor is overloaded.	Check the effective load ratio.	Effective load ratio is large.	Reduce the load or review the operation method.
					Effective load ratio is small.	Check (3).
		(3)	Thermal sensor in encoder is faulty.	Check the motor temperature at alarm occurrence.	Motor temperature is low.	Replace the servo motor.

Alarm No.47		Name: Cooling fan error			Stop method: All axes stop	
Alarm description		・Cooling fan speed of the servo amplifier is decreased. ・Cooling fan speed drops to the alarm level or lower.				
Display	Name	Cause		Checkpoint	Finding	Action
47.1	Cooling fan stop error	(1)	Foreign matter is caught in the cooling fan.	Check for foreign matter caught in the cooling fan.	Foreign matter is caught.	Remove the foreign matter.
					Foreign matter is not caught.	Check (2).
		(2)	Cooling fan life expiration.	Check if the fan is stopped.	Fan is stopped.	Replace the servo amplifier.
47.2	Decreased cooling fan speed error	(1)	Foreign matter is caught in the cooling fan.	Check for foreign matter caught in the cooling fan.	Foreign matter is caught.	Remove the foreign matter.
					Foreign matter is not caught.	Check (2).
		(2)	Cooling fan life expiration.	Check the cumulative power supply time of the servo amplifier.	Life is expired.	Replace the servo amplifier.

Alarm No.50		Name: Overload 1			Stop method: Corresponding axis stops	
Alarm description		・Load exceeds overload protection characteristic of servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
50.1	Thermal overload error 1 during operation	(1)	Electromagnetic brake is activated.	Check if the electromagnetic brake is activated.	Activated.	Review the wiring.
					Not activated.	Check (2).
		(2)	Servo amplifier is used in excess of its continuous output current.	Check the effective load ratio.	Effective load ratio is large.	Reduce load. Check operation pattern. Use servo motor that provides larger output.
					Effective load ratio is small.	Check (3).
		(3)	Servo system is instable and causing oscillation.	Check for oscillation in motor.	Oscillation is occurring.	Adjust the gain.
					Oscillation is not occurring.	Check (4).
		(4)	After the overload alarm has been output, the operation is restarted without having cool-off time.	Check if the alarm is reset after waiting 30 minutes or longer subsequent to the output of the alarm.	Not reset.	Reset the alarm after sufficient cool-off time.
					Reset.	Check (5).
		(5)	Servo amplifier is faulty.	Replace the servo amplifier, and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.

Alarm No.50		Name: Overload 1			Stop method: Corresponding axis stops	
Alarm description		・Load exceeds overload protection characteristic of servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
50.2	Thermal overload error 2 during operation	(1)	Machine struck something.	Check if the machine struck something.	Machine struck.	Review the operation pattern.
					Machine did not strike.	Check (2).
		(2)	Power cable is cut.	Check the power cable.	Problem found.	Modify the wiring.
					No problem found.	Check (3).
		(3)	Incorrect connections to/from the servo motor.	Check the wiring of U, V and W phase.	Problem found.	Perform wiring correctly.
					No problem found.	Check (4).
		(4)	Electromagnetic brake is activated.	Examine checkpoints described in the alarm display "50.1".		
		(5)	Servo amplifier is used in excess of its continuous output current.			
		(6)	Servo system is instable and causing oscillation.			
		(7)	Servo amplifier is faulty.			
		(8)	Encoder is faulty.	Replace the servo motor, and check the reproducibility of the error.	Not reproduced.	Replace the servo motor.
50.3	Thermal overload error 4 during operation	(1)	Machine struck something.	Examine checkpoints described in the alarm display "50.2".		
		(2)	Power cable is cut.			
		(3)	Incorrect connections to/from the servo motor			
		(4)	Electromagnetic brake is activated.			
		(5)	Servo amplifier is used in excess of its continuous output current.			
		(6)	Servo system is instable and causing oscillation.			
		(7)	Servo amplifier is faulty.			
		(8)	Encoder is faulty.			

Alarm No.50		Name: Overload 1			Stop method: Corresponding axis stops	
Alarm description		・Load exceeds overload protection characteristic of servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
50.4	Thermal overload error 1 during a stop	(1)	Electromagnetic brake is activated.	Check if the electromagnetic brake is activated during operation.	Activated.	Review the wiring
					Not activated.	Check (2).
		(2)	Servo amplifier is used in excess of its continuous output current.	Check the effective load ratio.	Effective load ratio is large.	Reduce load. Check operation pattern. Use servo motor that provides larger output.
					Effective load ratio is small.	Check (3).
		(3)	Hunting occurs during servo lock.	Check for hunting.	Hunting occurs.	Adjust the gain.
					Hunting does not occur.	Check (4).
		(4)	After the overload alarm has been output, the operation is restarted without having cool-off time.	Check if the alarm is reset after waiting 30 minutes or longer subsequent to the output of the alarm.	Not reset.	Reset the alarm after sufficient cool-off time.
					Reset.	Check (5).
		(5)	Servo amplifier is faulty.	Replace the servo amplifier, and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
50.5	Thermal overload error 2 during a stop	(1)	Machine struck something.	Check if the machine struck something.	Machine struck.	Review the operation pattern.
					Machine did not strike.	Check (2).
		(2)	Power cable is cut.	Check the power cable.	Problem found.	Modify the wiring.
					No problem found.	Check (3).
		(3)	Incorrect connections to/from the servo motor.	Check the wiring of U, V and W phase.	Problem found.	Perform wiring correctly.
					No problem found.	Check (4).
		(4)	Electromagnetic brake is activated.	Examine checkpoints described in the alarm display "50.4".		
		(5)	Servo amplifier is used in excess of its continuous output current.			
		(6)	Hunting occurs during a stop.			
		(7)	Servo amplifier is faulty.			
		(8)	Encoder is faulty.	Replace the servo motor, and check the reproducibility of the error.	Not reproduced.	Replace the servo motor.

Alarm No.50		Name: Overload 1			Stop method: Corresponding axis stops	
Alarm description		・Load exceeds overload protection characteristic of servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
50.6	Thermal overload error 4 during a stop	(1)	Machine struck something.	Examine checkpoints described in the alarm display "50.5".		
		(2)	Power cable is cut.			
		(3)	Incorrect connections to/from the servo motor.			
		(4)	Electromagnetic brake is activated.			
		(5)	Servo amplifier is used in excess of its continuous output current.			
		(6)	Hunting occurs during a stop.			
		(7)	Servo amplifier is faulty.			
		(8)	Encoder is faulty.			

Alarm No.51		Name: Overload 2			Stop method: Corresponding axis stops	
Alarm description		・Machine collision or the like caused maximum output current to flow for several seconds continuously.				
Display	Name	Cause		Checkpoint	Finding	Action
51.1	Thermal overload error 3 during operation	(1)	Power cable is cut.	Check the power cable.	Misconnection found.	Modify the wiring.
					Normal.	Check (2).
		(2)	Incorrect connections to/from the servo motor.	Check the wiring of U, V and W phase.	Problem found.	Modify the wiring.
					No problem found.	Check (3).
		(3)	Misconnection of encoder cable.	Check the encoder cable connection.	Problem found.	Check the cable connection.
					No problem found.	Check (4).
		(4)	Machine struck something.	Check if the machine struck something.	Machine struck.	Review the operation pattern.
					Machine did not strike.	Check (5).
		(5)	Torque is saturated.	Check the torque during the operation.	Torque is saturated.	Review the operation pattern.
					Torque is not saturated.	Check (6).
		(6)	Servo amplifier is faulty.	Replace the servo amplifier, and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
					Reproduced.	Check (7).
		(7)	Encoder is faulty.	Replace the servo motor, and check the reproducibility of the error.	Not reproduced.	Replace the servo motor.
51.2	Thermal overload error 3 during a stop	(1)	Power cable is cut.	Examine checkpoints described in the alarm display "51.1".		
		(2)	Incorrect connections to/from the servo motor.			
		(3)	Misconnection of encoder cable.			
		(4)	Machine struck something.			
		(5)	Torque is saturated.			
		(6)	Servo amplifier is faulty.			
		(7)	Encoder is faulty.			

Alarm No.52		Name: Error excessive			Stop method: Corresponding axis stops	
Alarm description		・The droop pulse existing between the model position and the actual servo motor position exceeds the alarm level.				
Display	Name	Cause		Checkpoint	Finding	Action
52.3	Excess droop pulse	(1)	Power cable is cut.	Check the power cable.	No connection (open phase).	Modify the wiring.
					No problem found.	Check (2).
		(2)	Misconnection of the servo motor.	Check the connection of U, V and W phase.	Misconnection found.	Modify the wiring.
					Misconnection not found.	Check (3).
		(3)	Misconnection of encoder cable.	Check the axis where encoder cable is connected.	Misconnection found.	Modify the wiring.
					Misconnection not found.	Check (4).
		(4)	Torque limit value is too small.	Check the torque limit value.	Torque limit value is small.	Increase the torque limit value.
					Within the setting range.	Check (5).
		(5)	Machine struck something.	Check if the machine struck something.	Struck.	Review the operation pattern.
					Did not strike.	Check (6).
		(6)	Torque shortage.	Check if the torque is saturated.	Torque is saturated.	Reduce load. Check operation pattern. Use servo motor that provides larger output.
					Torque is not saturated.	Check (7).
		(7)	Equipment cannot be started because of torque shortage caused by the power supply voltage drop.	Check the bus voltage using MR Configurator .	Bus voltage is low.	Review the power supply voltage.
					Bus voltage is high.	Check (8).
		(8)	Acceleration/deceleration time constant is too small.	Set acceleration/ deceleration time longer, and check the reproducibility of the error.	Not reproduced.	Review the operation pattern.
					Reproduced.	Check (9).
		(9)	Position loop gain is too small.	Change the position loop gain, and check the reproducibility of the error.	Not reproduced.	Review the position loop gain.
					Reproduced.	Check (10).
		(10)	Servo motor shaft is rotated by external force.	Measure the actual servo motor position in the servo lock status.	Motor moves.	Check the machine.
					Does not move.	Check (11).
		(11)	Encoder is faulty.	Check if the alarm still occurs after replacing the servo motor by a properly operating servo motor.	Alarm does not occur.	Replace the servo motor.
52.4	Maximum deviation at 0 torque limit	(1)	Torque limit is set to 0.	Check the torque limit value.	Torque limit is 0.	Increase the torque limit value.

Alarm No. 8A		Name: USB communication time-out error			Stop method: All axes stop	
Alarm description		・Communication between the servo amplifier and a communication device (PC, etc.) stops for the specified time or longer.				
Display	Name	Cause		Checkpoint	Finding	Action
8A.1	USB communication time-out error	(1)	Communication commands are not sent.	Check if commands are sent from the personal computer.	Not sent.	Send commands from the personal computer.
					Sent.	Check (2).
		(2)	USB cable has breakage.	Replace the USB cable and check the reproducibility of the error.	Not reproduced.	Replace the USB cable.
					Reproduced.	Check (2).
		(3)	Servo amplifier is faulty.	Replace the servo amplifier, and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.

Alarm No. 8E		Name: USB communication error			Stop method: All axes stop	
Alarm description		・USB communication error occurs between the servo amplifier and a communication device (PC, etc.)				
Display	Name	Cause		Checkpoint	Finding	Action
8E.1	USB communication receive error	(1)	USB cable is faulty.	Replace the USB cable and check the reproducibility of the error.	Not reproduced.	Replace the USB cable.
					Reproduced.	Check (2).
		(2)	Setting of communication device (personal computer, etc.) is improper.	Check the communication setting of the communication device.	Incorrect setting found.	Review the setting.
					Setting is correct.	Check (3).
		(3)	Servo amplifier is faulty.	Replace the servo amplifier, and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
8E.2	USB communication checksum error	(1)	Setting of communication device (personal computer, etc.) is improper.	Check the communication setting of the communication device.	Incorrect setting found.	Review the setting.
8E.3	USB communication character error	(1)	Character not in the specification is transmitted.	Check the character code at transmission.	Character not in the specification is transmitted.	Modify the send command.
					Only character in the specification is transmitted.	Check (2).
		(2)	Communication protocol is faulty.	Check if transmission data conforms the communication protocol.	Does not conform.	Modify transmission data according to the communication protocol.
					Conforms.	Check (3).
		(3)	Setting of communication device (personal computer, etc.) is improper.	Check the communication setting of the communication device.	Incorrect setting found.	Review the setting.

<table>
<tr><td colspan="2">Alarm No. 8E</td><td colspan="3">Name: USB communication error</td><td colspan="2">Stop method: All axes stop</td></tr>
<tr><td colspan="2">Alarm description</td><td colspan="5">・USB communication error occurs between the servo amplifier and a communication device (PC, etc.)</td></tr>
<tr><td>Display</td><td>Name</td><td colspan="2">Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td rowspan="5">8E.4</td><td rowspan="5">USB communication command error</td><td rowspan="2">(1)</td><td rowspan="2">Command not in the specification is transmitted.</td><td rowspan="2">Check the command code at transmission.</td><td>Command not in the specification is transmitted.</td><td>Modify the send command.</td></tr>
<tr><td>Only commands in the specification is transmitted.</td><td>Check (2).</td></tr>
<tr><td rowspan="2">(2)</td><td rowspan="2">Communication protocol is faulty.</td><td rowspan="2">Check if transmission data conforms the communication protocol.</td><td>Does not conform.</td><td>Modify transmission data according to the communication protocol.</td></tr>
<tr><td>Conforms.</td><td>Check (3).</td></tr>
<tr><td>(3)</td><td>Setting of communication device (personal computer, etc.) is improper.</td><td>Check the communication setting of the communication device.</td><td>Incorrect setting found.</td><td>Review the setting.</td></tr>
<tr><td rowspan="5">8E.5</td><td rowspan="5">USB communication data No. error</td><td rowspan="2">(1)</td><td rowspan="2">Data No. not in the specification is transmitted.</td><td rowspan="2">Check the data No. at transmission.</td><td>Data No. not in the specification is transmitted.</td><td>Modify the send command.</td></tr>
<tr><td>Only data No. in the specification is transmitted.</td><td>Check (2).</td></tr>
<tr><td rowspan="2">(2)</td><td rowspan="2">Communication protocol is faulty.</td><td rowspan="2">Check that transmission data conforms the communication protocol.</td><td>Does not conform.</td><td>Modify transmission data according to the communication protocol.</td></tr>
<tr><td>Conforms.</td><td>Check (3).</td></tr>
<tr><td>(3)</td><td>Setting of communication device (personal computer, etc.) is improper.</td><td>Check the communication setting of the communication device.</td><td>Incorrect setting found.</td><td>Review the setting.</td></tr>
</table>

8.4 Remedies for warnings

CAUTION	・If an absolute position counter warning (E3.□) 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.
  - Main circuit device overheat warning (91.□)
  - Excessive regenerative warning (E0.□)
  - Overload warning 1 (E1.□)

When a warning whose stop method is all axis stop in the following table occurs, the servo amplifier goes into the servo-off status and the servo motor stops at the warning occurrence.
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 MR Configurator to refer to a factor of warning occurrence.

<table>
<tr><td colspan="2">Warning No. 91</td><td colspan="3">Name: Main circuit device overheat warning</td><td colspan="2">Stop method: Axes can operate (warning detected at both axes)</td></tr>
<tr><td colspan="2">Warning description</td><td colspan="5">・The temperature inside of the servo amplifier exceeds the warning level.</td></tr>
<tr><td>Display</td><td>Name</td><td colspan="2">Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td rowspan="3">91.1</td><td rowspan="3">Main circuit device overheat warning</td><td rowspan="2">(1)</td><td rowspan="2">The temperature inside of the servo amplifier is high.</td><td rowspan="2">Check the surrounding air temperature of the servo amplifier.</td><td>Surrounding temperature is high. (over 55°C)</td><td>Lower the surrounding air temperature.</td></tr>
<tr><td>Surrounding temperature is low.</td><td>Check (2).</td></tr>
<tr><td>(2)</td><td>Specification of close mounting is not met.</td><td>Check the specification of close mounting.</td><td>Specification not met.</td><td>Use according to the specification.</td></tr>
<tr><td rowspan="2">91.2</td><td rowspan="2">Board temperature warning</td><td>(1)</td><td>The temperature inside of the servo amplifier is high.</td><td rowspan="2" colspan="3">Examine checkpoints described in the alarm display "91.1".</td></tr>
<tr><td>(2)</td><td>Specification of close mounting is not met.</td></tr>
</table>

Warning No. 92		Name: Battery cable disconnection warning			Stop method: Axes can operate (detected at the corresponding axis).	
Warning description		・Battery voltage of absolute position detection system is low.				
Display	Name	Cause		Checkpoint	Finding	Action
92.1	Encoder battery disconnection warning signal detection	(1)	Battery cable has breakage.	Check the battery cable.	Problem found.	Replace the battery. Repair the cable.
					No problem found.	Check (2).
		(2)	Battery voltage is decreasing (detected by encoder).	Measure the battery voltage.	Below 3.0VDC.	Replace the battery.
					3.0VDC or more.	Check (3).
		(3)	Encoder cable has breakage.	Check for breakage of the encoder cable.	Problem found.	Replace of repair the encoder cable.

Warning No. 96		Name: Home position setting warning			Stop method: Axes can operate (detected by the corresponding axis).	
Warning description		・Home positioning cannot be made.				
Display	Name	Cause		Checkpoint	Finding	Action
96.1	In-position error at home positioning	(1)	In-position (INP-A/INP-B) did not turn on within the specified time during home positioning.	Measure the number of droop pulses during home positioning.	In-position set value or larger.	Adjust the gain to make the number within In-position setting range. Remove the cause of droop pulse occurrence.
					Below INP set value.	Contact your local sales office.
96.2	Command input error at home positioning	(1)	Command is input during home positioning.	Check if the command is input during home positioning.	Command is input.	Input command after home positioning is completed.
					Command is not input.	Check (2).
		(2)	Creep speed is high.	Reduce the creep speed, and check the reproducibility of the error.	Not reproduced.	Reduce the creep speed.

Warning No. 9F		Name: Battery warning			Stop method: Axes can operate (warning detected at both axes).	
Warning description		・Battery voltage of absolute position detection system is low.				
Display	Name	Cause		Checkpoint	Finding	Action
9F.1	Low battery	(1)	Battery voltage is low.	Measure the battery voltage.	Below 3.2VDC.	Replace the battery.

Warning No. E0	Name: Excessive regeneration warning				Stop method: Axes can operate (warning detected at both axes)	
Warning description	・There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative resistor or regenerative option.					
Display	Name	Cause		Checkpoint	Finding	Action
E0.1	Excessive regeneration warning	(1)	Permissible regenerative power of the built-in regenerative resistor or regenerative option is over 85%.	Check the regenerative load ratio with MR Configurator.	85% or more.	Reduce the frequency of positioning. Increase the deceleration time constant. Reduce the load. Use a regenerative option if not being used.

Warning No. E1	Name: Overload warning 1				Stop method: Axes can operate (detected at the corresponding axis)	
Warning description	・There is a possibility that overload alarm (50.1, 51.□) may occur.					
Display	Name	Cause		Checkpoint	Finding	Action
E1.1	Thermal overload warning 1 during operation	(1)	Load is 85% or larger of the overload alarm (50.1) alarm level.	Examine checkpoints described in the alarm display "50.1".		
E1.2	Thermal overload warning 2 during operation	(1)	Load is 85% or larger of the overload alarm (50.2) alarm level.	Examine checkpoints described in the alarm display "50.2".		
E1.3	Thermal overload warning 3 during operation	(1)	Load is 85% or larger of the overload alarm (51.1) alarm level	Examine checkpoints described in the alarm display "51.1".		
E1.4	Thermal overload warning 4 during operation	(1)	Load is 85% or larger of the overload alarm (50.3) alarm level.	Examine checkpoints described in the alarm display "50.3".		
E1.5	Thermal overload warning 1 during a stop	(1)	Load is 85% or larger of the overload alarm (50.4) alarm level.	Examine checkpoints described in the alarm display "50.4".		
E1.6	Thermal overload warning 2 during a stop	(1)	Load is 85% or larger of the overload alarm (50.5) alarm level.	Examine checkpoints described in the alarm display "50.5".		
E1.7	Thermal overload warning 3 during a stop	(1)	Load is 85% or larger of the overload alarm (51.2) alarm level.	Examine checkpoints described in the alarm display "52.1".		
E1.8	Thermal overload warning 4 during a stop	(1)	Load is 85% or larger of the overload alarm (50.6) alarm level.	Examine checkpoints described in the alarm display "50.6".		

<table>
<tr><td colspan="2">Warning No. E3</td><td colspan="3">Name: Absolute position counter warning</td><td colspan="2">Stop method: Axes can operate (detected at the corresponding axis)</td></tr>
<tr><td colspan="2">Warning description</td><td colspan="5">・The multi-revolution counter value of the absolute position encoder exceeds the maximum revolution range.
・Absolute position encoder pulses are faulty.</td></tr>
<tr><td>Display</td><td>Name</td><td colspan="2">Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td>E3.1</td><td>Multi-revolution counter travel distance excess warning</td><td>(1)</td><td>The travel distance from the home position is 32768 rotation or more in the absolute position system.</td><td>Check the multi-revolution counter with MR Configurator.</td><td>32768 rotation or more.</td><td>Review the operation range.
Make home position return.</td></tr>
<tr><td rowspan="3">E3.2</td><td rowspan="3">Absolute positioning counter error</td><td rowspan="2">(1)</td><td rowspan="2">Encoder is faulty.</td><td rowspan="2">Replace the servo motor, and check the reproducibility of the error.</td><td>Not reproduced.</td><td>Use the newly replaced servo motor.</td></tr>
<tr><td>Not reproduced.</td><td>Check (2).</td></tr>
<tr><td>(2)</td><td>Fault is generated from the surrounding environment of the unit.</td><td>Check for noise and other factors.</td><td>Problem found.</td><td>Take countermeasure according to the cause.</td></tr>
</table>

<table>
<tr><td colspan="2">Warning No. E4</td><td colspan="3">Name: Parameter warning</td><td colspan="2">Stop method: Axes can operate (detected at the corresponding axis)</td></tr>
<tr><td colspan="2">Warning description</td><td colspan="5">・At parameter write, write to parameter outside of the setting range is attempted.</td></tr>
<tr><td>Display</td><td>Name</td><td colspan="2">Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td>E4.1</td><td>Parameter setting range error warning</td><td>(1)</td><td>Parameter value set from the servo system controller is outside of the setting range.</td><td>Check the parameter set from the servo system controller.</td><td>Outside of the setting range.</td><td>Set a parameter within the range.</td></tr>
</table>

<table>
<tr><td colspan="2">Warning No. E6</td><td colspan="3">Name: Servo forced stop warning</td><td colspan="2">Stop method: All axes stop</td></tr>
<tr><td colspan="2">Warning description</td><td colspan="5">・Forced stop signal is turned off.</td></tr>
<tr><td>Display</td><td>Name</td><td colspan="2">Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td rowspan="5">E6.1</td><td rowspan="5">Servo forced stop warning</td><td rowspan="2">(1)</td><td rowspan="2">Forced stop (EM1) is turned off.</td><td rowspan="2">Check the forced stop (EM1).</td><td>OFF</td><td>Ensure safety and deactivate (turn on). forced stop (EM1).</td></tr>
<tr><td>ON</td><td>Check (2).</td></tr>
<tr><td rowspan="2">(2)</td><td rowspan="2">24VDC of external power supply is not input.</td><td rowspan="2">Check if 24VDC of external power supply is input.</td><td>Not input.</td><td>Input 24VDC.</td></tr>
<tr><td>Input.</td><td>Check (3).</td></tr>
<tr><td>(3)</td><td>Servo amplifier is faulty.</td><td>Replace the servo amplifier, and check the reproducibility of the error.</td><td>Not reproduced.</td><td>Use the newly replaced servo amplifier.</td></tr>
</table>

<table>
<tr><td colspan="2">Warning No. E7</td><td colspan="3">Name: Controller forced stop warning</td><td colspan="2">Stop method: All axes stop</td></tr>
<tr><td colspan="2">Warning description</td><td colspan="5">・Forced stop signal is input from the servo system controller.</td></tr>
<tr><td>Display</td><td>Name</td><td colspan="2">Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td>E7.1</td><td>Controller forced stop warning</td><td>(1)</td><td>Forced stop signal was input from the servo system controller.</td><td>Check if the servo system controller is in forced stop status.</td><td>In forced stop status.</td><td>Ensure safety and deactivate forced stop signal of the controller.</td></tr>
</table>

Warning No. E8		Name: Cooling fan speed reduction warning			Stop method: Axes can operate (warning detected at both axes)	
Warning description		・The speed of cooling fan drops to or below the warning level.				
Display	Name	Cause		Checkpoint	Finding	Action
E8.1	Decreased cooling fan speed warning	(1)	Foreign matter is caught in the fan causing decreased speed.	Check for foreign matter adhesion.	Adhered.	Remove the foreign matter.
					Not adhered.	Check (2).
		(2)	Cooling fan life expiration.	Check the cumulative power supply time of the servo amplifier.	Life is expired.	Replace the servo amplifier, or repair (replace) the cooling fan.

Warning No. E9		Name: Main circuit off warning			Stop method: All axes stop (warning detected at both axes).	
Warning description		・Servo-on command is input when the main circuit power is off. ・Bus voltage drops when servo motor is running below 50r/min.				
Display	Name	Cause		Checkpoint	Finding	Action
E9.1	Servo-on signal on at main circuit off	(1)	Main circuit power is off.	Check the main circuit power input.	Not input.	Turn on the main circuit power.
					Input.	Check (2).
		(2)	Connector for the main circuit power is disconnected.	Check the connector of the main circuit power.	Disconnected.	Connect properly.
					No problem found.	Check (3).
		(3)	Bus voltage is below 215VDC.	Check the bus voltage value with MR Configurator.	Below 215VDC.	Review the wiring. Review the power supply capacity.
E9.2	Bus voltage drop during low speed operation	(1)	Bus voltage drops when motor is running below 50[r/min].	Check the bus voltage value at the monitor.	Below 200VDC.	Review the power supply capacity. Set acceleration time longer.

Warning No. EB		Name: The other axis fault warning			Stop method: All axes stop (warning detected at both axes).	
Warning description		・In the other axis, alarm demanding all axes stop (11.□, 15.□, 17.□, 24.□ and 32.□) is output.				
Display	Name	Cause		Checkpoint	Finding	Action
EB.1	The other axis fault warning	(1)	Alarm No. 11.□ is output in the other axis.	Check that Alarm No. 11.□ is output in the other axis.	Alarm is output.	Remove the cause of Alarm No. 11.□ in other the axis.
		(2)	Alarm No. 15.□ is output in the other axis.	Check that Alarm No. 15.□ is output in the other axis.	Alarm is output.	Remove the cause of Alarm No. 15.□ in other the axis.
		(3)	Alarm No. 17.□ is output in the other axis.	Check that Alarm No. 17.□ is output in the other axis.	Alarm is output.	Remove the cause of Alarm No. 17.□ in other the axis.
		(4)	Alarm No. 24.□ is output in the other axis.	Check that Alarm No. 24.□ is output in the other axis.	Alarm is output.	Remove the cause of Alarm No. 24.□ in other the axis.
		(5)	Alarm No. 32.□ is output in the other axis.	Check that Alarm No. 32.□ is output in the other axis.	Alarm is output.	Remove the cause of Alarm No. 32.□ in other the axis.

Warning No. EC		Name: Overload warning 2			Stop method: Axes can operate (detected at the corresponding axis).	
Warning description		・The operation, in which current exceeding the rating flows intensively in any of U, V and W phases of the servo motor, is repeated.				
Display	Name	Cause		Checkpoint	Finding	Action
EC.1	Overload warning 2	(1)	During a stop, current flows intensively in any of U, V and W phases of the servo motor repeatedly.	Change the stop position and check the reproducibility of the error.	Not reproduced.	Reduce the positioning frequency at the specific positioning address.
					Reproduced.	Check (2).
		(2)	Load is too large or the capacity is not enough.	Measure the effective load ratio during a stop.	Effective load ratio is large.	Reduce the load. Use servo amplifier and servo motor with larger capacities.

Warning No. ED		Name: Output watt excess warning			Stop method: Axes can operate (detected at the corresponding axis).	
Warning description		・The status, in which the output wattage (speed x torque) of the servo motor exceed the rated output, continues steadily.				
Display	Name	Cause		Checkpoint	Finding	Action
ED.1	Output watt excess	(1)	Output wattage of the servo motor exceeds 150% of the rated output.	Measure motor speed and torque with MR Configurator.	Output wattage exceeds 150% of the rated output.	Reduce the servo motor speed. Reduce the load.

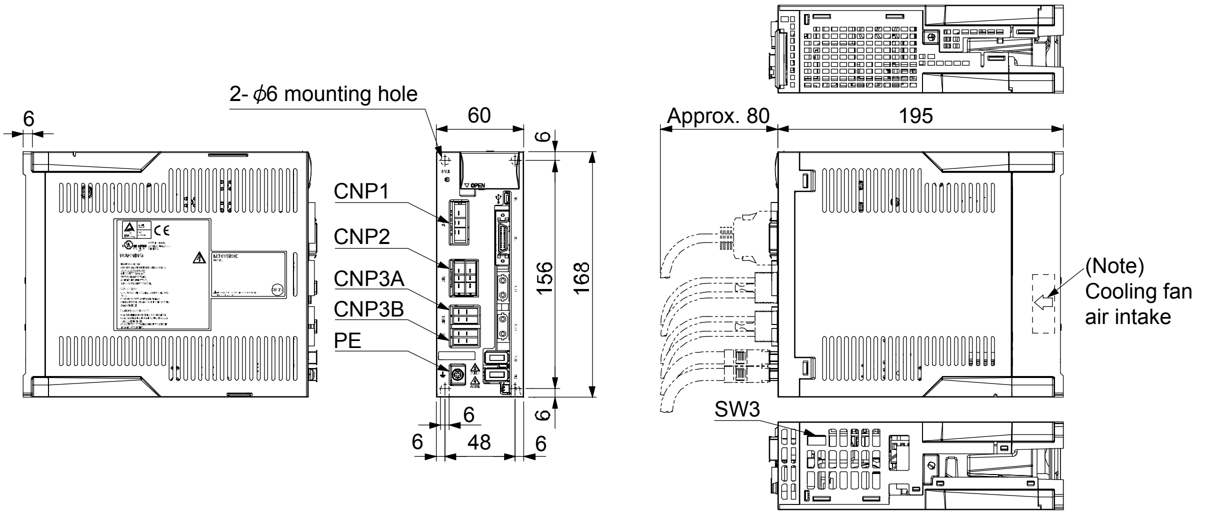
MEMO

9. OUTLINE DRAWINGS

9.1 Servo amplifier

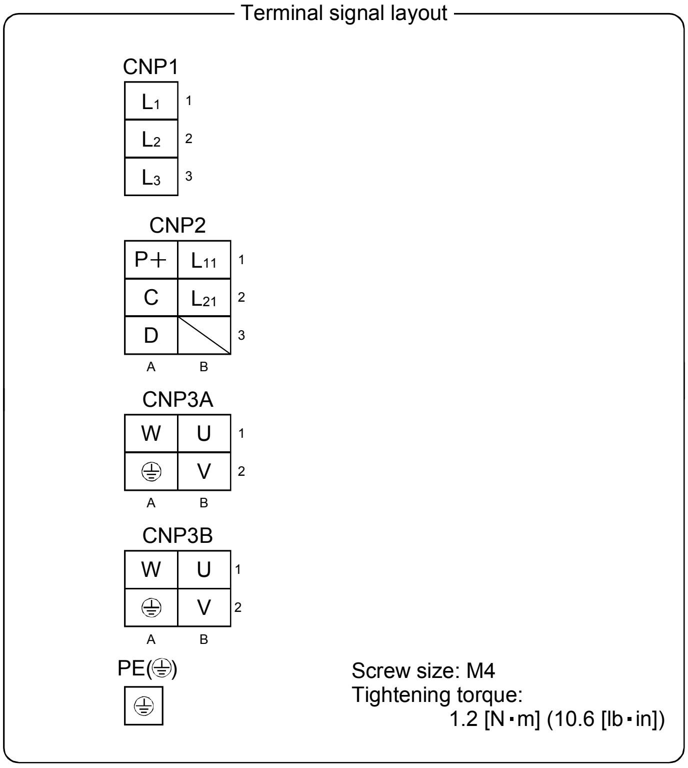
(1) MR-J3W-22B・MR-J3W-44B

[Unit: mm]

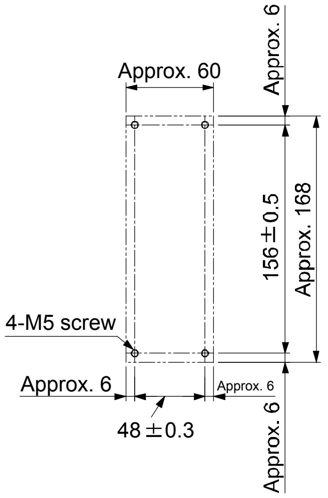


Note. Cooling fan is equipped only with MR-J3W-44B. It is not necessary to drill air holes on the control box surface for the cooling fan.

Mass: 1.4 [kg] (3.09 [lb])



Screw size: M4
Tightening torque:
1.2 [N・m] (10.6 [lb・in])

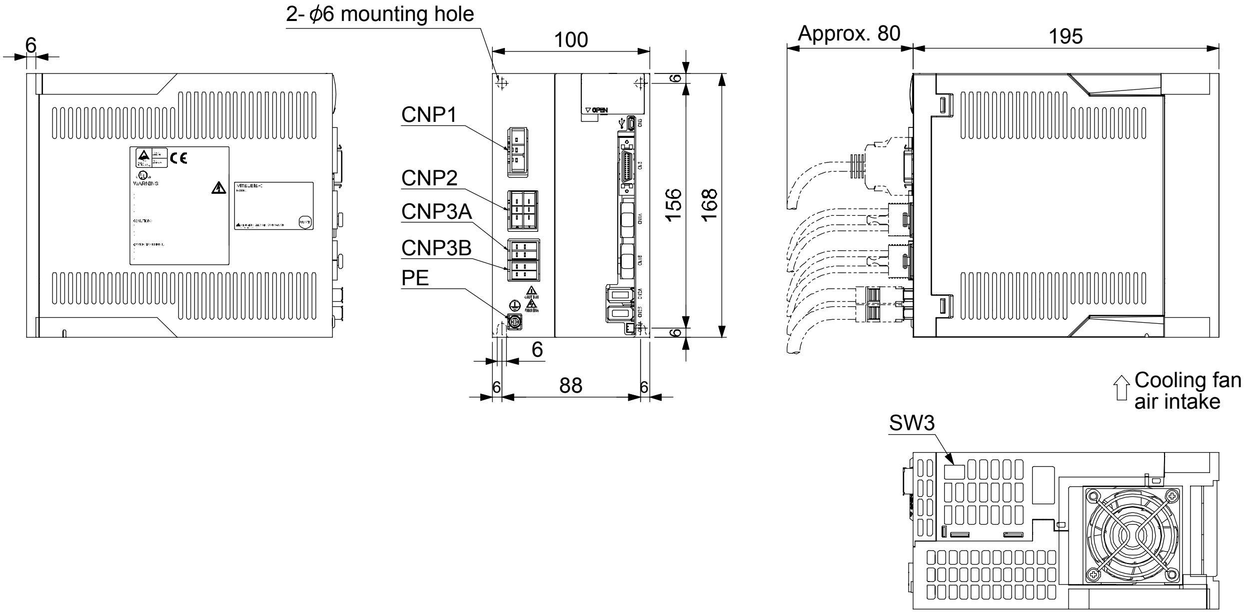


Mounting hole process drawing

Mounting screw
Screw size: M5
Tightening torque: 3.24 [N・m] (28.7 [lb・in])

(2) MR-J3W-77B

[Unit: mm]



Mass: 2.3 [kg] (5.07 [lb])

Terminal signal layout

CNP1

L_1	1
L_2	2
L_3	3

CNP2

A	B	
P+	L_{11}	1
C	L_{21}	2
D		3

CNP3A

A	B	
W	U	1
⏚	V	2

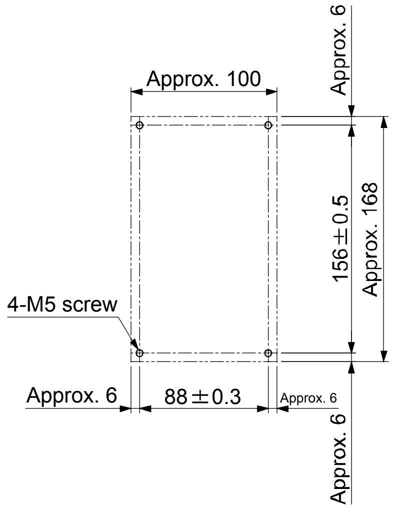
CNP3B

A	B	
W	U	1
⏚	V	2

PE(⏚)

⏚

Screw size: M4
Tightening torque:
1.2 [N•m] (10.6 [lb•in])



Mounting hole process drawing

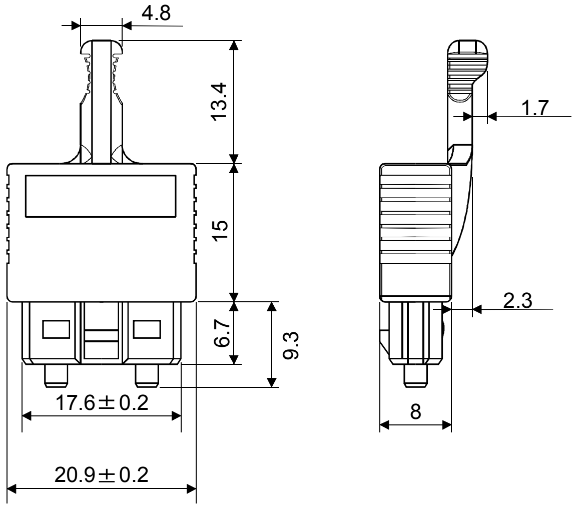
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N・m] (28.7 [lb・in])

9.2 Connector

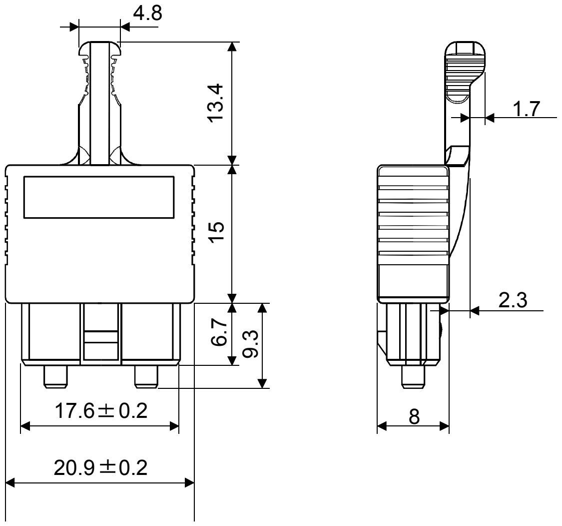
(1) CN1A・CN1B connector

[Unit: mm]

F0-PF2D103



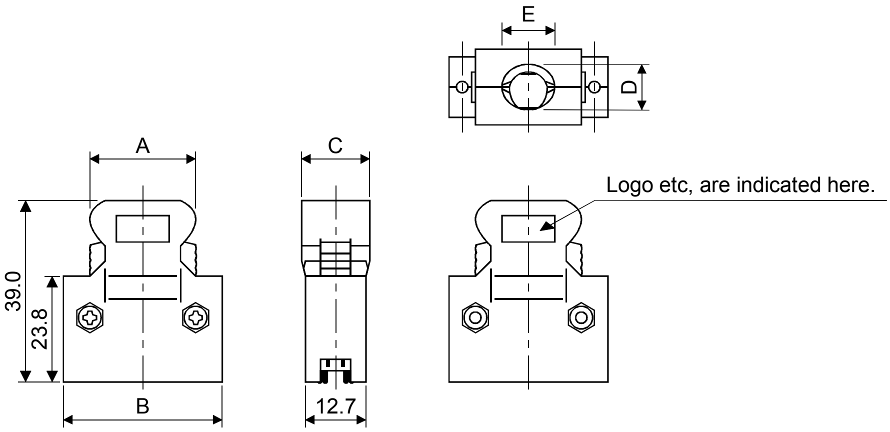
F0-PF2D103-S



(2) Miniature delta ribbon (MDR) system (3M)

(a) One-touch lock type

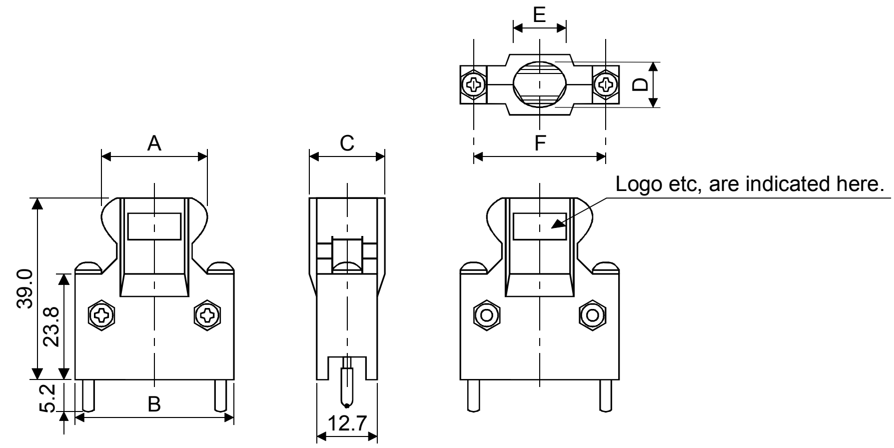
[Unit: mm]



Connector	Shell kit	Each type of dimension				
		A	B	C	D	E
10126-3000PE	10326-52F0-008	25.8	37.2	14.0	10.0	12.0

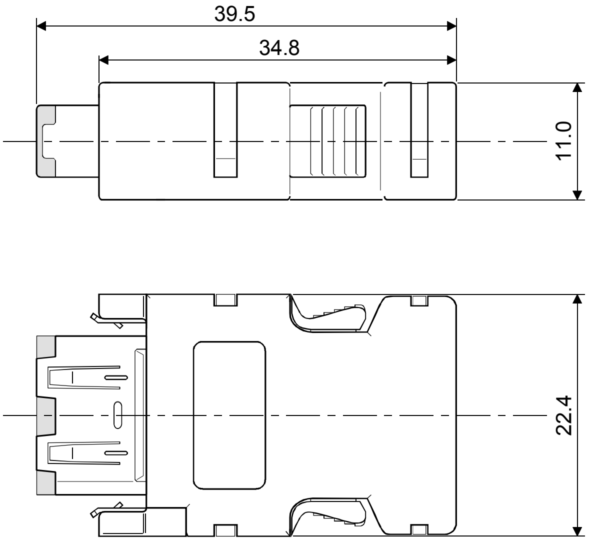
(b) Jack screw M2.6 type
This is not available as option.

[Unit: mm]



Connector	Shell kit	Each type of dimension					
		A	B	C	D	E	F
10126-3000PE	10326-52A0-008	25.8	37.2	14.0	10.0	12.0	31.3

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



10. CHARACTERISTICS

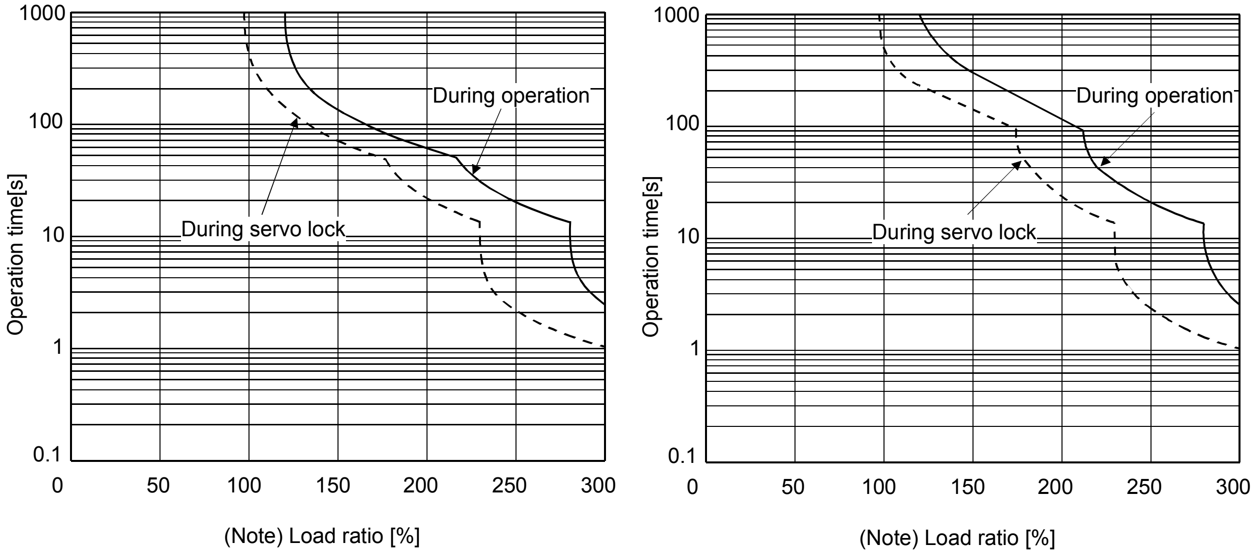
10.1 Overload protection characteristics

An electronic thermal relay is built in the servo amplifier to protect the servo motor and servo amplifier from overloads. Overload 1 alarm (50.□) occurs if overload operation performed is above the electronic thermal relay protection curve shown in any of Figs 10.1. Overload 2 alarm (51.□) 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 closely mounting MR-J3W-44B, operate the servo amplifier at 90% or smaller effective load ratio.

Servo amplifier MR-J3W series has solid-state servo motor overload protection. (The motor full load current is 115% rated current.)



HF-MP053 ・ 13
HF-KP053 ・ 13

HF-MP23・43・73
HF-KP23・43・73
HF-S51・52
HC-UP72
HC-LP52

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. 10.1 Electronic thermal relay protection characteristics

10.2 Power supply equipment capacity and generated loss

(1) Amount of heat generated by the servo amplifier

Table 10.1 indicates servo amplifiers' power supply capacities and losses generated under rated load. For thermal design of an enclosure, use the values in Table 10.1 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.

Values shown in the table are the values when same servo motors are used for the A-axis and the B-axis. When using different servo motors for the A-axis and the B-axis, calculate the mean of the two servo motor values, and use the mean value as a reference.

Table 10.1 Power supply capacity and generated heat per servo amplifier at rated output

Servo motor × 2	(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	
HF-KP053	0.6	35	15	0.7
HF-KP13	0.6	35	15	0.7
HF-KP23	1	35	15	0.7
HF-KP43	1.8	55	15	1.1
HF-KP73	2.6	85	15	1.7
HF-MP053	0.6	35	15	0.7
HF-MP13	0.6	35	15	0.7
HF-MP23	1	35	15	0.7
HF-MP43	1.8	55	15	1.1
HF-MP73	2.6	85	15	1.7
HF-SP51	2.0	55	15	1.1
HF-SP52	2.0	55	15	1.1
HC-LP52	2.0	55	15	1.1
HC-UP72	2.6	85	15	1.7

Note 1. Note that the power supply capacity will vary according to the power supply impedance. This value is applicable when 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 11.2.

(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℃ at the ambient temperature of 40℃. (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 10.1.

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

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 10.1, assume that P is the sum of all losses generated in the enclosure. Refer to Table 10.1 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 10.1 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.

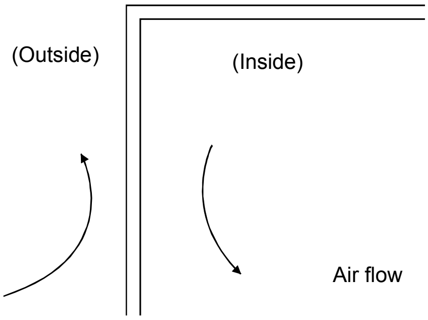


Fig. 10.2 Temperature distribution in enclosure

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.

10.3 Dynamic brake characteristics

POINT

- Dynamic brake operates at occurrence of alarm, servo forced stop warning (E6.1), and controller forced stop warning (E7.1), and when power is turned off. Do not use dynamic brake to stop in a normal operation as it is the function to stop in emergency.
- Maximum usage time of dynamic brake for a machine operating under recommended load inertia moment is ratio 1000 time while decelerating from rated speed to a stop with frequency of once in 10 minutes.
- Be sure to make forced stop (EM1) valid after servo motor stops when using forced stop (EM1) frequently in other than emergency.

10.3.1 Dynamic brake operation

(1) Calculation of coasting distance

Fig. 10.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use Equation 10.2 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the servo motor and machine operation speeds. (Refer to (2) of this section.)

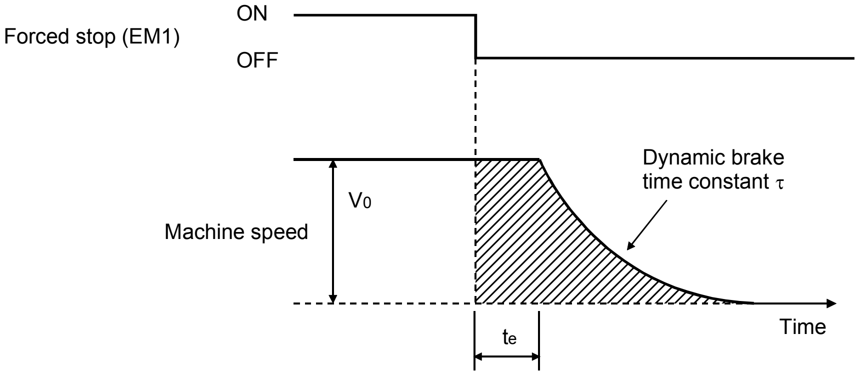


Fig. 10.3 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left[1 + \frac{J_L}{J_M} \right] \right\} \cdots\cdots\cdots (10.2)$$

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]

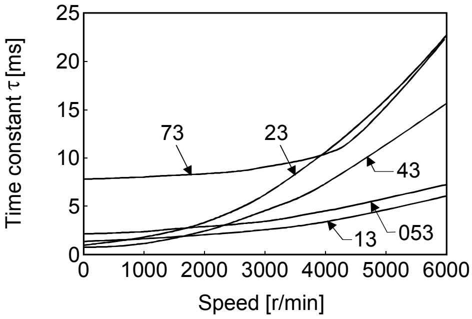
τ : Dynamic brake time constant .... [s]

t_e : Delay time of control section .... [s]

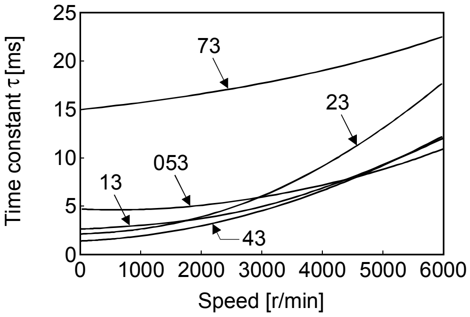
There is internal relay delay time of about 10ms.

(2) Dynamic brake time constant

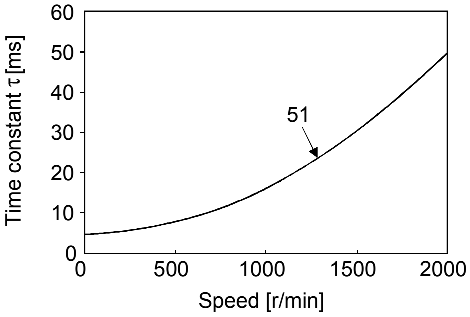
The following shows necessary dynamic brake time constant τ for the equations (10.2).



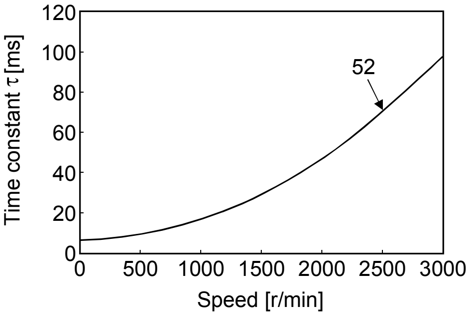
HF-MP series



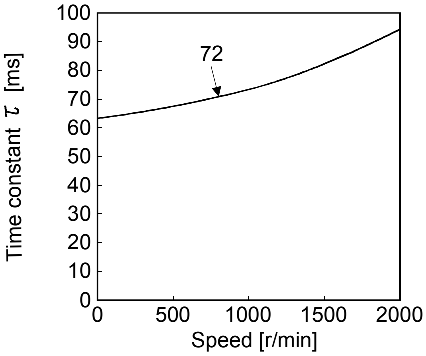
HF-KP series



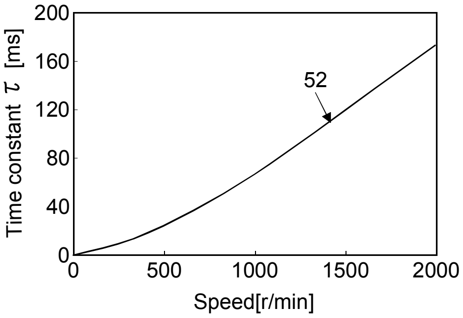
HF-SP1000r/min series



HF-SP2000r/min series



HC-UP series



HC-LP series

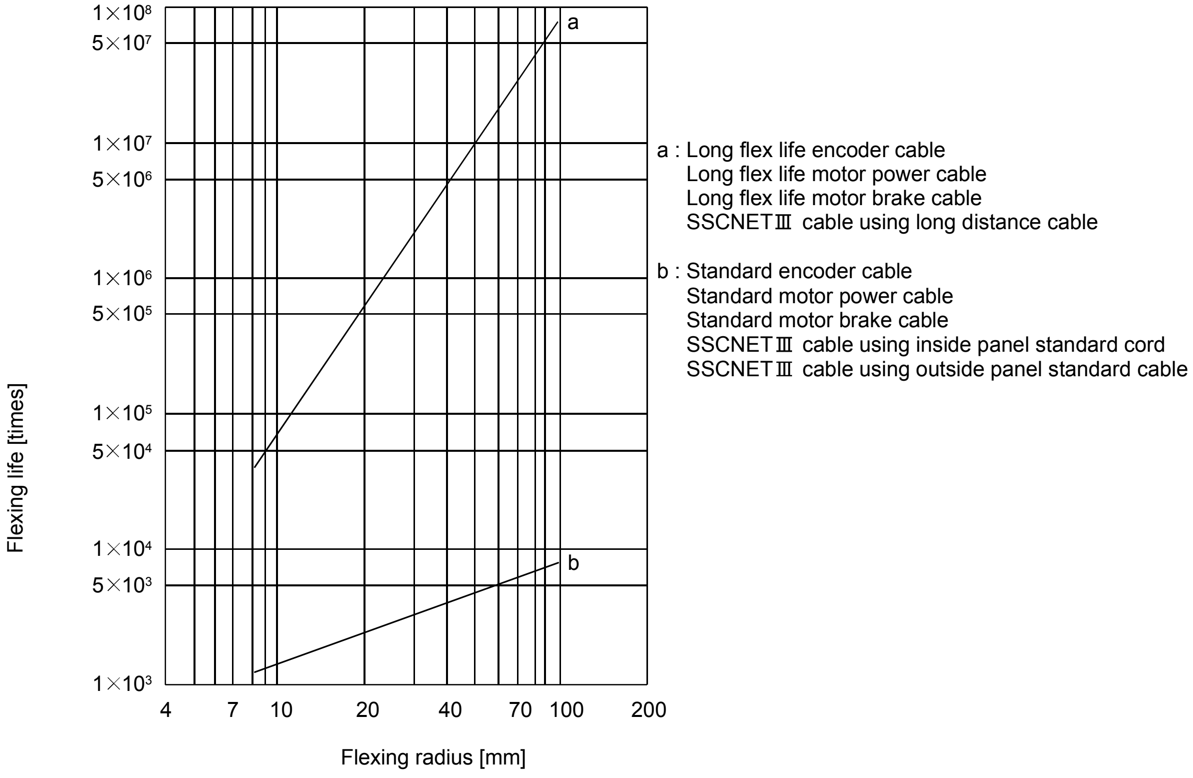
10.3.2 The dynamic brake at the load inertia moment

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 dynamic brake may burn. If there is a possibility that the load inertia moment may exceed the value, contact your local sales office.
The values of the load inertia moment ratio in the table are the values at the maximum rotation speed of the servo motor.

Servo motor series	Load inertia moment ratio [times]
HF-KP	30
HF-MP	
HF-SP	
HC-UP	
HC-LP	

10.4 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.



10.5 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 (253VAC) 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-J3W-22B	120A (Attenuated to approx. 2A in 10ms)	20 to 30A (Attenuated to approx. 0A in 1 to 2ms)
MR-J3W-44B		
MR-J3W-77B	120A (Attenuated to approx. 12A in 20ms)	

Since large inrush currents flow in the power supplies, always use no-fuse breakers and magnetic contactors. (Refer to section 11.6.)
When circuit protectors are used, it is recommended to use the inertia delay type that will not be tripped by an inrush current.

MEMO

11. OPTIONS AND AUXILIARY EQUIPMENT

WARNING	· Before wiring or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, 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.

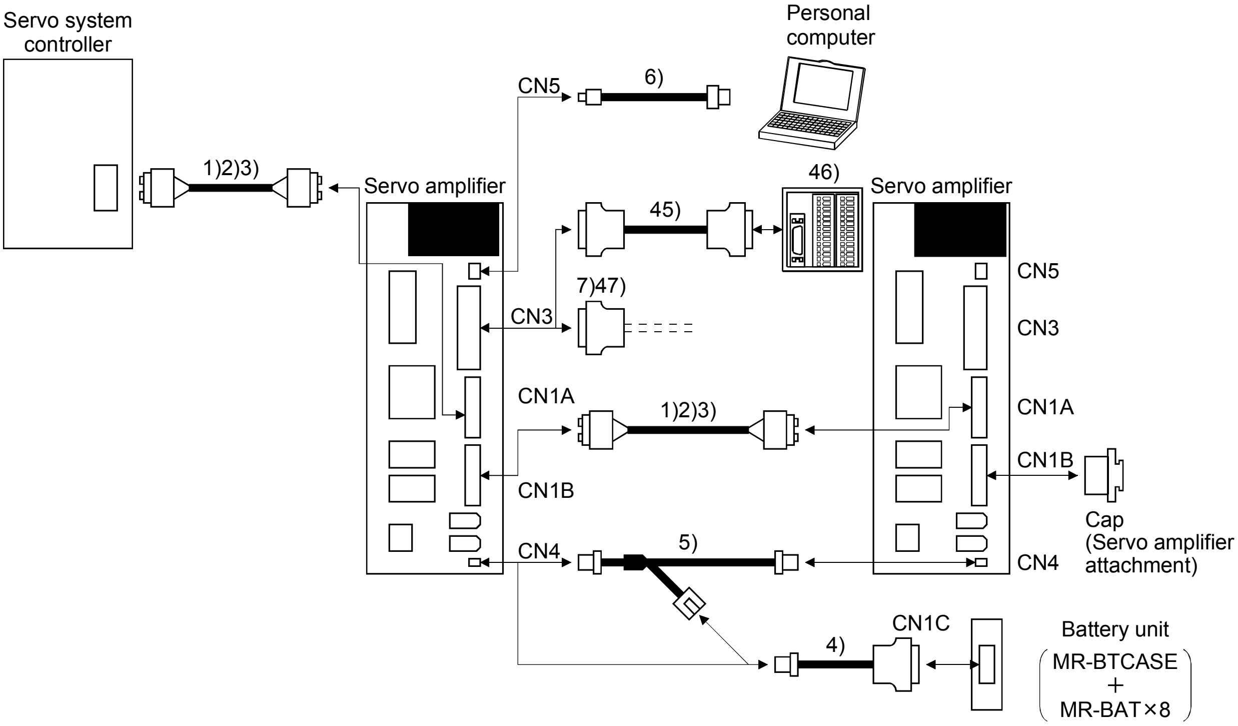
11.1 Cable/connector sets

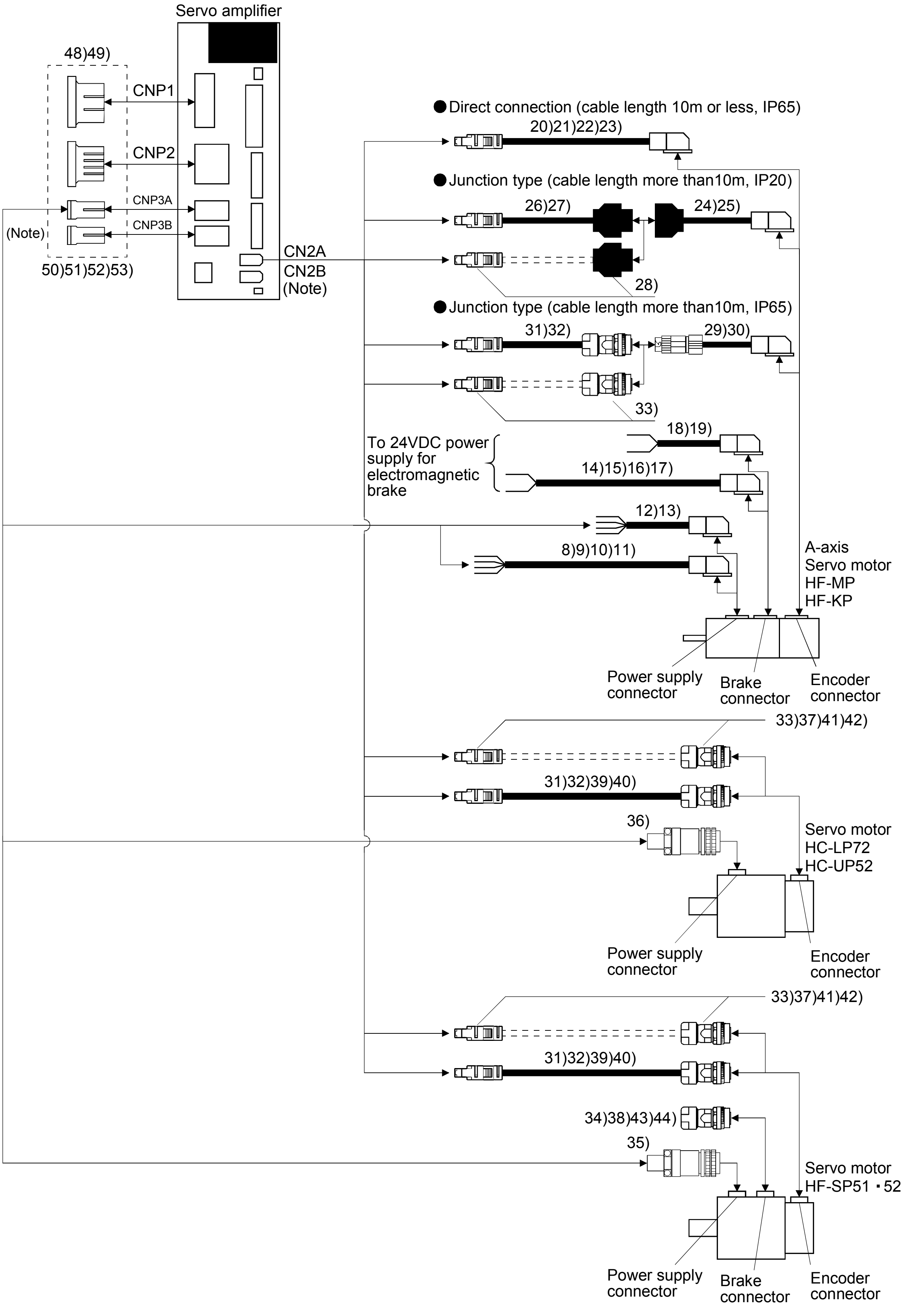
POINT

- The IP rating indicated is the cable's or connector's protection against ingress of dust and water when the cable or connector is connected to a servo amplifier or servo motor. If the IP rating of the cable, connector, servo amplifier and servo motor vary, the overall IP rating depends on the lowest IP rating of all components.

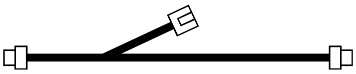
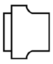
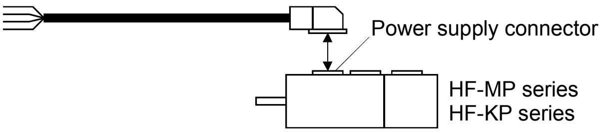
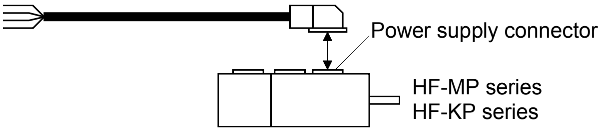
As the cables and connectors used with this servo, purchase the options indicated in this section.

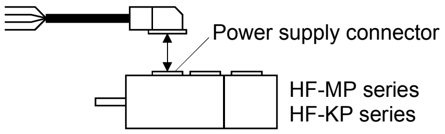
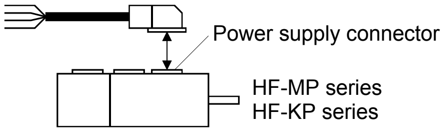
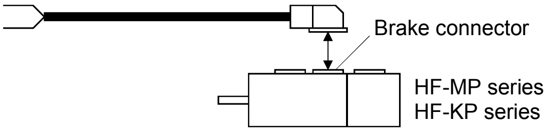
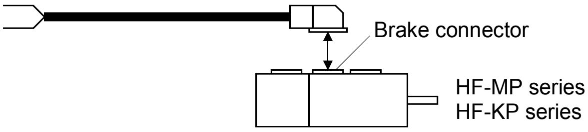
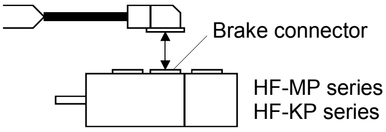
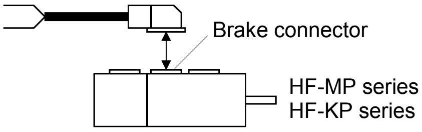
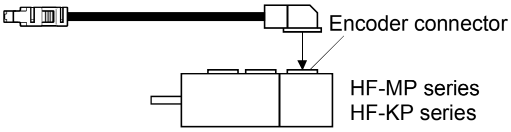
11.1.1 Combinations of cable/connector sets

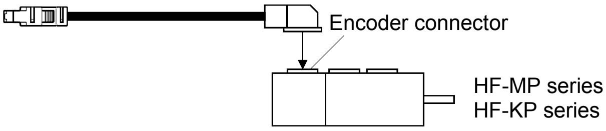
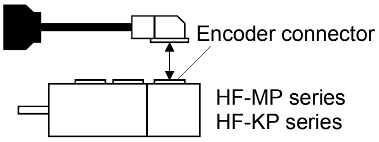
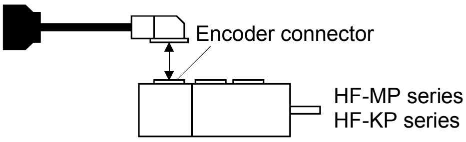
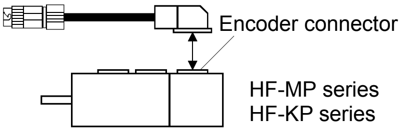
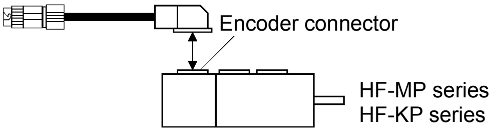


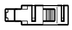
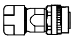
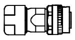
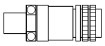
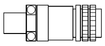
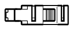
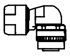
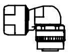
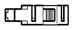
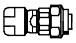
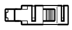


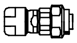
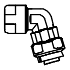
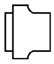
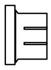
Note. B-axis options are the same as the A-axis options.

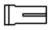
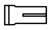
(Note 1) No.	Product	Model	Description	Application
1)	SSCNETⅢ cable	MR-J3BUS☐M Cable length: 0.15 to 3m (Refer to section 11.1.5.)	Connector: PF-2D103 (Japan Aviation Electronics Industry, Ltd.) Connector: PF-2D103 (Japan Aviation Electronics Industry, Ltd.) 	Inside panel standard cord
2)	SSCNETⅢ cable	MR-J3BUS☐M-A Cable length: 5 to 20m (Refer to section 11.1.5.)		Outside panel standard cable
3)	SSCNETⅢ cable	MR-J3BUS☐M-B Cable length: 30 to 50m (Refer to section 11.1.5.)	Connector: CF-2D103-S (Japan Aviation Electronics Industry, Ltd.) Connector: CF-2D103-S (Japan Aviation Electronics Industry, Ltd.) 	Long distance cable
4)	Battery cable	MR-J3BT1CBL☐M Cable length: 0.3, 1m	Socket: DF3-2S-2C Socket contact: DF3-2428SC(F)C (Hirose Denki) Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or similar product) 	For connection with the battery unit
5)	Junction battery cable	MR-J3BT2CBL☐M Cable length: 0.3, 1m	Socket: DF3-2S-2C Socket contact: DF3-2428SC(F)C (Hirose Denki) Junction plug: DF3-2EP-2C Plug contact: DF3-EP2428PC(F)A (Hirose Denki)  Socket: DF3-2S-2C Socket contact: DF3-2428SC(F)C (Hirose Denki)	As a junction for the battery
6)	USB cable	MR-J3USBCBL3M Cable length: 3m	For CN5 connector minB connector (5 pins) For personal computer connector A connector 	For connection with PC-AT compatible personal computer
7)	Connector set	MR-J2CMP2	 Connector: 10126-3000PE Shell kit: 10326-52F0-008 (3M or similar product)	Quantity: 1
8)	Motor power supply cable	MR-PWS1CBL ☐ M-A1-L Cable length: 2・5・10m	 Refer to section 11.1.3 for details.	IP65 Load side lead
9)	Motor power supply cable	MR-PWS1CBL ☐ M-A1-H Cable length: 2・5・10m		IP65 Load side lead Long flex life
10)	Motor power supply cable	MR-PWS1CBL ☐ M-A2-L Cable length: 2・5・10m	 Refer to section 11.1.3 for details.	IP65 Opposite-to-load side lead
11)	Motor power supply cable	MR-PWS1CBL ☐ M-A2-H Cable length: 2・5・10m		IP65 Opposite-to-load side lead Long flex life

(Note 1) No.	Product	Model	Description	Application
12)	Motor power supply cable	MR-PWS2CBL03M-A1-L Cable length: 0.3m	 Refer to section 11.1.3 for details.	IP55 Load side lead
13)	Motor power supply cable	MR-PWS2CBL03M-A2-L Cable length: 0.3m	 Refer to section 11.1.3 for details.	IP55 Opposite-to-load side lead
14)	Motor brake cable	MR-BKS1CBL □ M-A1-L Cable length: 2 ・ 5 ・ 10m	 Refer to section 11.1.4 for details.	IP65 Load side lead
15)	Motor brake cable	MR-BKS1CBL □ M-A1-H Cable length: 2 ・ 5 ・ 10m		IP65 Load side lead Long flex life
16)	Motor brake cable	MR-BKS1CBL □ M-A2-L Cable length: 2 ・ 5 ・ 10m	 Refer to section 11.1.4 for details.	IP65 Opposite-to-load side lead
17)	Motor brake cable	MR-BKS1CBL □ M-A2-H Cable length: 2 ・ 5 ・ 10m		IP65 Opposite-to-load side lead Long flex life
18)	Motor brake cable	MR-BKS2CBL03M-A1-L Cable length: 0.3m	 Refer to section 11.1.4 for details.	IP55 Load side lead
19)	Motor brake cable	MR-BKS2CBL03M-A2-L Cable length: 0.3m	 Refer to section 11.1.4 for details.	IP55 Opposite-to-load side lead
20)	Encoder cable	MR-J3ENCBL □ M-A1-L Cable length: 2 ・ 5 ・ 10m	 Refer to section 11.1.2 (1) for details.	IP65 Load side lead
21)	Encoder cable	MR-J3ENCBL □ M-A1-H Cable length: 2 ・ 5 ・ 10m		IP65 Opposite-to-load side lead Long flex life

(Note 1) No.	Product	Model	Description	Application
22)	Encoder cable	MR-J3ENCBL □ M-A2-L Cable length: 2・5・10m	 Refer to section 11.1.2 (1) for details.	IP65 Opposite-to-load side lead
23)	Encoder cable	MR-J3ENCBL □ M-A2-H Cable length: 2・5・10m		IP65 Opposite-to-load side lead Long flex life
24)	Encoder cable	MR-J3JCBL03M-A1-L Cable length: 0.3m	 Refer to section 11.1.2 (3) for details.	IP20 Load side lead
25)	Encoder cable	MR-J3JCBL03M-A2-L Cable length: 0.3m	 Refer to section 11.1.2 (3) for details.	IP20 Opposite-to-load side lead
26)	Encoder cable	MR-EKCBL □ M-L Cable length: 20・30m	 For HF-MP・HF-KP series Refer to section 11.1.2 (2) for details.	IP20
27)	Encoder cable	MR-EKCBL □ M-H Cable length: 20・30・40・50m		IP20 Long flex life
28)	Encoder connector set	MR-ECNM	 For HF-MP・HF-KP series Refer to section 11.1.2 (2) for details.	IP20
29)	Encoder cable	MR-J3JSCBL03M-A1-L Cable length: 0.3m	 Refer to section 11.1.2 (4) for details.	IP65 Load side lead
30)	Encoder cable	MR-J3JSCBL03M-A2-L Cable length: 0.3m	 Refer to section 11.1.2 (4) for details.	IP65 Opposite-to-load side lead
31)	Encoder cable	MR-J3ENSCBL □ M-L Cable length: 2・5・10・20・30m	 Refer to section 11.1.2 (5) for details.	IP67 Standard flex life
32)	Encoder cable	MR-J3ENSCBL □ M-H Cable length: 2・5・10・20・30・40・50m		IP67 Long flex life

(Note 1) No.	Product	Model	Description	Application
33)	Encoder connector set	MR-J3SCNS	  Refer to section 11.1.2 (5) for details.	IP67
34)	Brake connector set	MR-BKCNS1	Straight plug: CM10-SP2S-L (D6) Socket contact: CM10-#22SC (S2) (D8)-100 (DDK)  For HF-SP51・52	IP67
35)	Power supply connector set	MR-PWCNS4	Plug: CE05-6A18-10SD-D-BSS Cable clamp: CE3057-10A-1-D (DDK)  For HF-SP51・52 Example of applicable cable Applicable wire size: 2mm^2 (AWG14) to 3.5mm^2 (AWG12) Cable finish ϕD: ϕ10.5 to 14.1mm	IP67
36)	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-UP72 For HC-LP52	Be sure to use this when corresponding to EN standard IP65
37)	Encoder connector set	MR-J3SCNSA	  For HF-SP・HC-UP・HC-LP series Refer to section 11.1.2 (5) for details.	IP67
38)	Brake connector set	MR-BKCNS1A	Angle plug: CM10-AP2S-L (D6) Socket contact: CM10-#22SC (S2) (D8)-100 (DDK)  For HF-SP series	IP67
39)	Encoder cable	MR-J3ENSCBL ☐ M-L-S06 Cable length: 2・5・10・20・30m	 For HF-SP・HC-UP・HC-LP series Refer to section 11.1.2 (5) for details.	IP67 (Note 2)
40)	Encoder cable	MR-J3ENSCBL ☐ M-H-S06 Cable length: 2・5・10・20・30・40・50m		IP67 Long flex life (Note 2)
41)	Encoder connector set	MR-J3SCNS-S06	  For HF-SP・HC-UP・HC-LP series Refer to section 11.1.2 (5) for details.	IP67 (Note 2)
42)	Encoder connector set	MR-J3SCNSA-S06	  For HF-SP・HC-UP・HC-LP series Refer to section 11.1.2 (5) for details.	IP67 (Note 2)

(Note 1) No.	Product	Model	Description	Application
43)	Brake connector set	MR-BKCNS1-S06	Straight plug: CM10-SP2S-VP-L Socket contact: CM10-#22SC (S2) (D8)-100 (DDK)  For HF-SP series	IP67 (Note 2)
44)	Brake connector set	MR-BKCNS1A-S06	Angle plug: CM10-AP2S-VP-L Socket contact: CM10-#22SC (S2) (D8)-100 (DDK)  For HF-SP series	IP67 (Note 2)
45)	Junction terminal block cable	MR-TBNATBL □ M Cable length: 0.5・1m (Refer to section 11.12.)	Connector for the junction terminal block Connector: 10126-6000EL Shell kit: 10326-3210-000 (3M or similar product) Connector for the servo amplifier Connector: 10126-6000EL Shell kit: 10326-3210-000 (3M or similar product) 	For junction terminal block connection
46)	Junction terminal block	MR-TB26A	Refer to section 11.12	
47)	Connector set	MR-ECN1	 Connector: 10126-3000PE Shell kit: 10326-52F0-008 (3M or similar product)	Quantity: 20
48)	Connector set	MR-J3WCNP12-DM	 For CNP1 Receptacle housing: J43FSS-03V-KX Receptacle contact: BJ4F-71GF-M3.0 (Japan Solderless Terminals) Compatible cable example Cable size: 1.25mm^2 (AWG16) to 2.0mm^2 (AWG14) Outer diameter of sheath: ϕ2.0 to 3.8mm Crimping tool (YRF-1130) is required.  For CNP2 Receptacle housing: F32FMS-06V-KXY Receptacle contact: BF3F-71GF-P2.0 (Japan Solderless Terminals) Compatible cable example Cable size: 1.25mm^2 (AWG16) to 2.0mm^2 (AWG14) Outer diameter of sheath: ϕ2.4 to 3.4mm Crimping tool (YRF-1070) is required.	Quantity: 1 each
49)	Connector set	MR-J3WCNP12-DM-10P		Quantity: 10 each

(Note 1) No.	Product	Model	Description	Application
50)	Connector set	MR-J3WCNP3-DL	Use this connector to directly connect to the servo amplifier using MR-PWS1CBL□M-□.  For CNP3A/CNP3B Receptacle housing: F35FDC-04V-K Receptacle contact: LF3F-41GF-P2.0 (Japan Solderless Terminals) Compatible cable example Cable size: 0.75mm^2 (AWG19) to 1.25mm^2 (AWG16) Outer diameter of sheath: ϕ1.8 to 2.8mm Crimping tool (YRF-880) is required.	Quantity: 1 For thin wire
51)	Connector set	MR-J3WCNP3-DL-20P		Quantity: 20 For thin wire
52)	Connector set	MR-J3WCNP3-D2L	Use this connector when making extension cables for the HF-KP and HF-MP series. Also use this for HF-SP, HC-LP, and HC-UP.  For CNP3A/CNP3B Receptacle housing: F35FDC-04V-K Receptacle contact: BF3F-71GF-P2.0 (Japan Solderless Terminals) Compatible cable example Cable size: 1.25mm^2 (AWG16) to 2.0mm^2 (AWG14) Outer diameter of sheath: ϕ2.4 to 3.4mm Crimping tool (YRF-1070) is required.	Quantity: 1 For thick wire
53)	Connector set	MR-J3WCNP3-D2L-20P		Quantity: 20 For thick wire

Note 1. 1) to 3), 6) and 8) to 44) are the same as servo amplifier options.

2. Use this option when the connector is expected to receive large vibration and shock.

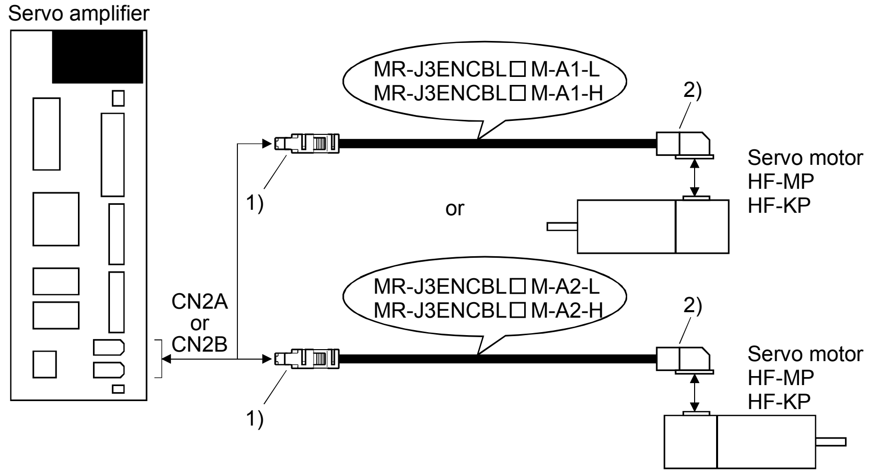
11.1.2 Encoder cable/connector sets

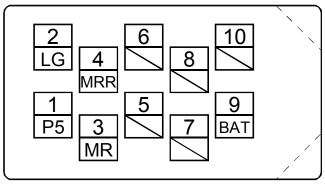
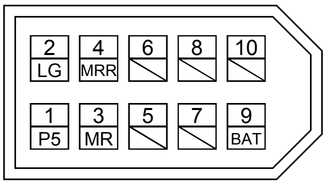
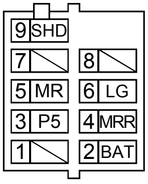
(1) MR-J3ENCBL□M-A1-L/H・MR-J3ENCBL□M-A2-L/H

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							IP rating	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 life	
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 life	

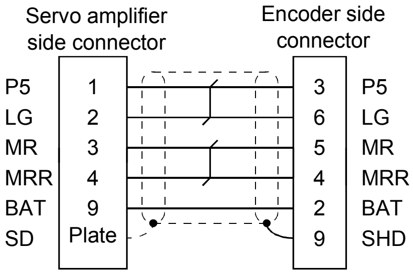
(a) Connection of servo amplifier and servo motor



Cable model	1) For CN2 connector	2) For encoder connector
MR-J3ENCBL□M-A1-L	Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) (Note) Signal layout  View seen from wiring side. or Connector set: 54599-1019 (Molex) (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 ╲.
MR-J3ENCBL□M-A1-H		
MR-J3ENCBL□M-A2-L		
MR-J3ENCBL□M-A2-H		

(b) Cable internal wiring diagram

MR-J3ENCBL2M-L/-H
MR-J3ENCBL5M-L/-H
MR-J3ENCBL10M-L/-H



(2) MR-EKCBL□M-L/H

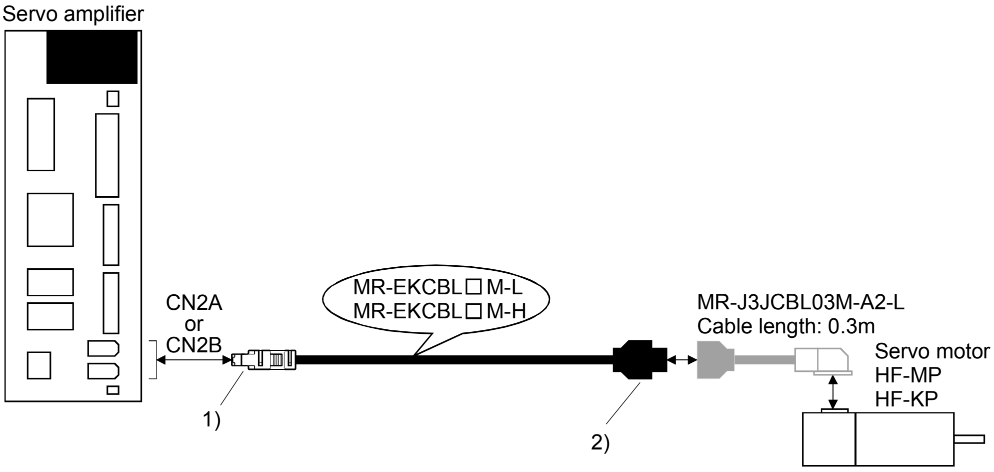
> **POINT**
>
> - The following encoder cables are of four-wire type. When using any of these encoder cables, set parameter No.PC04 to "1□□□" to select the four-wire type.
>   MR-EKCBL30M-L
>   MR-EKCBL30M-H
>   MR-EKCBL40M-H
>   MR-EKCBL50M-H

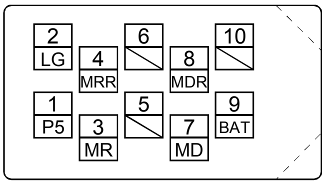
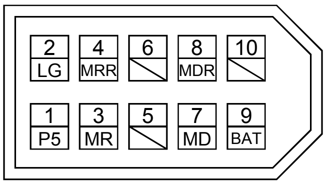
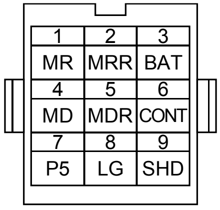
The servo amplifier and servo motor cannot be connected with these cables only. The servo motor side encoder cable (MR-J3JCBL03M-A1-L or MR-J3JCBL03M-A2-L) is required.
The numerals in the Cable Length field of the table are the symbols entered in the □ part of the cable model. The cables of the lengths with the symbols are available.

Cable model	Cable length							IP rating	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 life	

Note. Four-wire type cable.

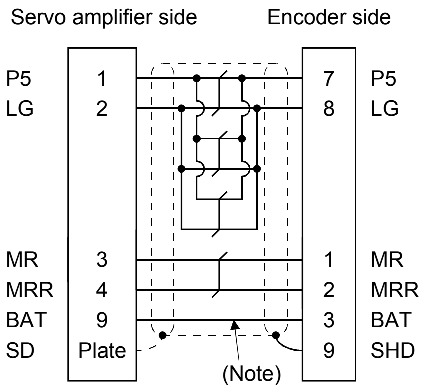
(a) Connection of servo amplifier and servo motor



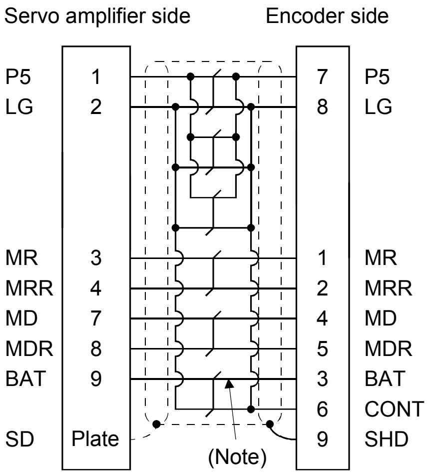
Cable model	1) For CN2 connector	2) For encoder connector
MR-EKCBL□M-L	Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) Connector set: 54599-1019 (Molex) (Note) Signal layout  View seen from wiring side. or (Note) Signal layout  View seen from wiring side. Note. Keep open the pins shown with ⧅. Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.	Housing: 1-172161-9 Crimping pin: 170359-1 (Tyco Electronics or equivalent) Cable clamp: MTI-0002 (Toa Electric Industries) Signal layout  View seen from wiring side. Note. Keep open the pin shown with an ⧅.
MR-EKCBL□M-H		

(b) Internal wiring diagram

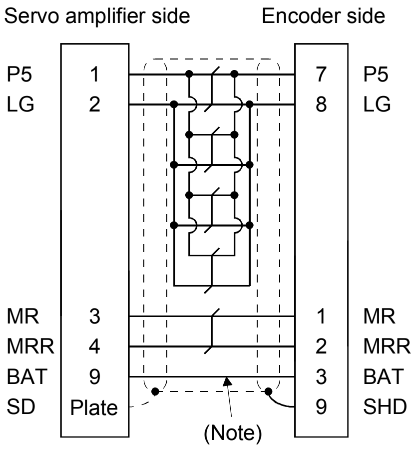
MR-EKCBL20M-L



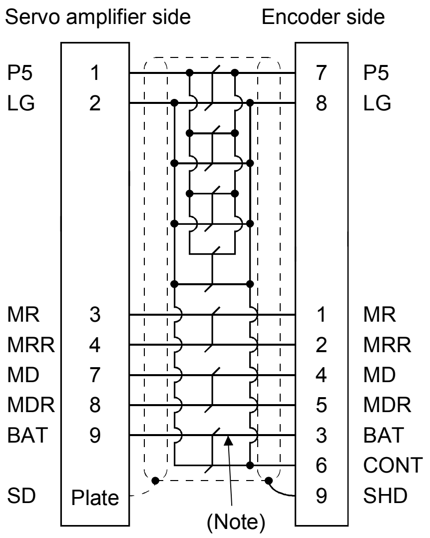
MR-EKCBL30M-L



MR-EKCBL20M-H



MR-EKCBL30M-H
MR-EKCBL40M-H
MR-EKCBL50M-H



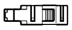
Note. Always make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.

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 life	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 11.5 for the specifications of the used cable.

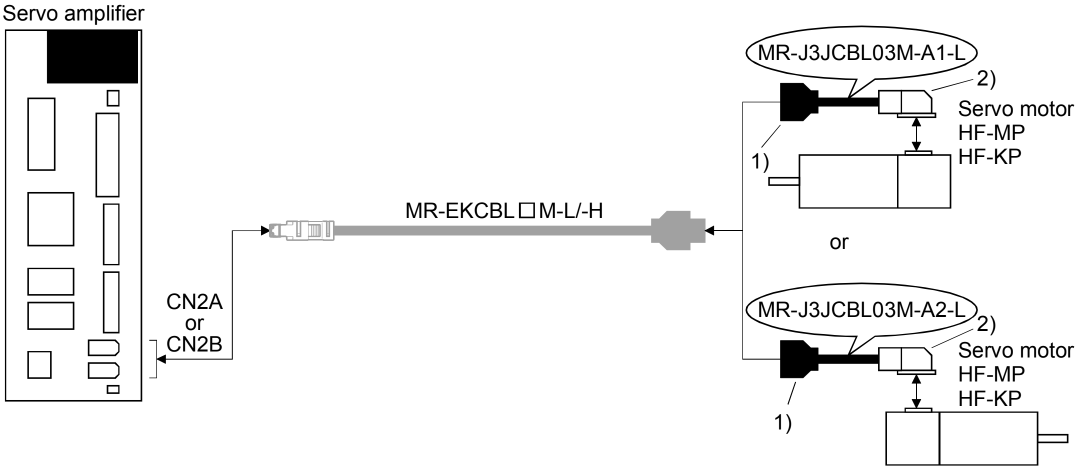
Parts/tool	Description	
Connector set	MR-ECNM  Servo amplifier side connector Receptacle: 36210-0100PL Shell kit: 536310-3200-008 (3M) Or Connector set: 54599-1019(Molex)	 Encoder side connector Housing: 1-172161-9 Connector pin: 170359-1 (Tyco Electronics or equivalent) Cable clamp: MTI-0002 (Toa Electric Industries)

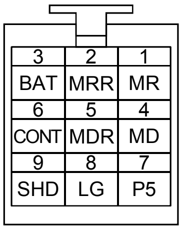
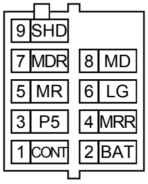
(3) MR-J3JCBL03M-A1-L・MR-J3JCBL03M-A2-L

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.

Cable model	Cable length	IP rating	Flex life	Application
MR-J3JCBL03M-A1-L	0.3m	IP20	Standard	For HF-MP・HF-KP servo motor Load side lead Use in combination with MR-EKCBL □M-L/H.
MR-J3JCBL03M-A2-L				For HF-MP・HF-KP servo motor Opposite-to-load side lead Use in combination with MR-EKCBL □M-L/H.

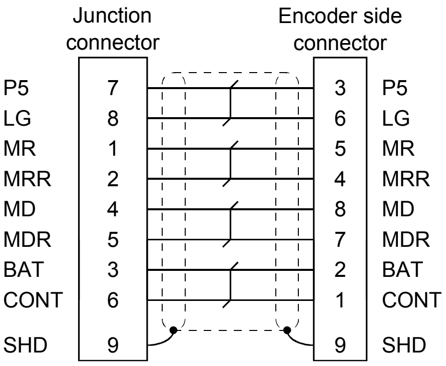
(a) Connection of servo amplifier and servo motor



Cable model	1) Junction connector	2) For encoder connector
MR-J3JCBL03M-A1-L	Housing: 1-172169-9 Contact: 1473226-1 Cable clamp: 316454-1 Crimping tool: 91529-1 (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
MR-J3JCBL03M-A2-L		

(b) Internal wiring diagram

MR-J3JCBL03M-A1-L

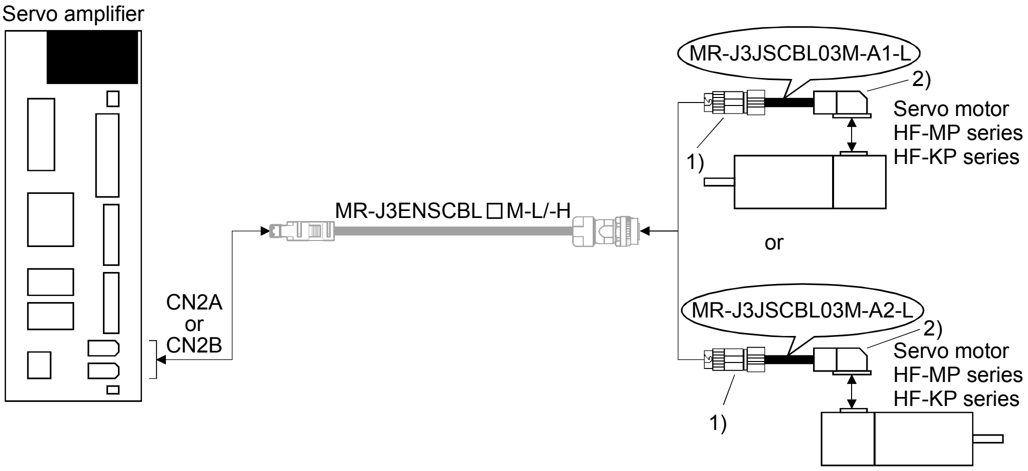


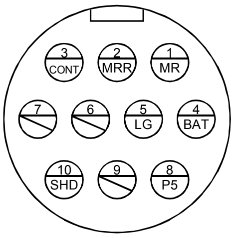
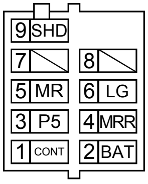
(4) MR-J3JSCBL03M-A1-L · MR-J3JSCBL03M-A2-L

A servo amplifier and a servo motor cannot be connected by these cables alone. The servo motor side encoder cable (MR-J3ENSCBL□M-L/H) is required.

Cable model	Cable length	IP rating	Flex life	Application
MR-J3JSCBL03M-A1-L	0.3m	IP65	Standard	For HF-MP · HF-KP servo motor Load side lead Use in combination with MR-J3ENSCBL□M-L/H.
MR-J3JSCBL03M-A2-L				For HF-MP · HF-KP servo motor Opposite-to-load side lead Use in combination with MR-J3ENSCBL□M-L/H.

(a) Connection of servo amplifier and servo motor



Cable model	1) For CN2 connector	2) For encoder connector
MR-J3JSCBL03M-A1-L	Receptacle: CM10-CR10P-M (DDK) Complied cable AWG20 or less (Note) Signal layout  View seen from wiring side Note. Keep open the pin shown with an ⊘.	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 ⧅.
MR-J3JSCBL03M-A2-L		

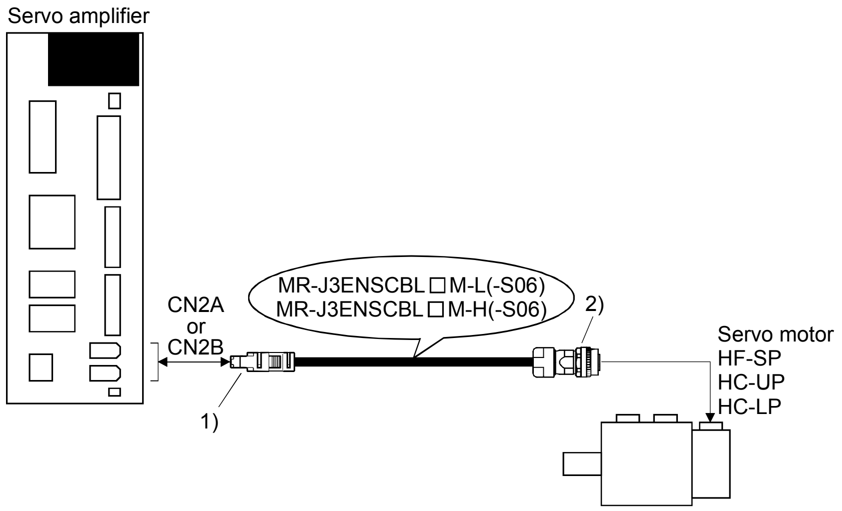
(5) MR-J3ENSCBL☐M-L(-S06) ・ MR-J3ENSCBL☐M-H(-S06)

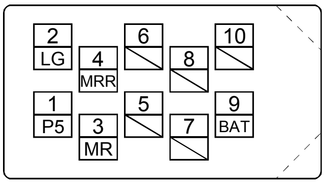
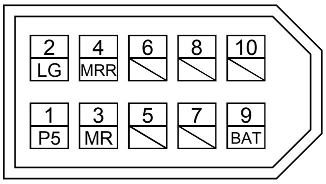
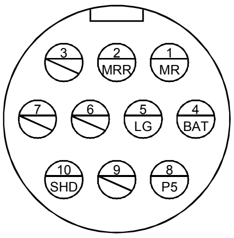
These cables are detector cables for HF-SP ・ HC-UP ・ HC-LP Series servo motors. The number in the cable length column of the table indicates the symbol filling the square ☐ in the cable model. Cable lengths corresponding to the specified symbols are prepared.

Cable model	Cable length							IP rating	Flex life	Application
	2m	5m	10m	20m	30m	40m	50m			
MR-J3ENSCBL ☐ M-L	2	5	10	20	30			IP67	Standard	For HF-SP ・ HC-UP ・ HC-LP servo motor
MR- J3ENSCBL ☐ M-H	2	5	10	20	30	40	50	IP67	Long flex life	
MR-J3ENSCBL ☐ M-L-S06	2	5	10	20	30			IP67	Standard	For HF-SP ・ HC-UP ・ HC-LP servo motor (Note)
MR-J3ENSCBL ☐ M-H-S06	2	5	10	20	30	40	50	IP67	Long flex life	

Note. Use this option when the connector is expected to receive large vibration and shock. The connector at the servo motor side can be removed up to 5 times. Use the dedicated tool 357J-52780T (DDK) or a spanner with jaw size of 21mm.

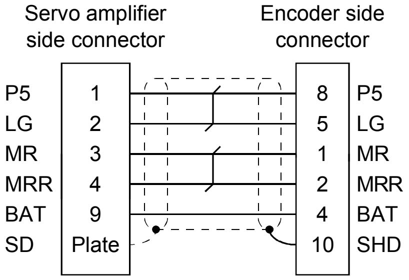
(a) Connection of servo amplifier and servo motor



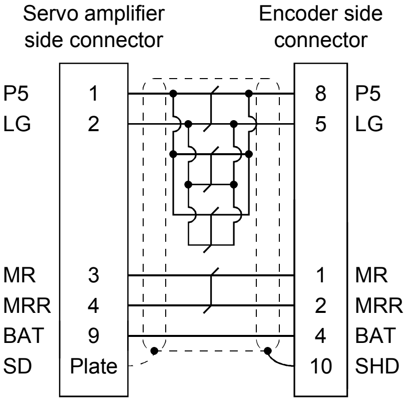
Cable model	1) For CN2 connector	2) For encoder connector
MR-J3ENSCBL□M-L (-S06)	Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) (Note) Signal layout  View seen from wiring side. or Connector set: 54599-1019 (Molex) (Note) Signal layout  View seen from wiring side. Note. Keep open the pins shown with ⧅. Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.	In case of 10m or shorter cables Straight plug: CM10-SP10S-M(D6) or CM10-SP10S-VP-M Socket contact: CM10-#22SC(C1)(D8)-100 Crimping tool: 357J-50446 (DDK) Applicable cable AWG20 to 22 In case of 20m or longer cables Straight plug: CM10-SP10S-M(D6) or CM10-SP10S-VP-M Socket contact: CM10-#22SC(C2)(D8)-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 ⊘.
MR-J3ENSCBL□M-H (-S06)		

(b) Internal wiring diagram

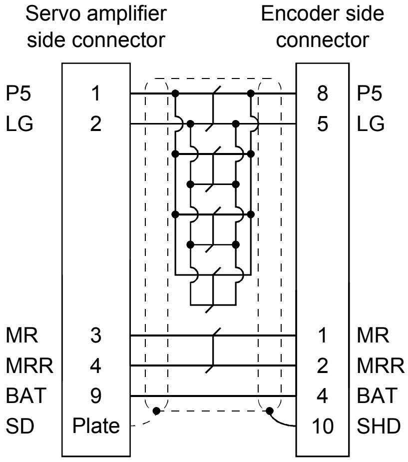
MR-J3ENSCBL2M-L (-S06) /H (-S06)
MR-J3ENSCBL5M-L (-S06) /H (-S06)
MR-J3ENSCBL10M-L (-S06) /H (-S06)



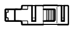
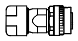
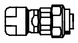
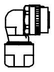
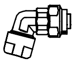
MR-J3ENSCBL20M-L (-S06)
MR-J3ENSCBL30M-L (-S06)



MR-J3ENSCBL20M-H (-S06)
MR-J3ENSCBL30M-H (-S06)
MR-J3ENSCBL40M-H (-S06)
MR-J3ENSCBL50M-H (-S06)



(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 11.5 for the specifications of the used cable.

Parts/Tool (Connector set)	Description	
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 (D6) Socket contact: CM10-#22SC (S1) (D8)-100 Applicable wire size: AWG20 or less (DDK)
MR-J3SCNS-S06 (Option) (Note)		 Encoder side connector Straight plug: CM10-SP10S-VP-M Socket contact: CM10-#22SC (S1) (D8)-100 Applicable wire size: AWG20 or less (DDK)
MR-J3SCNSA (Option)		 Encoder side connector Straight plug: CM10-AP10S-M (D6) Socket contact: CM10-#22SC (S1) (D8)-100 Applicable wire size: AWG20 or less (DDK)
MR-J3SCNSA-S06 (Option) (Note)		 Encoder side connector Straight plug: CM10-AP10S-VP-M Socket contact: CM10-#22SC (S1) (D8)-100 Applicable wire size: AWG20 or less (DDK)

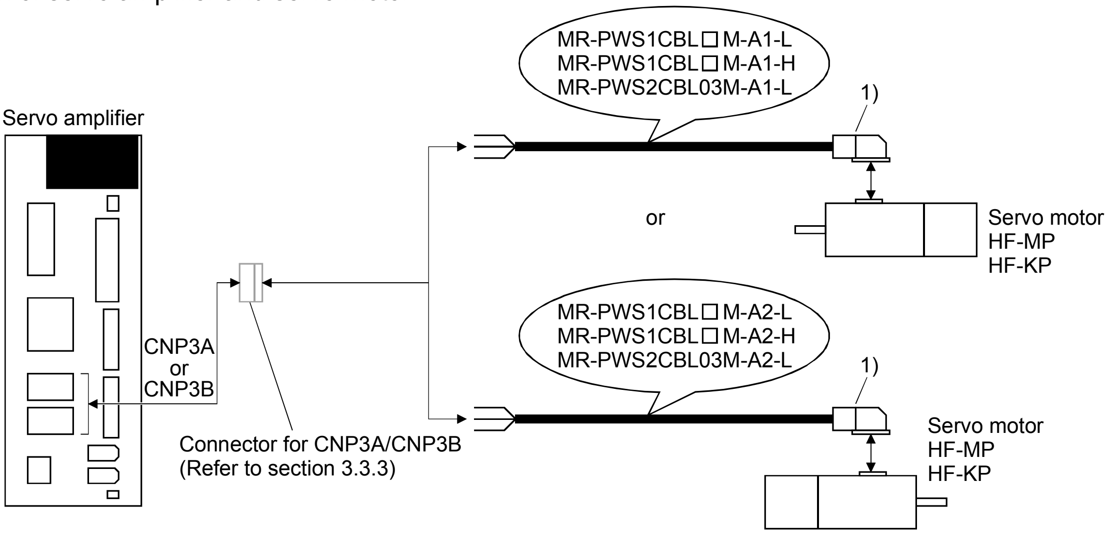
Note. Use this option when the connector is expected to receive large vibration and shock. The connector at the servo motor side can be removed up to 5 times. Use the dedicated tool 357J-52780T (DDK) or a spanner with jaw size of 21mm.

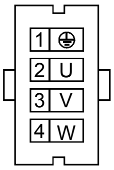
11.1.3 Motor power supply cables

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				IP rating	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 life	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL□M-A2-H		2	5	10	IP65	Long flex life	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

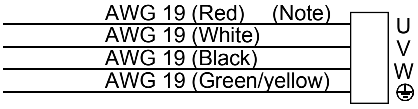
(1) Connection of servo amplifier and servo motor



Cable model	1) For motor power supply connector	
MR-PWS1CBL□M-A1-L	Connector: JN4FT04SJ1-R Hood, socket insulator Bushing, ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT160-3-TMH5B (Japan Aviation Electronics Industry)	Signal layout  View seen from wiring side.
MR-PWS1CBL□M-A2-L		
MR-PWS1CBL□M-A1-H		
MR-PWS1CBL□M-A2-H		
MR-PWS2CBL03M-A1-L	Connector: JN4FT04SJ2-R Hood, socket insulator Bushing, ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT160-3-TMH5B (Japan Aviation Electronics Industry)	
MR-PWS2CBL03M-A2-L		

(2) Internal wiring diagram

MR-PWS1CBL□M-A1-H MR-PWS1CBL□M-A2-H
MR-PWS2CBL03M-A1-L MR-PWS2CBL03M-A2-L



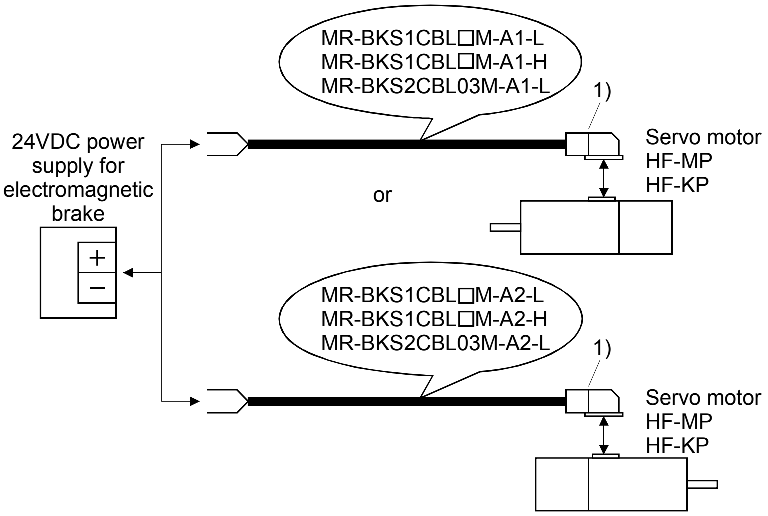
Note. These are not shielded cables.

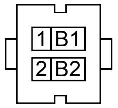
11.1.4 Motor brake cables

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.

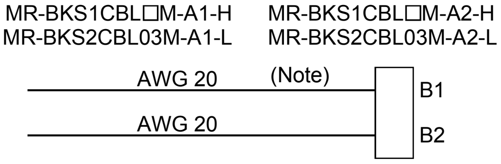
Cable model	Cable length				IP rating	Flex life	Application
	0.3m	2m	5m	10m			
MR-PWS1CBL☐M-A1-L		2	5	10	IP65	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL☐M-A2-L		2	5	10	IP65	Standard	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-PWS1CBL☐M-A1-H		2	5	10	IP65	Long flex life	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL☐M-A2-H		2	5	10	IP65	Long flex life	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	Connector: JN4FT02SJ1-R Hood, socket insulator Bushing, ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT160-3-TMH5B (Japan Aviation Electronics Industry)	Signal layout  View seen from wiring side.
MR-BKS1CBL☐M-A2-L		
MR-BKS1CBL☐M-A1-H		
MR-BKS1CBL☐M-A2-H		
MR-BKS2CBL03M-A1-L	Connector: JN4FT02SJ2-R Hood, socket insulator Bushing, ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT160-3-TMH5B (Japan Aviation Electronics Industry)	
MR-BKS2CBL03M-A2-L		

(2) Internal wiring diagram



Note. These are not shielded cables.

11.1.5 SSCNETⅢ cable

POINT

- Do not see directly the light generated from CN1A・CN1B connector of servo amplifier or the end of SSCNETⅢ cable. When the light gets into eye, you may feel something is wrong for eye. (The light source of SSCNETⅢ complies with class1 defined in JIS C6802 or IEC 60825-1.)

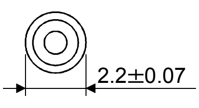
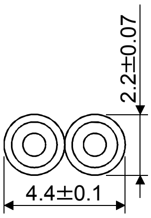
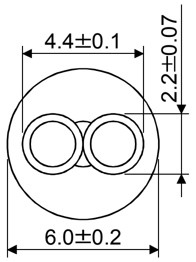
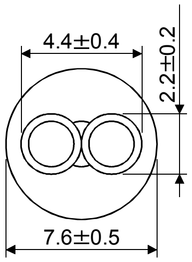
(1) Model explanations

Numeral in the column of cable length on the table is a symbol put in the □ part of cable model. Cables of which symbol exists are available.

Cable model	Cable length											Flex life	Application・remark
	0.15m	0.3m	0.5m	1m	3m	5m	10m	20m	30m	40m	50m		
MR-J3BUS□M	015	03	05	1	3							Standard	Using inside panel standard cord
MR-J3BUS□M-A						5	10	20				Standard	Using outside panel standard cable
(Note) MR-J3BUS□M-B									30	40	50	Long flex life	Using long distance cable

Note. For cable of 30m or less, contact our company.

(2) Specifications

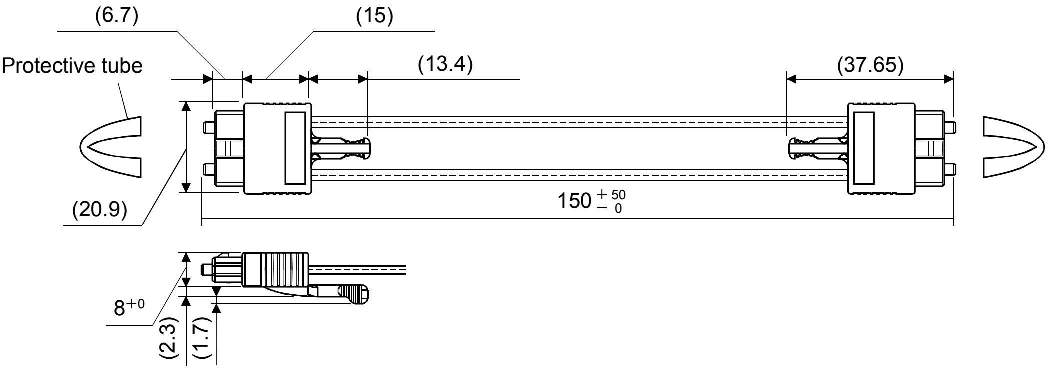
		Description			
SSCNETⅢ cable model		MR-J3BUS□M		MR-J3BUS□M-A	MR-J3BUS□M-B
SSCNETⅢ cable length		0.15m	0.3 to 3m	5 to 20m	30 to 50m
Optical cable (cord)	Minimum bend radius	25mm		Enforced covering cord: 50mm Cord: 25mm	Enforced covering cord: 50mm Cord: 30mm
	Tension strength	70N	140N	420N (Enforced covering cord)	980N (Enforced covering cord)
	Temperature range for use (Note)	−40 to 85℃			−20 to 70℃
	Ambient	Indoors (no direct sunlight) No solvent or oil			
	External appearance [mm]				

Note. This temperature range for use is the value for optical cable (cord) only. Temperature condition for the connector is the same as that for servo amplifier.

(3) Outline drawings

(a) MR-J3BUS015M

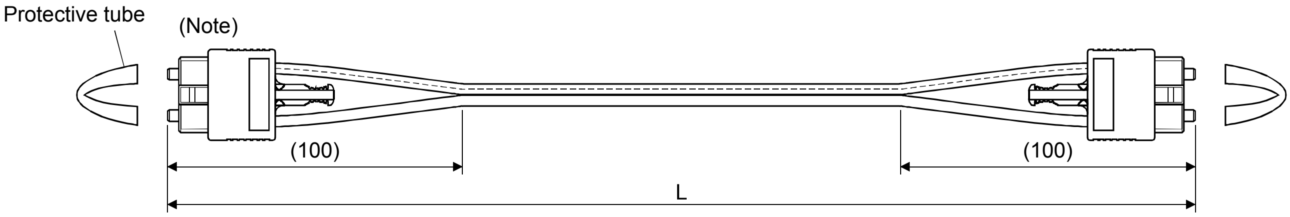
[Unit: mm]



(b) MR-J3BUS03M to MR-J3BUS3M

Refer to the table shown in (1) of this section for cable length (L).

[Unit: mm]



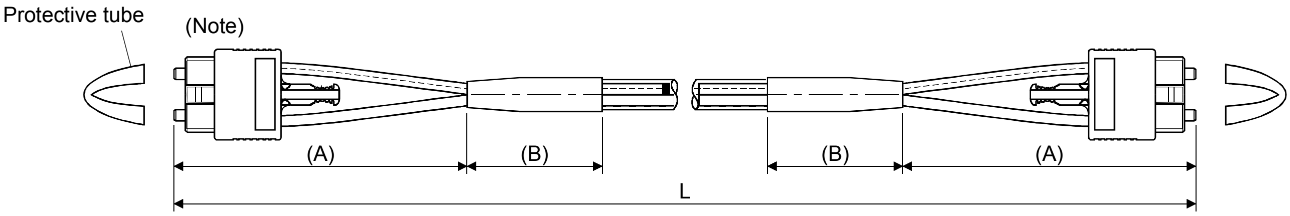
Note. Dimension of connector part is the same as that of MR-J3BUS015M.

(c) MR-J3BUS5M-A to MR-J3BUS20M-A・MR-J3BUS30M-B to MR-J3BUS50M-B

Refer to the table shown in (1) of this section for cable length (L).

SSCNETⅢ cable	Distortion dimension [mm]	
	A	B
MR-J3BUS5M-A to MR-J3BUS20M-A	100	30
MR-J3BUS30M-B to MR-J3BUS50M-B	150	50

[Unit: mm]



Note. Dimension of connector part is the same as that of MR-J3BUS015M.

11.1.6 Battery cable

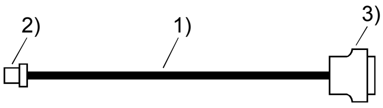
(1) Model explanations

The numbers in the Cable length column in the table go into □ of the cable model names. Cables with the lengths of the numbers are available.

Cable model	Cable length		Fiex life	Application / Remark
	0.3m	1m		
MR-J3BT1CBL□M	03	1	Standard	For connection of MR-BTCASE
MR-J3BT2CBL□M	03	1	Standard	For junction

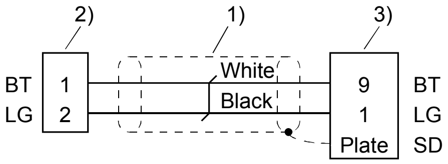
(2) MR-J3BT1CBL□M

(a) Appearance



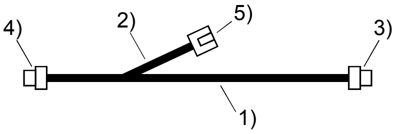
Parts	Description
1) Cable	VSVC 7/0.18 × 2C
2) Connector	Socket: DF3-2S-2C Socket contact: DF3-2428SC(F)C (Hirose Denki)
3) Connector	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or similar product)

(b) Internal wiring diagram



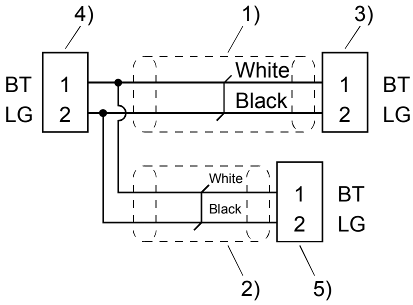
(3) MR-J3BT2CBL□M

(a) Appearance



Parts	Description
1) Cable	VSVC 7/0.18 × 2C
2) Cable	
3) Connector	Socket: DF3-2S-2C
4) Connector	Socket contact: DF3-2428SCFC (Hirose Denki)
5) Connector	Socket: DF3-2EP-2C Socket contact: DF3-EP2428PCFA (Hirose Denki)

(b) Internal wiring diagram



11.2 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.

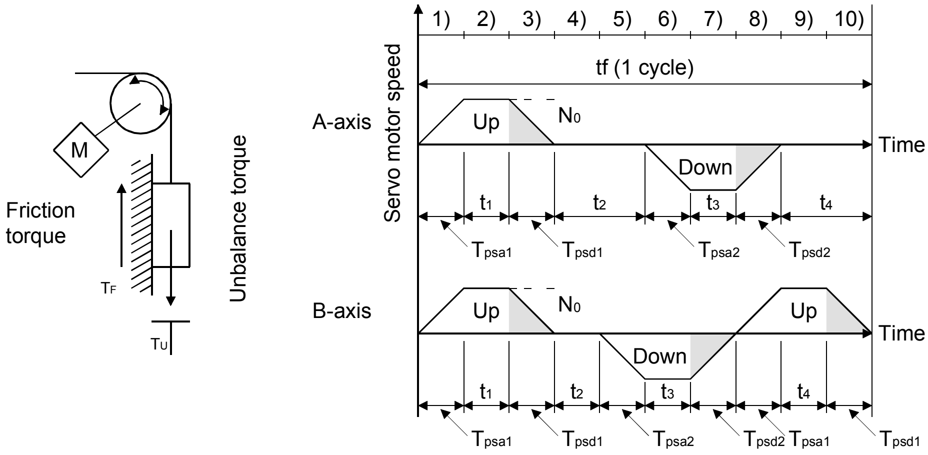
Servo amplifier	Regenerative power [W]		
	Built-in regenerative resistor	MR-RB14 [26Ω]	MR-RB34 [26Ω]
MR-J3W-22B	10	100	
MR-J3W-44B			
MR-J3W-77B	100		300

(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 E [J]
1), 8)-B-axis	$T_1 = \frac{(J_L+J_M)\cdot N_0}{9.55\times10^4}\cdot\frac{1}{T_{psa1}}+T_U+T_F$	$E_1=\frac{0.1047}{2}\cdot N_0\cdot T_1\cdot T_{psa1}$
2), 9)-B-axis	$T_2=T_U+T_F$	$E_2=0.1047\cdot N_0\cdot T_2\cdot t_1$
3), 10)-B-axis	$T_3 = \frac{-(J_L+J_M)\cdot N_0}{9.55\times10^4}\cdot\frac{1}{T_{psd1}}+T_U+T_F$	$E_3=\frac{0.1047}{2}\cdot N_0\cdot T_3\cdot T_{psd1}$
4), 5)-A-axis, 9, 10)-A-axis	$T_4=T_U$	$E_4\geq0$ (No regeneration)
5)-B-axis, 6)-A-axis	$T_5 = \frac{(J_L+J_M)\cdot N_0}{9.55\times10^4}\cdot\frac{1}{T_{psa2}}-T_U+T_F$	$E_5=\frac{0.1047}{2}\cdot N_0\cdot T_5\cdot T_{psa2}$
6)-B-axis, 7)-A-axis	$T_6=-T_U+T_F$	$E_6=0.1047\cdot N_0\cdot T_6\cdot t_3$
7)-B-axis, 8)-A-axis	$T_7 = \frac{-(J_L+J_M)\cdot N_0}{9.55\times10^4}\cdot\frac{1}{T_{psd2}}-T_U+T_F$	$E_7=\frac{0.1047}{2}\cdot N_0\cdot T_7\cdot T_{psd2}$

From the calculation results in 1) to 10), 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-J3W-22B	70	17
MR-J3W-44B	85	22
MR-J3W-77B	80	46

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.

Next, calculate the energy at different timings in one cycle of the operation. Energy is a positive value in driving and a negative value in regenerative driving. Write down the energy during driving/regenerative driving with signs in the calculation table as shown below. Negative values go into the shaded cells.

<Example>

Timing	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)
A-axis	E1	E2	E3	E4	E4	E5	E6	E7	E4	E4
B-axis	E1	E2	E3	E4	E5	E6	E7	E5	E6	E3
Sum	E 1)	E 2)	E 3)	E 4)	E 5)	E 6)	E 7)	E 8) (Note)	E 9)	E 10)
Regenerative Es			ES 3)				ES 7)			ES 10)
ER [J]			ER				ER			ER
PR [W]			ER/t_f							

Note. Energy is not a negative value after summing regenerative driving+driving

Calculate the sum of energy in each timing. For the timings (timing 3), 7) and 10) in the example) with negative sum totals, calculate the next formula.
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.

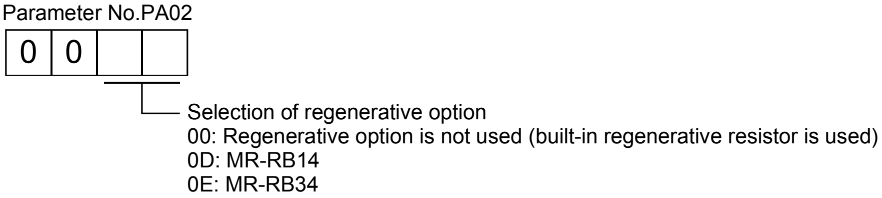
$$\mathrm{ER}\ [\mathrm{J}] = \eta \cdot \mathrm{Es} - \mathrm{Ec}$$

If the subtraction results are negative at all timings, the regenerative option is not needed. From the total of ER's whose subtraction results are positive and a 1-cycle period, the power consumption of the regenerative option can be calculated with the following expression. Regenerative option is not required when the energy consumption is equal to or less than the built-in regenerative energy.

Power consumption PR [W]$=$(total of positive ER's)/1-cycle operation period (t_f)

(3) Parameter setting

Set parameter No.PA02 according to the option to be used.



Selection of regenerative option
00: Regenerative option is not used (built-in regenerative resistor is used)
0D: MR-RB14
0E: MR-RB34

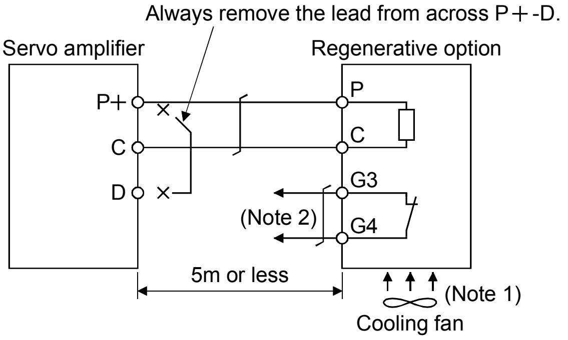
(4) Connection of the regenerative option

POINT

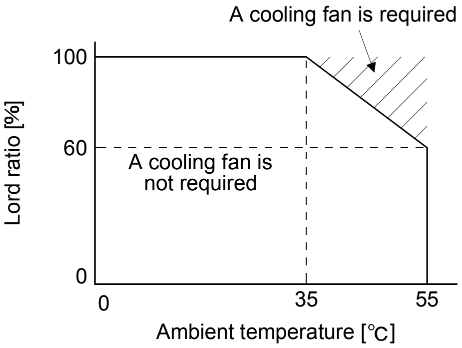
- For the sizes of wires used for wiring, refer to section 11.5.

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 wires and keep them clear of the regenerative option body. Always use twisted cables of max. 5m length for connection with the servo amplifier.

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 the ambient temperature is more than 55℃ and the regenerative load ratio is more than 60% in MR-RB34, forcefully cool the air with a cooling fan (1.0m^3/min or more, 92mm × 92mm). A cooling fan is not required if the ambient temperature is 35℃ or less.



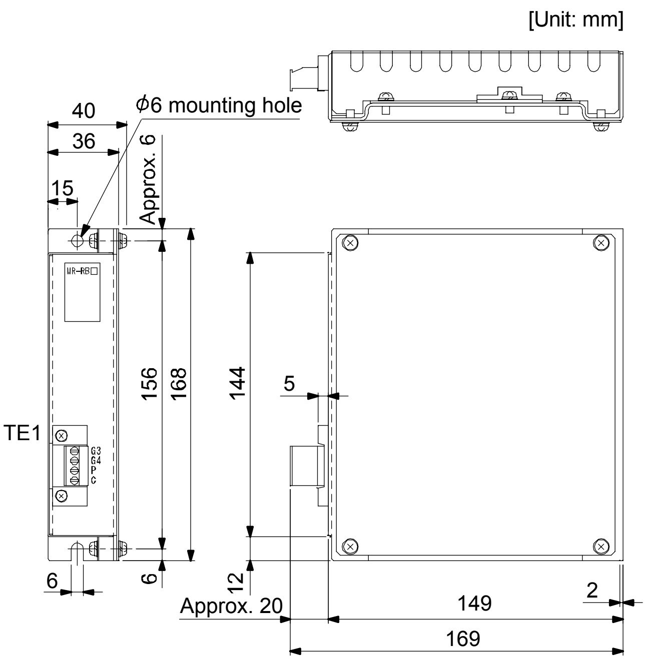
A cooling fan is not required for MR-RB14.

2. Make up a sequence which will switch off the magnetic contactor when abnormal heating occurs.

G3-G4 contact specifications
Maximum voltage: 120V AC/DC
Maximum current: 0.5A/4.8VDC
Maximum capacity: 2.4VA

(5) Outline drawing

(a) MR-RB14



・TE1

Terminal block

G3
G4
P
C

Applicable wire size: 0.2mm^2 (AWG24) to 2.5mm^2 (AWG12)

Tightening torque: 0.5 to 0.6 [N・m] (4 to 5 [lb・in])

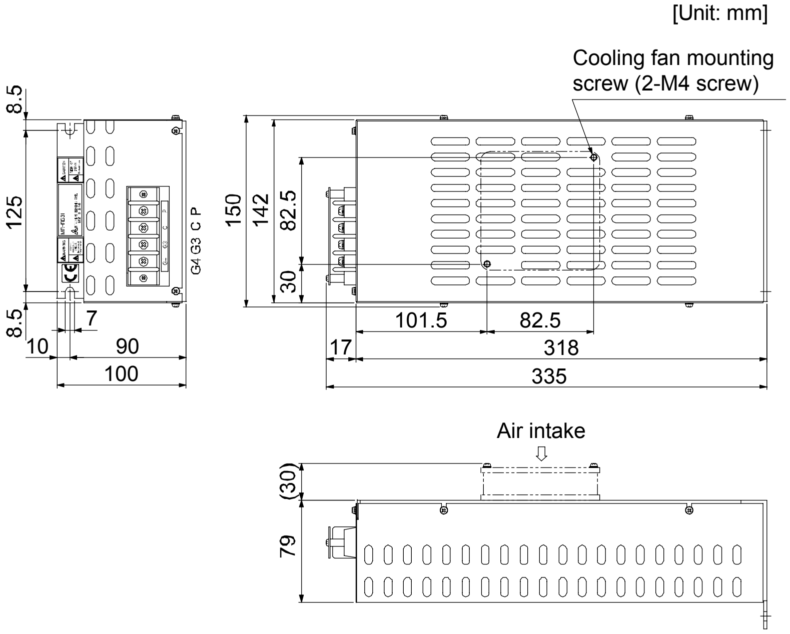
・Mounting screw

Screw size: M5

Tightening torque: 3.24 [N・m] (28.7 [lb・in])

Mass: 1.1 [kg] (2.4 [lb])

(b) MR-RB34



・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])

Mass: 2.9 [kg] (6.4 [lb])

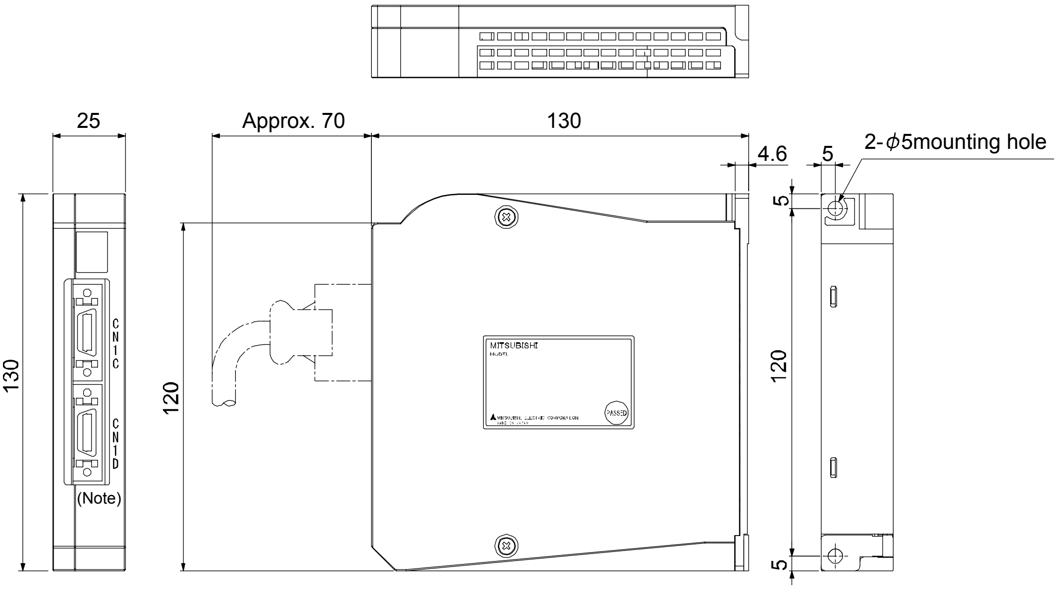
11.3 MR-BTCASE battery case and MR-BAT battery

POINT

- Refer to appendix 5 and 6 for battery transportation and the new EU Battery Directive.
- Always install eight MR-BAT batteries to a MR-BTCASE battery case.

These are used to configure an absolute position detection system. A MR-BTCASE battery case is a case that stores eight MR-BAT batteries by connector connections. A MR-BTCASE battery case can be used by four MR-J3W-B servo amplifiers (eight axes) at maximum. To connect a MR-BTCASE battery case to a servo amplifier, the MR-J3BT1CBL□M battery cable is required. To connect multiple servo amplifiers to a MR-BTCASE battery case, use the MR-J3BT2CBL□M junction battery cable. When using a MR-J3W-B servo amplifier in the incremental system, MR-BTCASE and MR-BAT are not required.
Battery backup time (battery life without charging) is 30,000 hours for one servo amplifier (two axes) and 10,000 hours for four servo amplifiers (eight axes). Refer to section 12.3 for the usage.

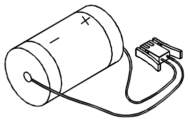
[Unit: mm]



Note. Leave this open.

Mass: 0.3 [kg]

Outline dimension drawing of MR-BTCASE



Appearance of MR-BAT

The next table shows model names of battery cables. The numbers in the Cable length column in the table go into □ of the cable model names.

Cable model	Cable length		Fiex life	Application / Remark
	0.3m	1m		
MR-J3BT1CBL□M	03	1	Standard	
MR-J3BT2CBL□M	03	1	Standard	For junction

11.4 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.

(1) Specifications

Item	Description
Compatibility with a servo amplifier	MRZJW3-SETUP221E version C1 or later is compatible.
Monitor	Display, high speed monitor, Multiple axis graph trend graph Minimum resolution changes with the processing speed of the personal computer.
Alarm	Display, history, amplifier data
Diagnostic	Digital I/O, no motor rotation, total power-on time, amplifier version info, motor information, tuning data, absolute encoder data, Axis name setting.
Parameters	Parameter list, turning, change list, detailed information
Test operation	Jog operation, positioning operation, Do forced output, program operation.
Advanced function	Machine analyzer, gain search, machine simulation, robust disturbance compensation, Advanced gain search
File operation	Data read, save, delete, print
Others	Automatic demo, help display

(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
Browser		Internet Explorer 4.0 or more
Display		One whose resolution is 1024×768 or more and that can provide a high color (16 bit) display. Connectable with the above personal computer.
Keyboard		Connectable with the above personal computer.
Mouse		Connectable with the above personal computer.
Printer		Connectable with the above personal computer.
USB cable		MR-J3USBCBL3M

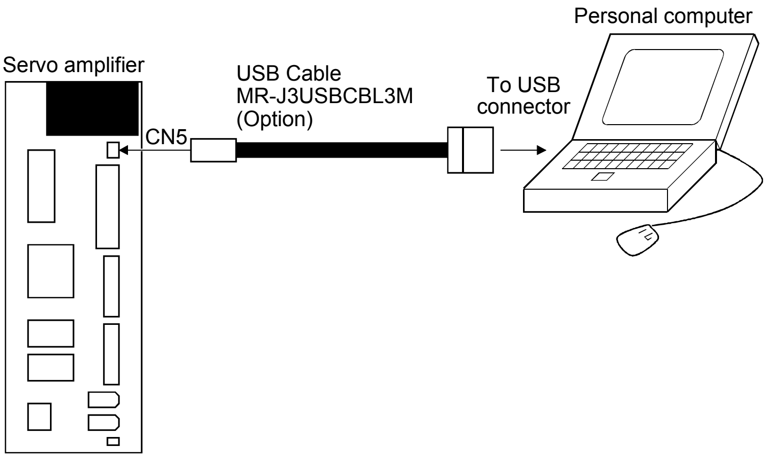
Note 1. Windows and Windows Vista is the registered trademarks of Microsoft Corporation in the United States and other countries. Pentium is the registered trademarks of Intel Corporation.

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



(3) MR Configurator

MR Configurator MRZJW3-SETUP221E supports MR-J3W-B. The following table shows notes for using MR-J3W-B with MR Configurator.

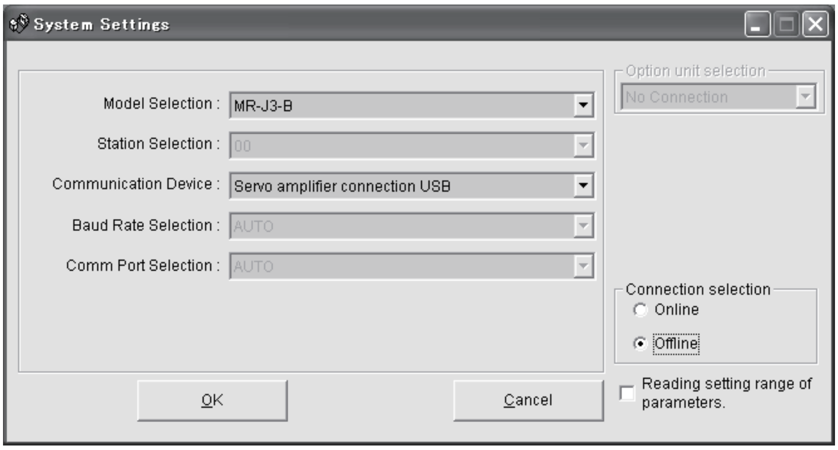
(a) Specification and setting

Item	Mode	Specification/setting
System setting		Select "MR-J3-B."
Station No. selection	A-axis	Servo amplifier: Set parameter No.PC15 to "0 (initial setting)". MR Configurator: Select the station number "0".
	B-axis	Servo amplifier: Set parameter No.PC15 to "1". MR Configurator: Select the station number "1".
USB communication	All monitor	Same display as MR-J3-B
	graph	Three channels for each of two axes can be measured. (Set measuring axes using parameters.)
	Test operation	One axis only (cannot use two axes simultaneously.)
	Machine analyzer	To vibrate one axis (cannot use two axes simultaneously.)
	I/O interface	Only the information on the communicating axis. Pin numbers of MR-J3-B are the pin numbers.
	Tuning	Vibration suppression control tuning and machine resonance filter tuning are not available.
Via EzSocket	Multiple axis monitor	Not supported
	Multiple axis graph	Three channels for each of two axes can be measured. (Set measuring axes using parameters.)

(b) Selecting an axis to communicate

Follow the following procedure to switch the communicating axis.

Step 1: Display the System Settings.



System Settings

Model Selection : MR-J3-B

Station Selection : 00

Communication Device : Servo amplifier connection USB

Baud Rate Selection : AUTO

Comm Port Selection : AUTO

Option unit selection: No Connection

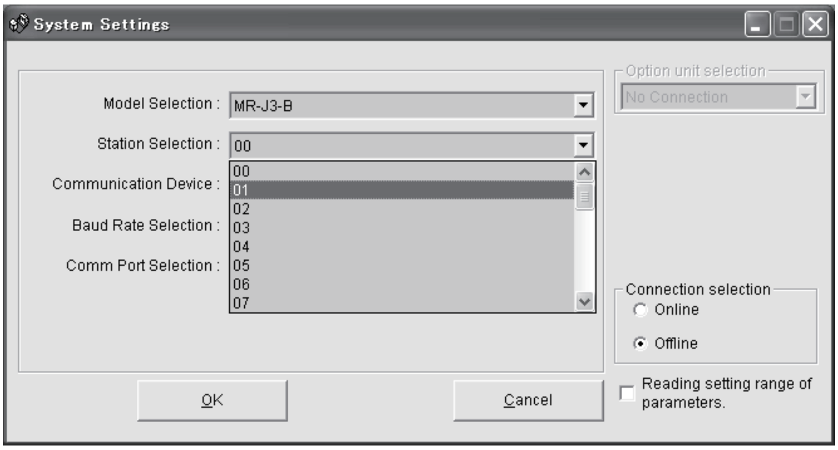
Connection selection

○ Online

● Offline

☐ Reading setting range of parameters.

Step 2: Press down "Ctrl"＋"Alt"＋"Shift"＋"F5" simultaneously to activate the station selection.



System Settings

Model Selection : MR-J3-B

Station Selection : 00

Communication Device :

Baud Rate Selection :

Comm Port Selection :

00
01
02
03
04
05
06
07

Option unit selection: No Connection

Connection selection

○ Online

● Offline

☐ Reading setting range of parameters.

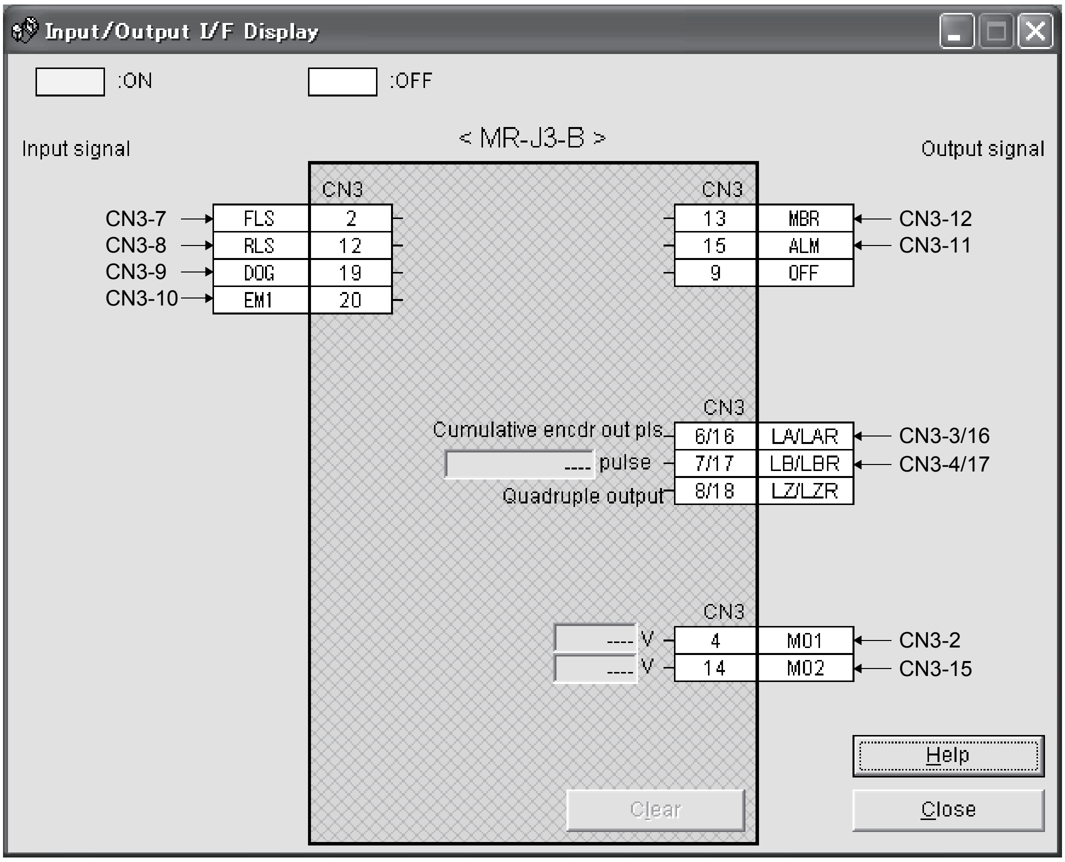
Step 3: Select the station "00" for the A-axis setting and the station "01" for the B-axis setting in the Station Selection.

(c) I/O interface

Pin numbers of the I/O interface are the pin numbers of the MR-J3-B. When using the pin numbers for MR-J3W-B, read the pin numbers as shown below.

Item	MR-J3-B	MR-J3W-B	
		A-axis	B-axis
Input device	CN3-2	CN3-7	CN3-20
	CN3-12	CN3-8	CN3-21
	CN3-19	CN3-9	CN3-22
	CN3-20	CN3-10	
Output device	CN3-13	CN3-12	CN3-25
	CN3-15	CN3-11	CN3-24
Encoder pulse output	CN3-6/16	CN3-3/16	CN3-5/18
	CN3-7/17	CN3-4/17	CN3-6/19
	CN3-8/18	Invalid (No function)	
Analog monitor output	CN3-4	CN3-2	
	CN3-14	CN3-15	

The next display shows the case when the A-axis (station 0) is set as the axis to communicate.



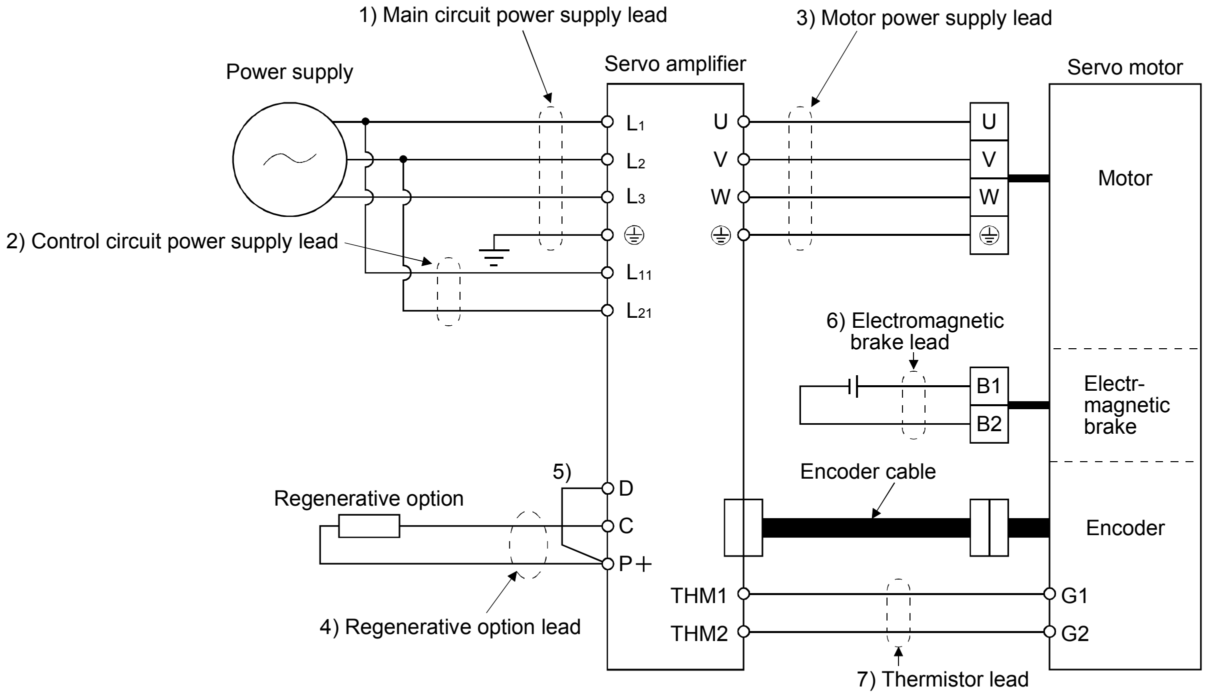
11.5 Selection example of wires

POINT

- Refer to section 11.1.5 for SSCNETⅢ cable.
- Wires indicated in this section are separated wires.
- To comply with the UL/CSA Standard, use the wires shown in appendix 4 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.



The following table shows selection examples of cable sizes. These sizes are common for the 600V Polyvinyl chloride insulated wire (IV wire) and for the 600V Grade heat-resistant polyvinyl chloride insulated wire (HIV wire).

Table 11.1 Wire size selection example 1 (IV/HIV wire)

Servo amplifier	Wires [mm^2] (Note 1)						
	1) L_1 ・ L_2 ・ L_3 ・ ⏚ (Note 3)	2) L_{11} ・ L_{21}	3) U ・ V ・ W ・ ⏚ (Note 2, 3)	4) P+ ・ C	5) P+ ・ D	6) B_1 ・ B_2 (Note 2)	7) THM1 ・ THM2
MR-J3W-22B	2 (AWG14)					1.25 (AWG16)	0.2 (AWG24)
MR-J3W-44B							

Note 1. Wires are selected based on the highest rated current among combining servo motors.

2. This wire size indicates the size of cable extension which is used when the wiring length exceeds 10m.

3. Use the crimping terminal specified as below for the PE terminal of the servo amplifier.

Crimping terminal : FVD2-4
Tool (body) : YNT-1614
Manufacturer : JST
Tightening torque : 1.2 N・m

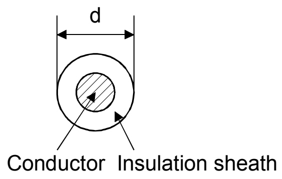
(2) Wires for cables

When fabricating a cable, use the wire models given in the following table or equivalent.

Table 11.2 Wires for option cables

Type	Model	Length [m]	Core size [mm^2]	Number of Cores	Characteristics of one core			(Note 3) Finishing OD [mm]	Wire model
					Structure [Wires/mm]	Conductor resistance [Ω/mm]	Insulation coating OD d [mm] (Note 1)		
Encoder cable	MR-J3ENCBL□M-A1-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-A2-L								
	MR-J3ENCBL□M-A1-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-J3ENCBL□M-A2-H								
	MR-J3JCBL03M-A1-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-J3JCBL03M-A2-L								
	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	UL 20276 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 (-S06)	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 (-S06)	2 to 10	AWG22	6 (3 pairs)	70/0.08	56 or less	1.2	7.1±0.3	(Note 3) ETEF 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) ETFE・SVP 40/0.08mm×6P Ban-gi-shi-15266
Motor power supply cable	MR-PWS1CBL□M-A1-L	2 to 10	AWG18	4	34/0.18	21.8 or less	1.71	62±0.3	HRZFEV-A(CL3) AWG18 4-cores
	MR-PWS1CBL□M-A2-L	2 to 10							
	MR-PWS1CBL□M-A1-H	2 to 10	(Note 6) AWG19 (0.75mm^2)	4	150/0.08	29.1 or less	1.63	5.7±0.5	(Note 4) RMFES-A(CL3X) AWG19 4-cores
	MR-PWS1CBL□M-A2-H	2 to 10							
	MR-PWS2CBL03M-A1-L	0.3	AWG19	4	30/0.18	25.8 or less	1.64	—	(Note 3, 7) J11B2330 UL 10125
	MR-PWS2CBL03M-A2-L	0.3							
Motor brake cable	MR-BKS1CBL□M-A1-L	2 to 10	AWG20	2	21/0.18	34.6 or less	1.35	4.7±0.1	(Note 4) HRZFEV-A(CL3) AWG20 2-cores
	MR-BKS1CBL□M-A2-L	2 to 10							
	MR-BKS1CBL□M-A1-H	2 to 10	(Note 6) AWG20 (0.75mm^2)	2	110/0.08	39.0 or less	1.37	4.5±0.3	RMFES-A(CL3X) AWG20 2-cores
	MR-BKS1CBL□M-A2-H	2 to 10							
	MR-BKS2CBL03M-A1-L	0.3	AWG20	2	19/0.203	32.0 or less	1.42	—	(Note 3, 7) J11B331 UL 10125
	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. Purchased from Taisei
5. Taiyo Electric Wire and Cable
6. These wire sizes assume that the UL-compliant wires are used at the wiring length of 10m.
7. These models consist with solid wires. Specify the color, separately.

11.6 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.

Rotary servo motor Total output	Linear servo motor total continuous thrust	No-fuse breaker			Fuse			(Note 2) Magnetic contactor
		Current		Voltage AC [V]	(Note 1) Class	Current [A]	Voltage AC [V]	
		Not using power factor improving reactor	Using power factor improving reactor					
300W or less		30A frame 5A	30A frame 5A	240	K5	15	300	S-N10
From over 300W to 600W	120N or less	30A frame 10A	30A frame 10A			20		
From over 600W to 1kW	From over 120N to 240N	30A frame 15A	30A frame 10A			20		
From over 1kW to 1.5kW	From over 240N to 480N	30A frame 20A	30A frame 15A			30		S-N18

Note 1. Refer to appendix 4(8) to use the servo amplifier as a UL/CSA compliant product.
2. Be sure to use a magnetic contactor with an operation delay time of 80ms or less. The operation delay time is the time interval between current being applied to the coil until closure of contacts.

11.7 Power factor improving AC reactors

The power factor improving AC reactors improve the phase factor by increasing the form factor of servo amplifier's input current.

It can reduce the power capacity.

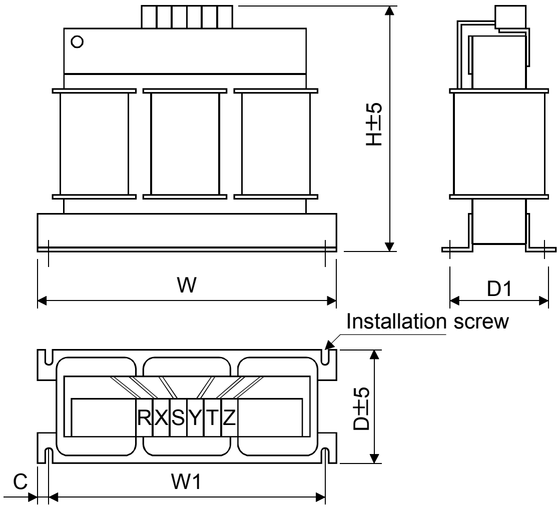
The input power factor is improved to be about 90%. For use with a 1-phase power supply, it may be slightly lower than 90%.

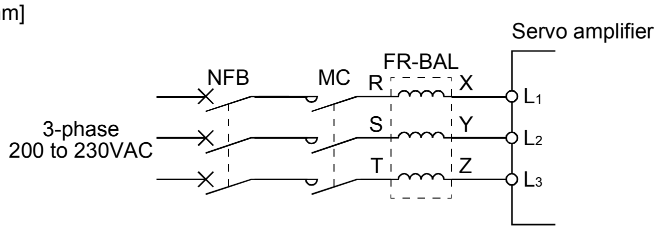
In addition, it reduces the higher harmonic of input side.

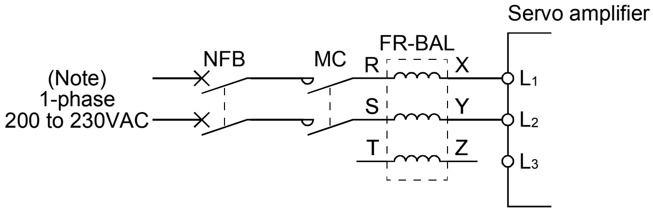
When using power factor improving reactors for two servo amplifiers or more, be sure to connect a power factor improving reactor to each servo amplifier.

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.

Rotary servo motor Total output	Linear servo motor total continuous thrust	Power factor improving AC reactor	Dimensions [mm]						Mounting screw size	Terminal screw size	Mass [kg (lb)]
			W	W1	H	D	D1	C			
300W or less		FR-BAL-0.4K	135	120	115	59	45	7.5	M4	M3.5	2.0 (4.41)
From over 300W to 450W	100N or less	FR-BAL-0.75K	135	120	115	69	57	7.5	M4	M3.5	2.8 (6.17)
From over 450W to 600W	From over 100N to 120N	FR-BAL-1.5K	160	145	140	71	55	7.5	M4	M3.5	3.7 (8.16)
From over 600W to 1kW	From over 120N to 240N	FR-BAL-2.2K	160	145	140	91	75	7.5	M4	M3.5	5.6 (12.35)
From over 1kW to 1.5kW	From over 240N to 480N	FR-BAL-3.7K	220	200	192	90	$70^{0}_{-2.5}$	10	M5	M4	8.5 (18.74)

11.8 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 rated current 40mA or less (Ex.) Omron : type MY

11.9 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

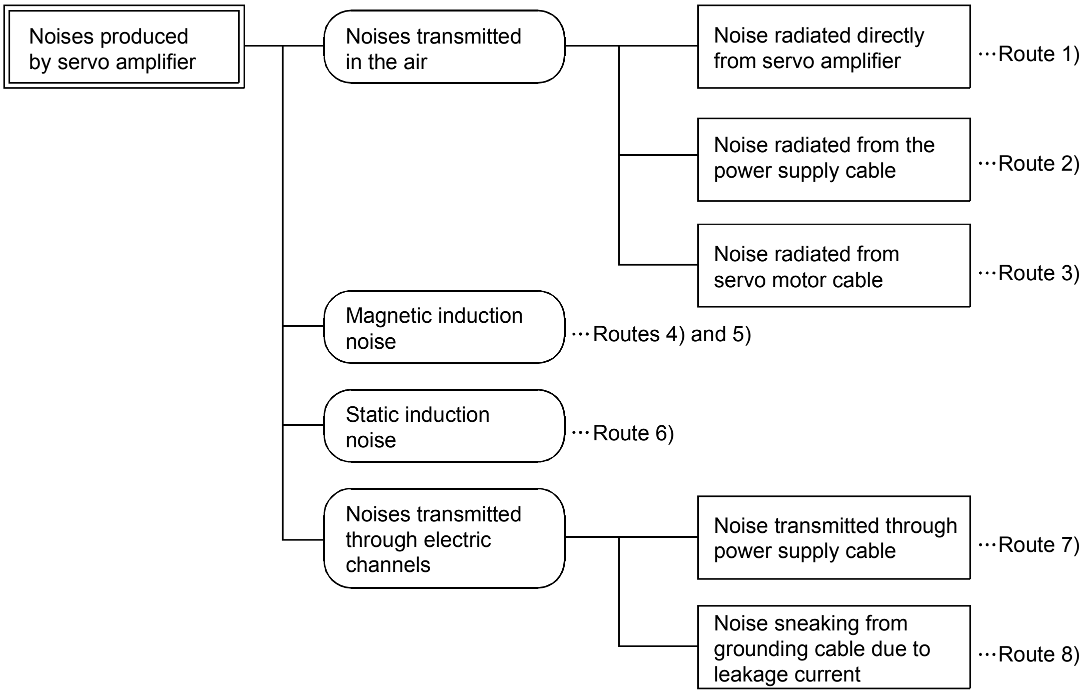
- Avoid laying power lines (input and output cables) and signal cables side by side or do not bundle them together. Separate power lines from signal cables.
- Use shielded, twisted pair cables for connection with the encoder and for control signal transmission, and connect the shield to the SD terminal.
- Ground the servo amplifier, servo motor, etc. together at one point (refer to section 3.12).

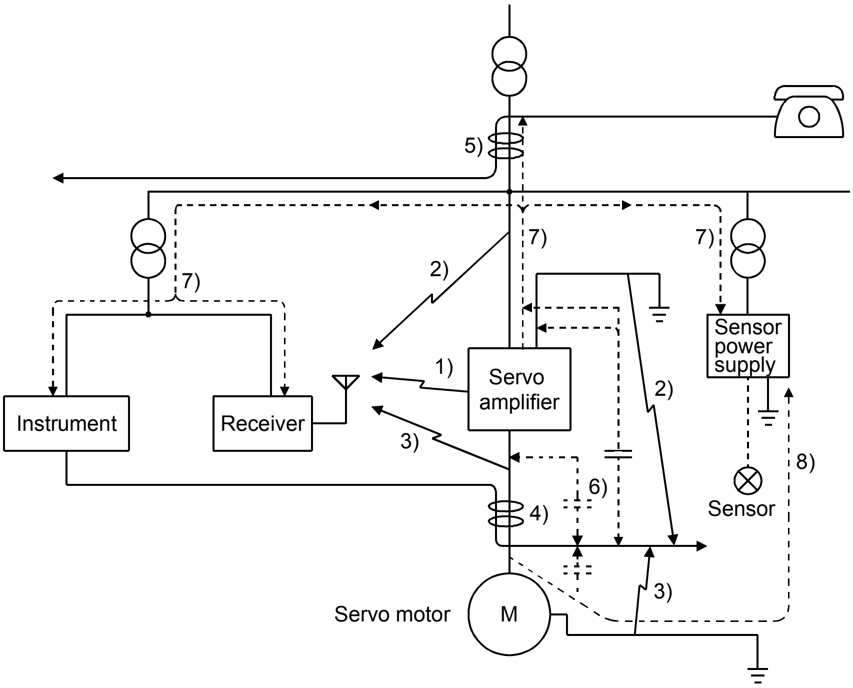
(b) Reduction techniques for external noises that cause the servo amplifier to malfunction

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) on the power cables (Input cables) of the servo amplifier. 2. Insert the line noise filter (FR-BSF01) 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.

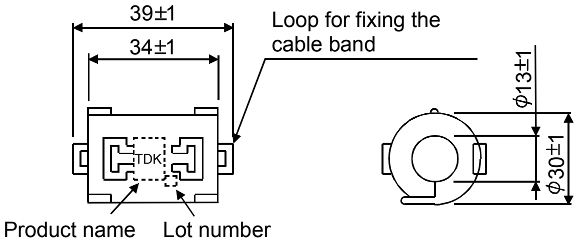
(2) Noise reduction products

(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-250 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

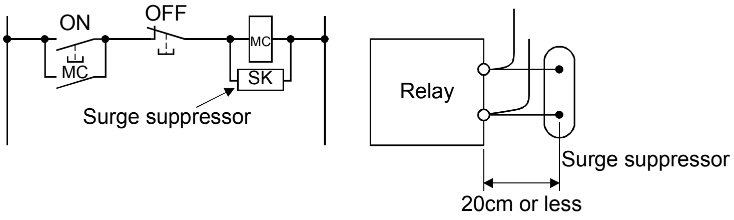
[Unit: mm]



Outline drawing (ZCAT3035-1330)

(b) Surge suppressor

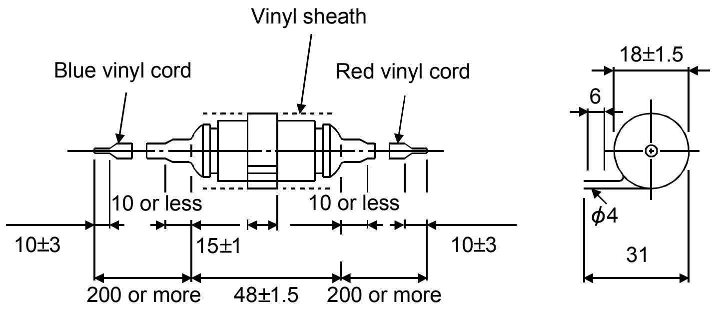
The recommended surge suppressor for installation to an AC relay, AC valve or the like near the servo amplifier is shown below. Use this product or equivalent.



(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)

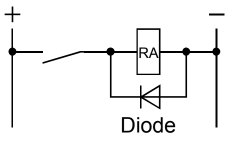
Outline drawing [Unit: mm]



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

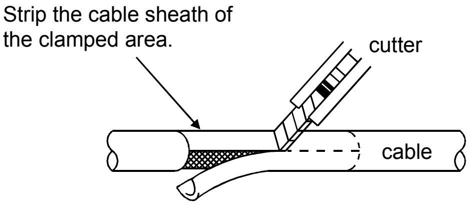


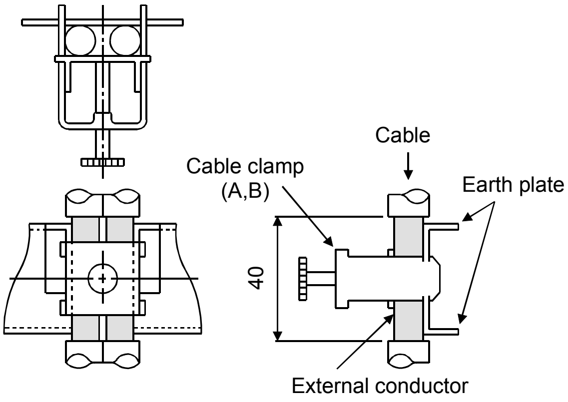
(c) Cable clamp fitting AERSBAN-☐SET

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.

[Unit: mm]



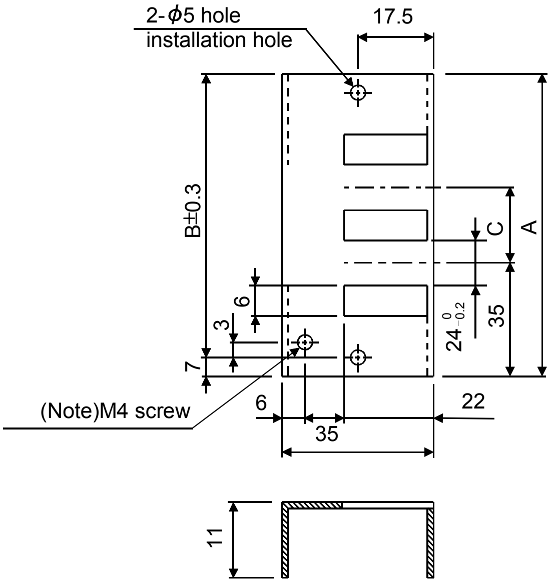


Clamp section diagram

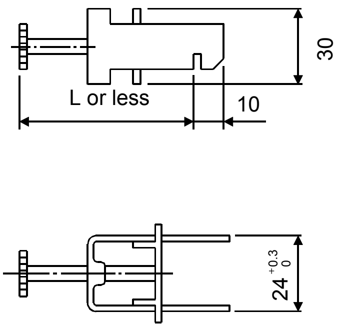
- Outline drawing

[Unit: mm]

Earth plate



Clamp section diagram



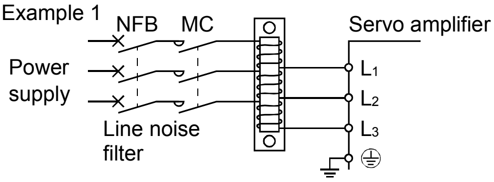
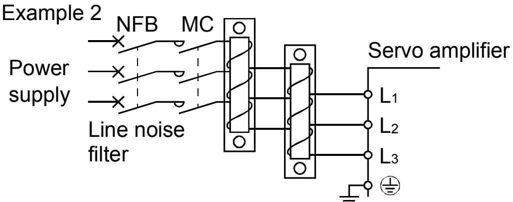
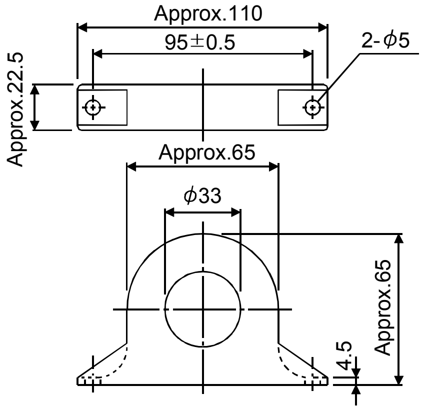
Note. Screw hole for grounding. Connect it to the earth plate of the control box.

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

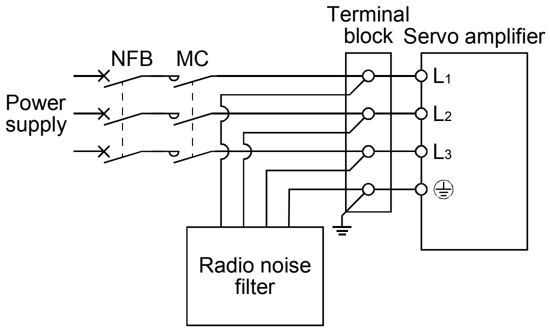
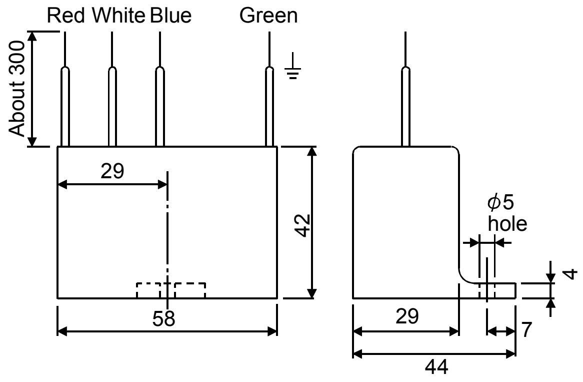
(d) Line noise filter (FR-BSF01)

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.

Connection diagram	Outline drawing [Unit: mm]
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 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)	FR-BSF01 (for wire size 3.5mm^2 (AWG12) or less)) 

(e) Radio noise filter (FR-BIF)

This filter is effective in suppressing noises radiated from the power supply side of the servo amplifier especially in 10MHz and lower radio frequency bands. The FR-BIF is designed for the input only.

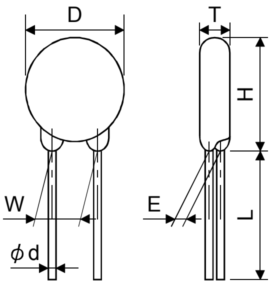
Connection diagram	Outline drawing (Unit: mm)
Make the connection cables as short as possible. Grounding is always required. When using the FR-BIF with a single-phase power supply, always insulate the wires that are not used for wiring. 	Leakage current: 4mA 

(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 and TND20V-471K manufactured by NIPPON CHEMI-CON, are recommended. For detailed specification and usage of the varistors, refer to the manufacturer catalog.

Power supply voltage	Varistor	Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) 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)

[Unit: mm]



Model	D Max.	H Max.	T Max.	E ±1.0	(Note)L min.	ϕd ±0.05	W ±1.0
TND20V-431K	21.5	24.5	6.4	3.3	20	0.8	10.0
TND20V-471K			6.6	3.5			

Note. For special purpose items for lead length (L), contact the manufacturer.

11.10 Leakage current breaker

(1) Selection method

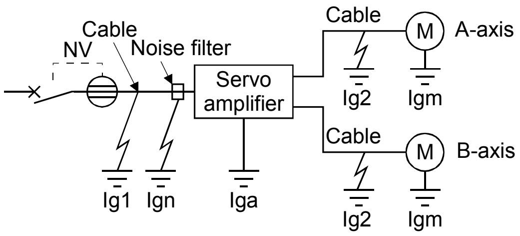
High-frequency chopper currents controlled by pulse width modulation flow in the AC servo circuits. Leakage currents containing harmonic contents are larger than those of the motor which is run with a commercial power supply.

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≥

10・{Ig1＋Ign＋Iga＋K・(Ig2 (A-axis)＋Igm (A-axis)＋Ig2 (B-axis)＋Igm (B-axis))} [mA]· · (11.1)



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

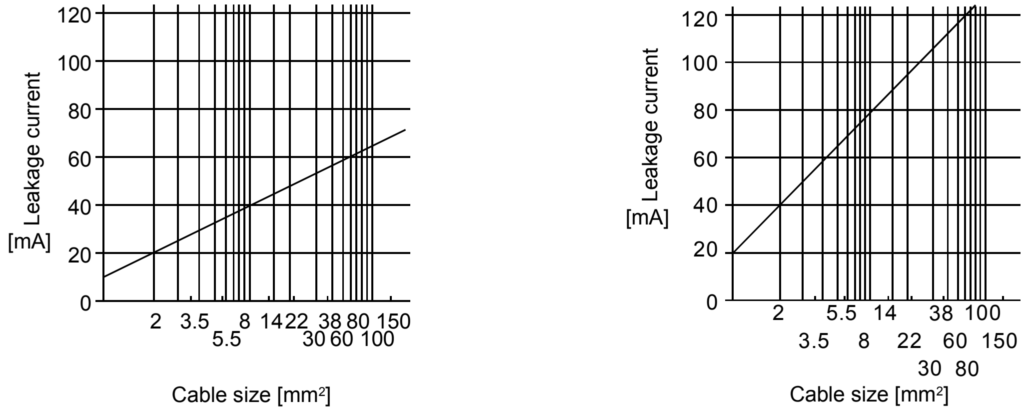
Ig1 : Leakage current on the electric channel from the leakage current breaker to the input terminals of the servo amplifier (Found from Fig. 11.1.)

Ig2 : Leakage current on the electric channel from the output terminals of the servo amplifier to the servo motor (Found from Fig. 11.1.)

Ign : Leakage current when a filter is connected to the input side (4.4mA per one FR-BIF)

Iga : Leakage current of the servo amplifier (Found from Table 11.4.)

Igm : Leakage current of the servo motor (Found from Table 11.3.)



a. 200V class

b. 400V class

Fig. 11.1 Leakage current example (Ig1, Ig2) for CV cable run in metal conduit

Table 11.3 Servo motor's leakage current example (Igm)

Servo motor power [kW]	Leakage current [mA]
0.05 to 0.75	0.1

Table 11.4 Servo amplifier's leakage current example (Iga)

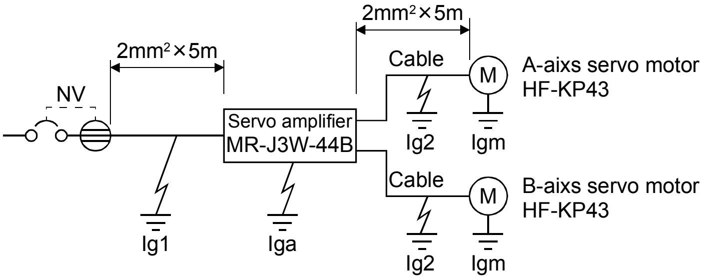
Servo amplifier	Leakage current [mA]
MR-J3W-22B MR-J3W-44B	0.1
MR-J3W-77B	0.15

Table 11.5 Leakage circuit breaker selection example

Servo amplifier	Rated sensitivity current of leakage circuit breaker [mA]
MR-J3W-22B MR-J3W-44B MR-J3W-77B	15

(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 (11.1) from the diagram.

$$Ig1 = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

$$Ig2 = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

$Ign = 0$ (not used)

$Iga = 0.1$ [mA]

$Igm = 0.1$ [mA]

Insert these values in Equation (11.1).

$$Ig \geq 10 \cdot \{0.1+0+0.1+1 \cdot (0.1+0.1+0.1+0.1)\}$$

$$\geq 6.0 \text{ [mA]}$$

According to the result of calculation, use a leakage current breaker having the rated sensitivity current (Ig) of 6.0 [mA] or more. A leakage current breaker having Ig of 15 [mA] is used with the NV-SP/SW/CP/CW/HW series.

11.11 EMC filter (recommended)

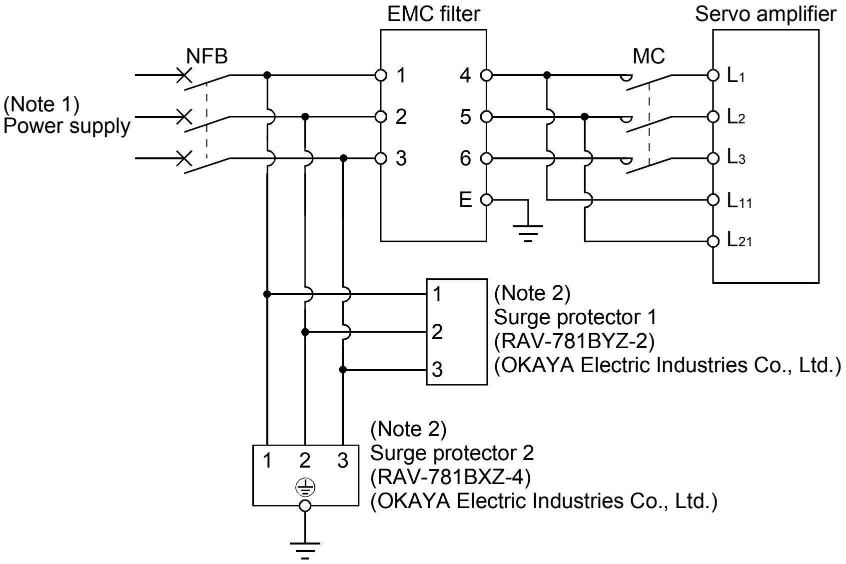
For compliance with the EMC directive of the EN Standard, it is recommended to use the following filter. Some EMC filters are large in leakage current.

(1) Combination with the servo amplifier

Servo amplifier	Recommended filter (Soshin Electric)		Mass [kg]([lb])
	Model	Leakage current [mA]	
MR-J3W-22B MR-J3W-44B	(Note) HF3010A-UN	5	3 (6.61)
MR-J3W-77B	(Note) HF3030A-UN		5.5 (12.13)

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. Refer to section 1.3 for the power supply specification.

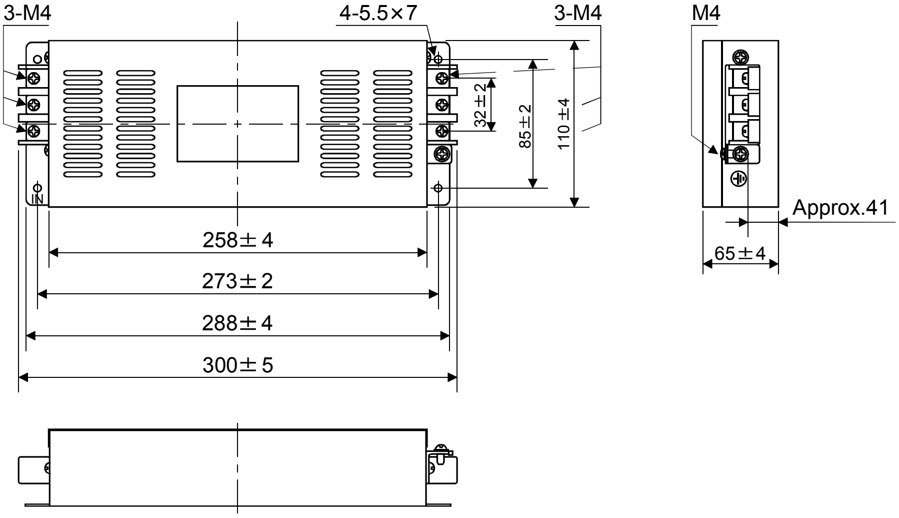
2. The example is when a surge protector is connected.

(3) Outline drawing

(a) EMC filter

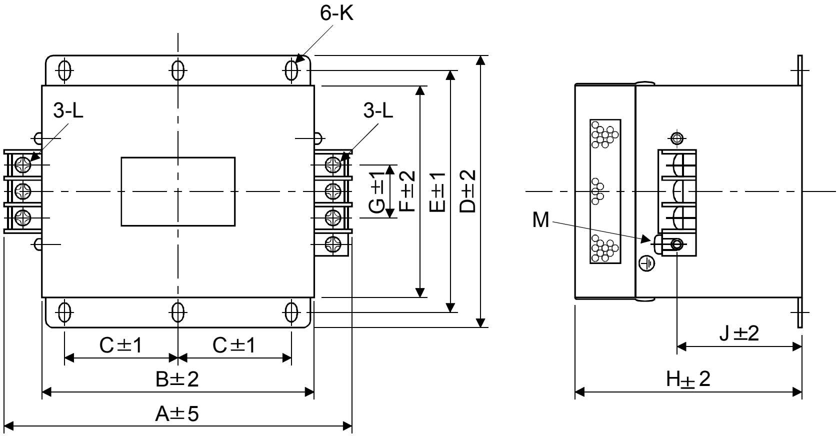
HF3010A-UN

[Unit: mm]



HF3030A-UN

[Unit: mm]



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

11.12 Junction terminal block MR-TB26A

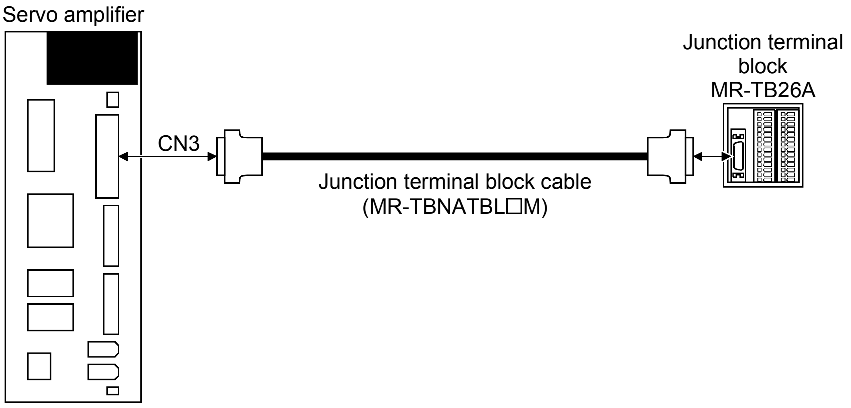
(1) Usage

When using a junction terminal block (MR-TB26A), always use it with a junction terminal block cable (MR-TBNATBL□M). To use a junction terminal block, mount it to the DIN rail.

MR－TBNATBL□M

Cable length
05: 0.5m
1 : 1m

Terminal numbers on a junction terminal block correspond with the pin numbers on the CN1 connector of a servo amplifier. The terminal symbol S is for the shield.



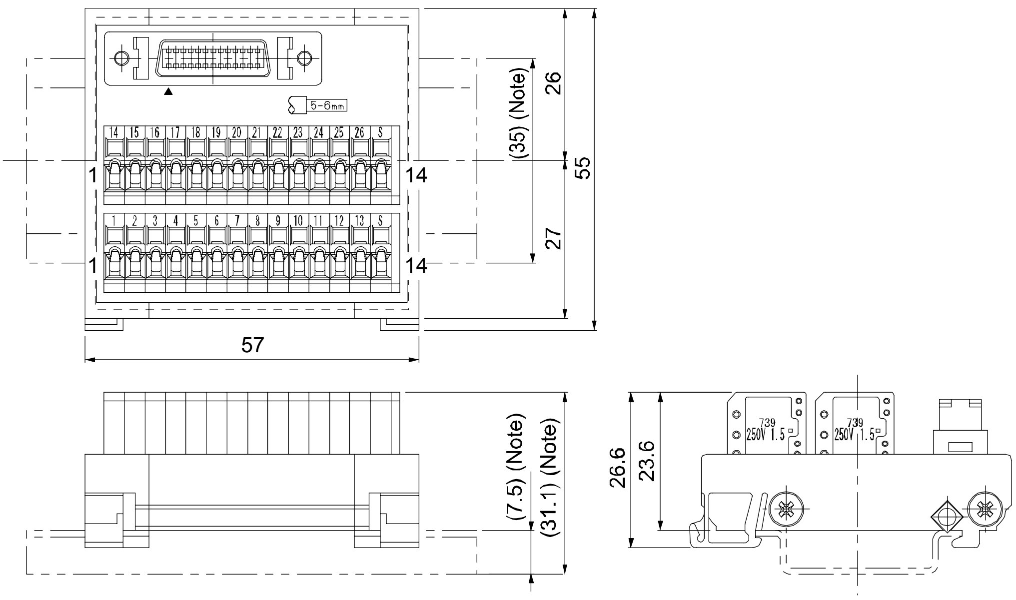
Ground the junction terminal block cable using the S terminal of the junction terminal block.

(2) Specifications

Item	Junction terminal block	MR-TB26A
Rating		30V/0.5A
Usable cables	Twisted wire	0.08mm^2 (AWG28) to 1.5mm^2 (AWG14)
	Solid wire	ϕ0.32 to 1.2mm
	Wire sheath outer diameter	Wire with ϕ3.4mm or less
Tool		210-619 (WAGO Company of Japan, LTD.) or equivalent 210-119SB (WAGO Company of Japan, LTD.) or equivalent
Stripped length		5 to 6mm

(3) Outline drawing

[Unit: mm]



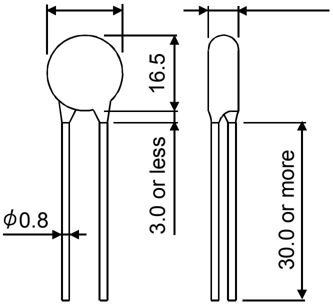
Note. Values in parenthesis are the sizes when installed with a 35mm DIN rail.

11.13 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 (Panasonic)
TNR-10V221K (Nippon chemi-con)
Outline drawing [mm] (ERZ-C10DK221)

MEMO

12. ABSOLUTE POSITION DETECTION SYSTEM

⚠CAUTION

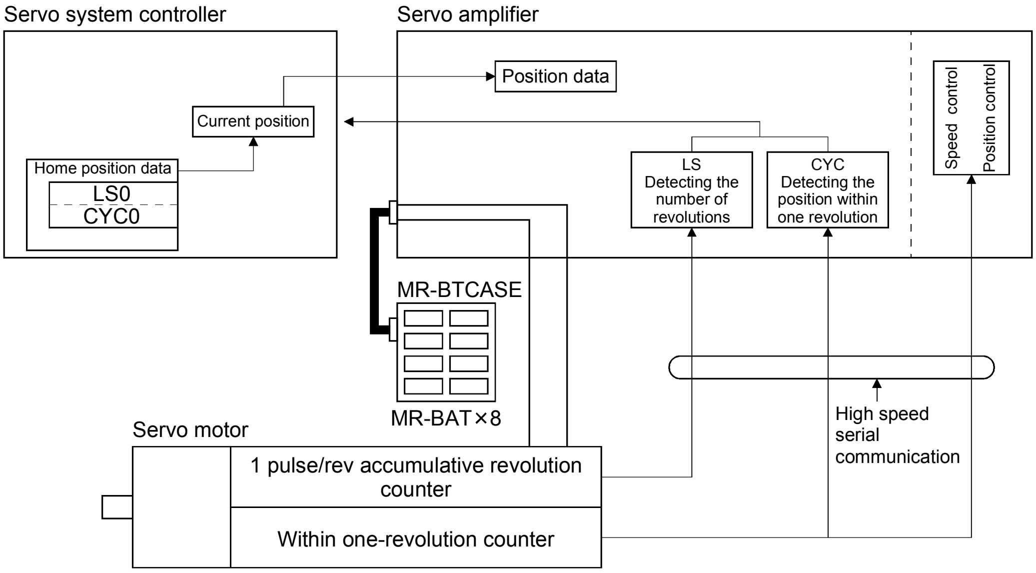
- If an absolute position erase alarm (25.1) or absolute position counter warning (E3.☐) has occurred, always perform home position setting again. Not doing so can cause runaway. Not doing so may cause unexpected operation.

POINT

- If the encoder cable is disconnected, absolute position data will be lost in the following servo motor series. HF-MP, HF-KP, HF-SP, HC-UP and HC-LP. After disconnecting the encoder cable, always execute home position setting and then positioning operation.

12.1 Features

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 servo system controller power is on or off.
Therefore, once home position return is made at the time of machine installation, home position return is not needed when power is switched on thereafter.
If a power failure or a fault occurs, restoration is easy.



12.2 Specifications

⚠WARNING

- Before wiring or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, always confirm from the front of the servo amplifier, whether the charge lamp is off or not.

⚠CAUTION

- Do not have new and old batteries installed together.
- When replacing batteries, replace all batteries by new batteries.

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.

(1) Specification list

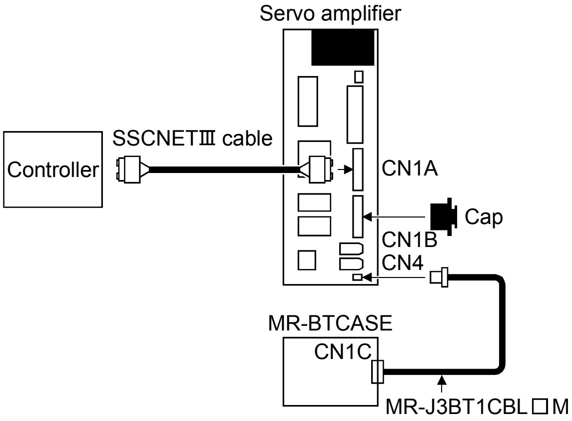
Item	Description
System	Electronic battery backup system
Battery unit	MR-BAT: Lithium battery (primary battery, nominal＋3.6V)×8 MR-BTCASE: Battery case
Maximum revolution range	Home position ±32767 rev.
(Note 1) Maximum speed at power failure	3000r/min
(Note 2) Battery backup time	Approx. 10,000 hours (battery life with power off)
(Note 3) Battery life	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.

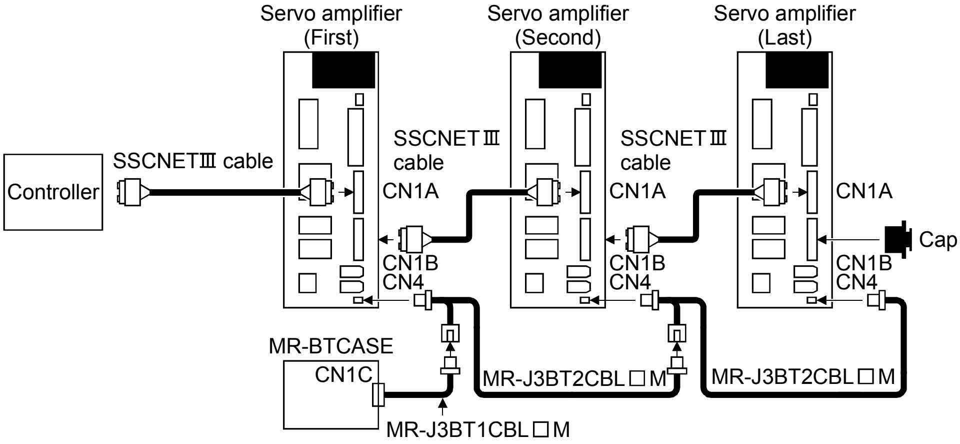
2. Time to hold data by a battery with power off. Replace battery within 3 years since the operation start whether power is kept on/off. If the battery is used out of specification, the absolute position lost (25) may occur.
3. Quality of battery degrades by the storage condition. It is recommended to connect and use battery in the servo amplifier within 2 years from the production date. The life of battery is 5 years from the production date regardless of the connection.

(2) Configuration

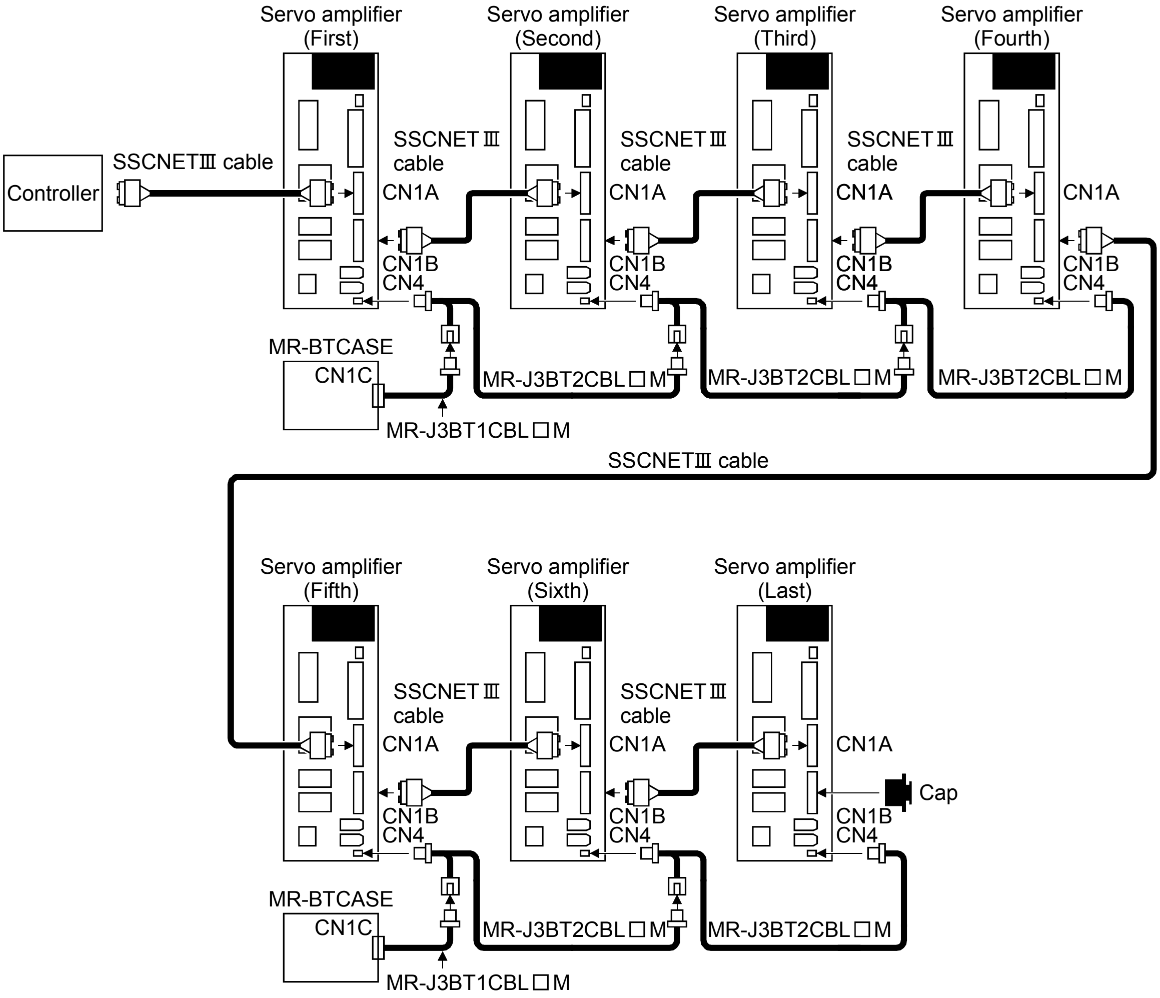
(a) When using one servo amplifier



(b) When using two to four servo amplifiers

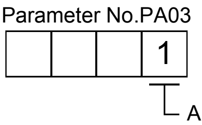


(c) When using five or more servo amplifiers



(3) Parameter setting

Set "□□□1" in parameter No.PA03 to make the absolute position detection system valid.



Absolute position detection system selection
0: Used in incremental system
1: Used in absolute position detection system

12.3 Assembling a battery unit

⚠CAUTION

- Do not have new and old batteries installed together.
- When replacing batteries, replace all batteries by new batteries.

POINT

- Always install eight MR-BAT batteries to a MR-BTCASE battery case.

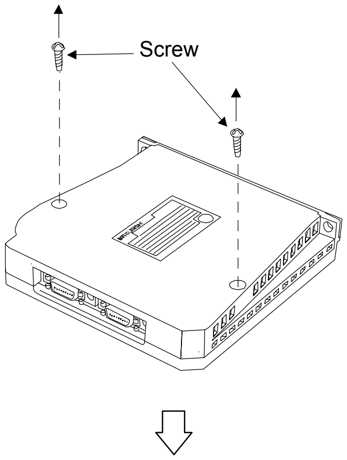
12.3.1 Required items

Product	Model	Use	Remarks
Battery case	MR-BTCASE	1	MR-BTCASE is a case that holds eight MR-BAT batteries and connect them to the connector.
Battery	MR-BAT	8	Lithium battery (primary battery, nominal＋3.6V)

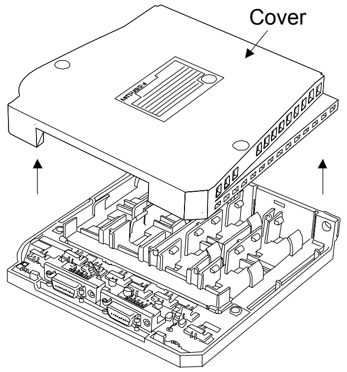
12.3.2 Disassembly and assembly of the battery case MR-BTCASE

(1) Disassembly of the case

MR-BTCASE is shipped assembled. To install MR-BATs, the case needs to be disassembled.

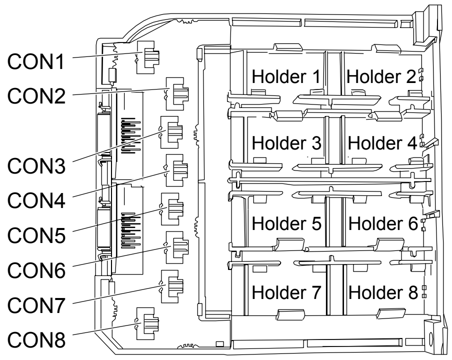


Remove the two screws using a Phillips screwdriver.

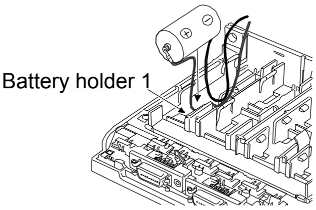


Remove the cover.

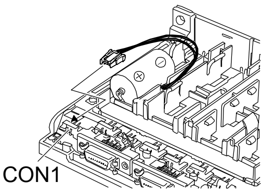
Parts name



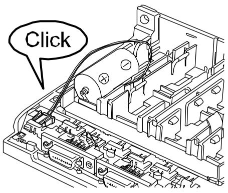
(2) Installation of MR-BAT



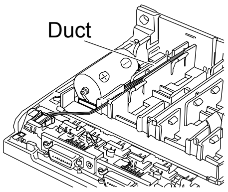
Securely insert MR-BAT to the battery holder 1.



Push the MR-BAT connector into CON1.

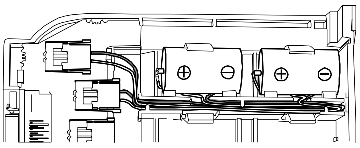


Confirm the click sound at this point.
The connector has to be connected in the right direction.
If the connector is pushed forcefully in the wrong direction, the connector will break.

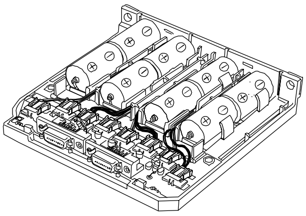


Place the MR-BAT lead wire to the duct designed to store lead wires.

Install other seven MR-BATs in the same manner.



Bring out the lead wire from the space between the ribs, and bend it as shown above to store it in the duct. Connect the lead wire to the connector. Be careful not to get the lead wire caught in the case or other parts.

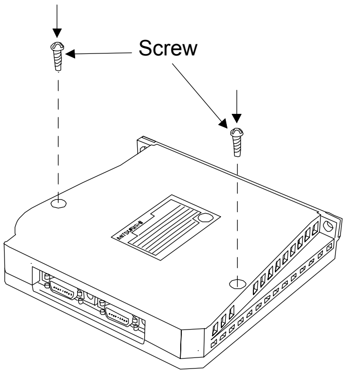


(3) Assembly of the case

After all MR-BATs are installed, fit the cover and insert screws into the two holes and tighten them.

POINT

- When assembling the case, be careful not to get the lead wires caught in the fitting parts or the screwing parts.



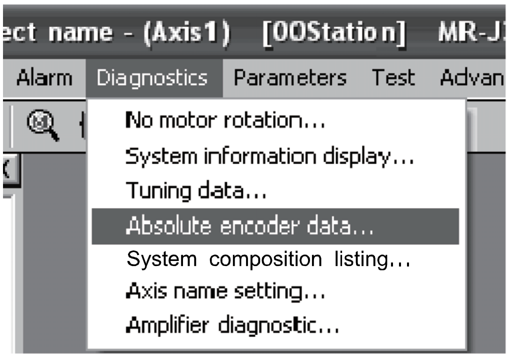
12.3.3 Battery transportation

Refer to appendix 5 and 6 for battery transportation and the new EU Battery Directive.

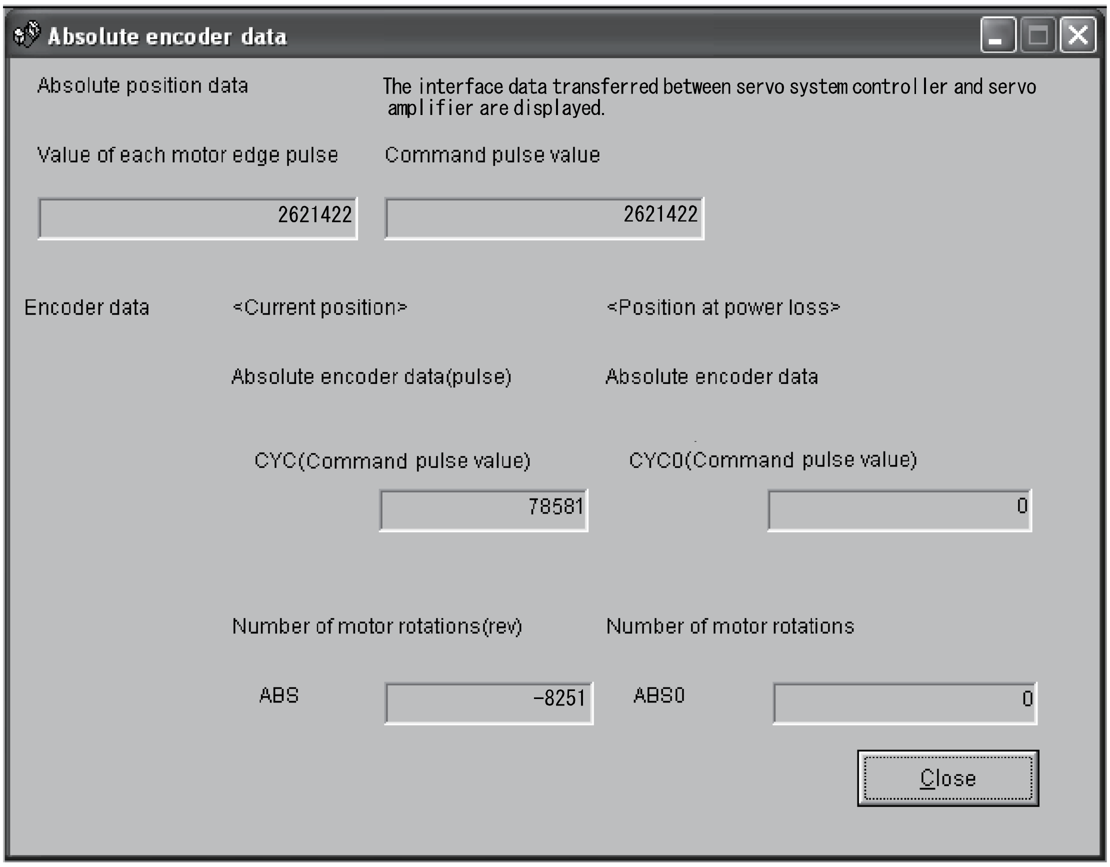
12.4 Confirmation of absolute position detection data

You can confirm the absolute position data with MR Configurator.
Choose "Diagnostics" and "Absolute Encoder Data" to open the absolute position data display screen.

(1) Choosing "Diagnostics" in the menu opens the sub-menu as shown below:



(2) By choosing "Absolute Encoder Data" in the sub-menu, the absolute encoder data display window appears.


Absolute encoder data

Absolute position data

The interface data transferred between servo system controller and servo amplifier are displayed.

Value of each motor edge pulse: 2621422

Command pulse value: 2621422

Encoder data

<Current position>

Absolute encoder data(pulse)

CYC(Command pulse value): 78581

Number of motor rotations(rev)

ABS: -8251

<Position at power loss>

Absolute encoder data

CYC0(Command pulse value): 0

Number of motor rotations

ABS0: 0

(3) Press the "Close" button to close the absolute encoder data display window.

13. USING A LINEAR SERVO MOTOR

13.1 Safety instructions

(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. 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 linear 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 linear 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.
- 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 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 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

⚠WARNING

- The linear servo motor uses a strong magnet on the secondary side. Therefore, not only the linear servo motor installation operators but also the machine operators must use abundance of caution. For example, one who uses a medical device like a pacemaker must keep away from the machine.
- The permanent magnet on the secondary side makes the magnetic bodies generate suction. Use caution with accidents so as not to get your hand stuck.
- The performance is not guaranteed if the specified servo amplifier and linear servo motor are not combined. If used with unspecified combination, the servo amplifier or linear servo motor may be damaged. Depending on the case, it can be out of control and operate unexpectedly, resulting in extremely dangerous condition.
- Under the packaged condition (cardboard) delivered from our company, the magnet on the secondary side does not have a serious effect on the outside. Before mounting to the machine, however, magnetic bodies (including tools) must be kept away from the secondary side (magnetic). The secondary side (magnetic) can have as double suction power as mounted normally, which may cause a serious injury. To avoid this, pay full attention to the ambience of workplace.

⚠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, linear 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.
- The linear servo motor installation operators and machine operators must not work wearing electronic devices (watch, calculator, personal computer, etc.) and magnetic recording media (IC card, magnetic card, floppy disc, etc.) and must not bring them around a magnetic. The magnetic influence may cause the operation failure or malfunction.
- When the protective function is operated, turn off the power immediately and eliminate its cause, and then turn it on again. If the linear servo motor is continued operating without eliminating the cause, it may run unexpectedly and results in a damage and injury.
- Securely attach the linear servo motor to the machine. If attach insecurely, it may come off during operation.

(4) Additional instructions

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

(a) 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 linear servo motor by the cables, shaft or encoder.
- 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 linear 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 linear servo motor which has been damaged or has any parts missing.
- Do not block the intake and exhaust areas of the servo amplifier. Doing so may cause faults.
- Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier and linear servo motor.
- Do not drop or strike servo amplifier or linear servo motor. Isolate from all impact loads.
- The protection method of the linear servo motor is IP00. Take necessary measures against dust, oil, etc. (Refer to section 13.4.1(2) Installation direction.)
- When mounting the secondary side (magnet), use nonmagnetic tools.
- Securely attach the linear servo motor to the machine. If attach insecurely, the linear servo motor may come off during operation.
- Do not modify the linear servo motor.
- Take safety measures, e.g. provide covers, to prevent accidental access to the linear servo motor during operation.
- The dynamic brake can be applied to the linear servo motor, but the coasting distance becomes longer when the moving body is heavy or when the speed is high. It may result in crashing into the stroke edge, which is highly dangerous. Install the anti-crash mechanism such as an air brake or an electric/mechanical stopper such as a shock absorber to reduce the shock of movable parts. (No linear servo motor with an electromagnetic brake is available.)
- The magnetic suction power acting between the primary side (coil) and the secondary (magnet) is always acting even when the linear servo motor power is not turned on. Because of this, the machine must be designed to be rigid enough to resist the magnetic suction power and maintain the accuracy.
- The running load by friction increases in proportion to the increase of the magnetic suction power, so the design must be made to decrease as much friction as possible, for example, by mounting guides with high accuracy.
- Do not use for vertical motion applications since magnetic poles cannot be detected with a vertical application.

⚠CAUTION

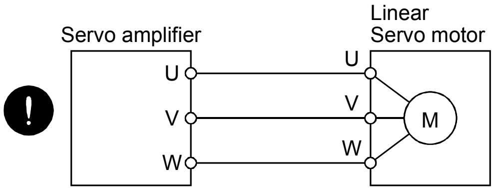
- Install the linear servo motor the way in which the thrust acts on the gravity center of the movable part. When the thrust does not act on the gravity center of the movable part, the moment is generated.
- Magnetic chips such as iron fragments can be attached to the permanent magnet on the secondary side, which may cause a malfunction. In the environment like this, take measures against the attachment and entry of magnetic chips.
- When the linear servo motor is operated over a long term under the condition where water for cutting or lubrication oil is splashed or where oil mist or dew condensation occurs due to supercooling or high humidity, insulation deterioration or other failures may be caused. Prevent the linear servo motor from oil and dust with a cover and take measures against dew condensation.
- More careful measures against oil and dust must be taken for the linear encoder than the linear servo motor. For details, please contact the linear encoder manufacturer individually.
- The moving direction of the linear servo motor and linear encoder must be matched. Otherwise, the linear servo motor may run unexpectedly.
- When two or more secondary side (magnet) is mounted, set the mounting screw accumulative pitch tolerance within ±0.2mm. Clearance may be left between the secondary sides (magnets) depending on the mounting method and the numbers.
- Do not hit the primary side (coil) on the stopper. The primary side may be damaged. Design the machine so that the stopper is hit on the top table attached to the primary side (coil).
- Tap holes on the linear servo motor are for machine installation. Do not use for other purposes.
- Do not touch the linear servo motor with wet hands.
- For installation, use all screw halls and tap holes prepared on the linear servo motor.
- When the equipment has been stored for an extended period of time, contact your local sales office.
- When you keep or use it, please fulfill the following environmental conditions.

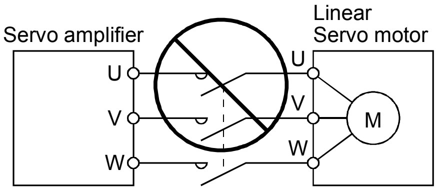
<table>
<tr><th colspan="3" rowspan="2">Items</th><th colspan="3">Environmental conditions</th></tr>
<tr><th>Servo amplifier</th><th colspan="2">Linear servo motor</th></tr>
<tr><td rowspan="4">Ambient temperature</td><td rowspan="2">In operation</td><td>[℃]</td><td>0 to 55 (non-freezing)</td><td colspan="2">0 to 40 (non-freezing)</td></tr>
<tr><td>[°F]</td><td>32 to 131 (non-freezing)</td><td colspan="2">32 to 104 (non-freezing)</td></tr>
<tr><td rowspan="2">In storage</td><td>[℃]</td><td>－20 to 65 (non-freezing)</td><td colspan="2">－15 to 70 (non-freezing)</td></tr>
<tr><td>[°F]</td><td>－4 to 149 (non-freezing)</td><td colspan="2">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="2">80%RH or less
(non-condensing)</td></tr>
<tr><td colspan="2">In storage</td><td colspan="3">90%RH or less (non-condensing)</td></tr>
<tr><td colspan="3">Ambience</td><td colspan="3">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="3">Max. 1000m above sea level</td></tr>
<tr><td colspan="3">Vibration</td><td>5.9 m/s^2 or less
(directions of X, Y and Z)</td><td>LM-H2 Series
LM-U2 Series</td><td>X・Y : 49 m/s^2</td></tr>
</table>

(b) Wiring

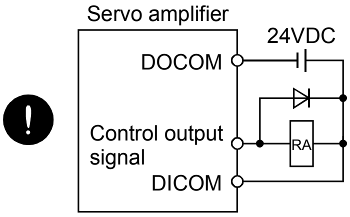
⚠ CAUTION

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

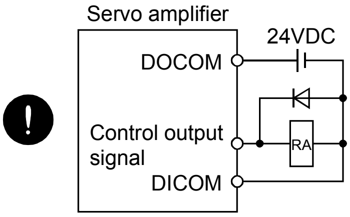




- Do not connect AC power directly to the linear servo motor. Otherwise, a fault may occur.
- The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



For the sink output interface



For the source output interface

- 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.
- The cables such as power cables deriving from the primary side (coil) cannot stand the long-term flexing action. Avoid the flexing action by fixing to the movable part, etc. Also, use the cable that stands the long-term flexing action for the wiring to the servo amplifier.

(c) 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.

(d) Usage

⚠CAUTION

- Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately.
- 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 linear servo motor.

(e) 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 linear servo motor with electromagnetic brake or an external brake mechanism for the purpose of prevention.
- 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).

(f) Maintenance, inspection and parts replacement

⚠CAUTION

- When the linear servo motor is damaged, it must be replaced. Contact your local sales office.
- 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 contact your local sales office.

(g) Disposal

⚠CAUTION

- The linear servo motor uses a strong magnet on the secondary side. Therefore, not only the operators but also the people around the work place must use abundance of caution when the linear servo motor is disassembled or discarded. For example, one who uses a medical device like a pacemaker must keep away from the machine.
- The permanent magnet on the secondary side makes the magnetic bodies (primary side [coil] and secondary side [magnet]) generate suction. Use special caution with the handling of the secondary side which is demagnetized before/after disassembly.
- When the linear servo motor is disassembled or discarded, do not put magnetic bodies (including the primary side [coil], the other secondary sides [magnet] and tools) close to the secondary side (magnet). The secondary side (magnetic) can have as double suction power as mounted normally, which may cause a serious injury. In all cases, pay full attention to the ambience of workplace to avoid this.
- A suction power is generated when magnetic bodies (including tools) are put near the permanent magnet on the secondary side. Be sure to use nonmagnetic tools for the disassembly and disposal of the linear servo motor or the work around it. These are required for the improvement of workability and safety ensuring.
- The personnel who work for the disassembly or disposal of the linear servo motor or those who are around the workplace must not work wearing electronic devices (watch, calculator, personal computer, etc.) and magnetic recording media (IC card, magnetic card, floppy disc, etc.) and must not bring them around the secondary side (magnet). Magnetic influence may cause the operation failure or malfunction.
- The servo amplifier and the primary side (coil) of the linear servo motor must be discarded in accordance with "About processing of waste".
- Since the secondary side (magnet) of the linear servo motor uses the permanent magnet, demagnetize the entire secondary side (magnet) by heating over 300℃ (572℉), then discard in accordance with "About processing of waste".
- Do not touch the secondary side after the demagnetization of the secondary side (magnet) by heating over 300℃ (572℉) until it becomes cool enough. Otherwise, you may get burnt.

(h) General instruction

⚠CAUTION

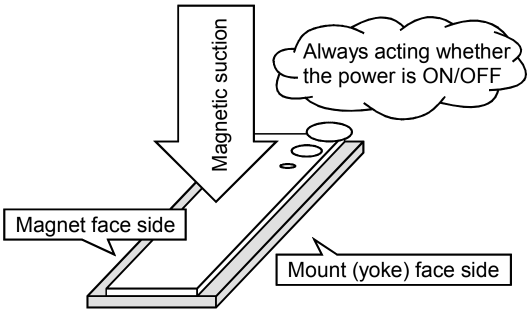
- To illustrate details, the equipment in the diagrams of this Specifications and Instruction Manual may have been drawn without covers and safety guards. When the equipment is operated, the covers and safety guards must be installed as specified. Operation must be performed in accordance with this Specifications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

13.2 Handling of Linear Servo Motor

(1) Magnetic suction

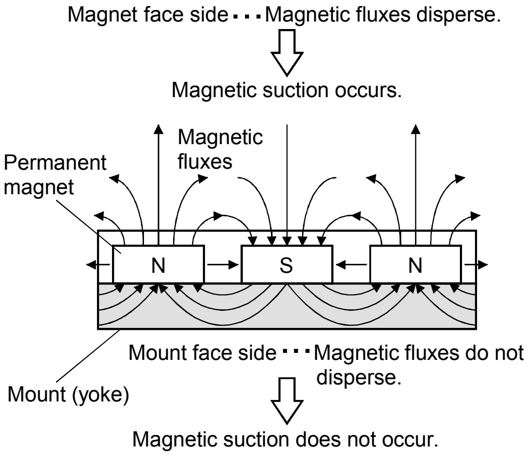
The secondary side of the linear servo motor contains a strong permanent magnet, so a magnetic suction power (power by which a magnet attracts magnetic bodies) is generated toward magnetic bodies such as iron.

This magnet suction is always acting whether the linear servo motor power is turned ON/OFF.



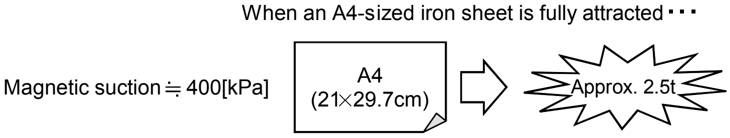
The magnetic fluxes generating from the permanent magnet disperse in the air from the magnet face side (facing the primary side), and most of them do not leak to the mount (yoke) side for its structure.

Because of this, a magnetic suction power occurs on the magnet face side of the secondary side and does not on the mount (yoke) face side.



The permanent magnet used for the linear servo motor is very strong.

When an A4-sized iron sheet is fully attracted, the magnetic suction power becomes as high as 2.5t. Use abundance of caution with the handling.

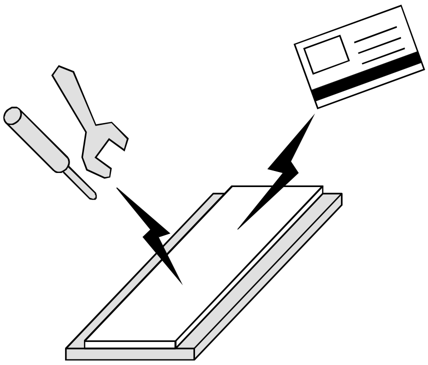


(2) For the safety

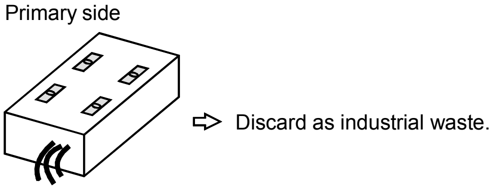
The magnetic suction power is in inverse proportion to square of the distance to a magnetic body, so it drastically increases when the distance becomes small.

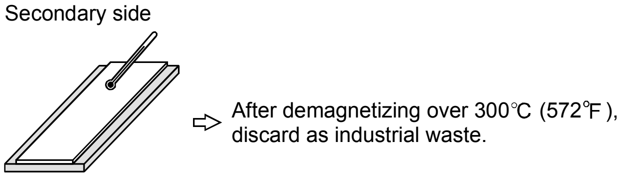
When mounting the secondary side of the linear side motor, ensure the sufficient distance from the magnetic bodies around it and securely fix those magnetic bodies.

(3) Notes on handling
- (a) Handling must be done by the engineers who have a full knowledge of this product.
- (b) One who uses a medical device like a pacemaker must keep away from the machine and equipment.
- (c) Do not wear metals such as watch, pierced earring, necklace, etc.
- (d) Use nonmagnetic tools.
  (Example) Explosion-proof beryllium copper alloy safety tools: bealon (NGK Insulators, Ltd.)
- (e) Do not put magnetic card, watch, portable phone, etc close to the motor.
- (f) Do not add a shock or a stress on the mold part of the product. (Otherwise, the linear servo motor may be damaged.)
- (g) Display "Note a strong magnetic." or the like and take action by giving cautions to the surrounding, etc.



(4) Disposal of linear servo motor
- (a) The primary side must be discarded as industrial waste.
- (b) The secondary side must be discarded as industrial waste after demagnetizing the secondary side over 300℃ (572℉).
- (c) When the demagnetization is not possible, pack into a box and return to us.
- (d) Do not leave the product.





13.3 Functions and configuration

13.3.1 Summary

In fields of semiconductor and liquid crystal related equipment, installed machine, etc. with strong demands for high accuracy, high-speed and high efficiency, the system using the linear servo motor for drive shaft is increasing. Since the linear servo system can obtain the characteristics of the high-speed and the high acceleration/deceleration greater than the ball screw drive system, and does not have a ball screw wear which is a weak point in the ball screw drive system, it can extend the life of the equipments. In addition, a response error does not occur and so the high accuracy system can be established.
The following shows the differences between the linear servo motor and the rotating servo motor.

Classification	Item	Differences		Remarks
		Linear servo motor	Rotating servo motor	
External I/O signal	Stroke limit input signal (FLS, RLS)	Required (when magnetic pole is detected)	Not required	Automatically turns ON in the parameter setting.
Motor pole adjustment	Magnetic pole detection operation	Required	Not required (adjusted at shipment)	Automatically executed at the first servo-on after turning the power on. For the absolute position linear encoder, the magnetic polarity detection can be made invalid in the setting of parameter No.PS01. (Refer to section 13.7.2 (2)(a).)
Home position return	Home position reference position	1048576 pluses unit (factory setting)	Servo motor 1 rotation unit	The home position pitch can be changed in the parameter settings. (Refer to section 13.7.3.)
Absolute position detection system	Battery for absolute position encoder (MR-J3BAT)	Not required	Required	The following alarm/warning is not detected. ・Absolute position erase (25.1) ・Battery cable disconnection warning (92.1) ・Battery warning (9F.1) ・Absolute position counter warning (E3.□)
Alarm/warning	Alarm/warning designed exclusively for the linear servo motor	Addition		Alarm/warning which is added or the contents is changed ・Encoder error1 (16.□) ・Encoder error2 (20.□) ・Initial magnetic pole detection error (27.□) ・Linear encoder error2 (28.□) ・Linear encoder error1 (2A.□) ・Linear servo control error (42.□) ・Linear servo motor overheat (46.1) ・Overload1 (50.□) ・Overload2 (51.□) ・Linear servo motor overheat warning (E2.1)
Auto tuning	Load inertia moment ratio (J)	Load to motor mass ratio	Load inertia moment ratio	

Classification	Item		Differences		Remarks
			Linear servo motor	Rotating servo motor	
MR Configurator 221 (Ver. C0 or later)	Motor speed (data display, setting)		Unit: mm/s	Unit: r/min	
	Test operation function	Positioning operation	Available	Available	
		Motor-less operation	Available	Not Available	
		JOG operation	Not available	Available	
		Program operation	Available	Available	

13.3.2 Combinations of Servo Amplifiers and Linear Servo Motors

(1) LM-H2 series

Linear servo motor		Servo amplifier
Primary side (coil)	Secondary side (magnet)	
LM-H2P1A-06M-4SS0	LM-H2S10-288-4SS0, LM-H2S10-384-4SS0, LM-H2S10-480-4SS0 LM-H2S10-768-4SS0	MR-J3W-44B MR-J3W-77B (Note)
LM-H2P2A-12M-1SS0	LM-H2S20-288-1SS0, LM-H2S20-384-1SS0, LM-H2S20-480-1SS0 LM-H2S20-768-1SS0	MR-J3W-44B MR-J3W-77B (Note)
LM-H2P2B-24M-1SS0		MR-J3W-77B
LM-H2P3A-24M-1SS0	LM-H2S30-288-1SS0, LM-H2S30-384-1SS0, LM-H2S30-480-1SS0 LM-H2S30-768-1SS0	MR-J3W-77B

Note. This servo motor can be used by setting "☐☐1☐" to parameter No.Po04.

(2) LM-U2 series

Linear servo motor		Servo amplifier
Primary side (coil)	Secondary side (magnet)	
LM-U2PAB-05M-0SS0	LM-U2SA0-240-0SS0, LM-U2SA0-300-0SS0, LM-U2SA0-420-0SS0	MR-J3W-22B
LM-U2PAD-10M-0SS0		MR-J3W-44B MR-J3W-77B (Note)
LM-U2PAF-15M-0SS0		
LM-U2PBB-07M-1SS0	LM-U2SB0-240-1SS0, LM-U2SB0-300-1SS0, LM-U2SB0-420-1SS0	MR-J3W-22B
LM-U2PBD-15M-1SS0		MR-J3W-77B
LM-U2PBF-22M-1SS0		

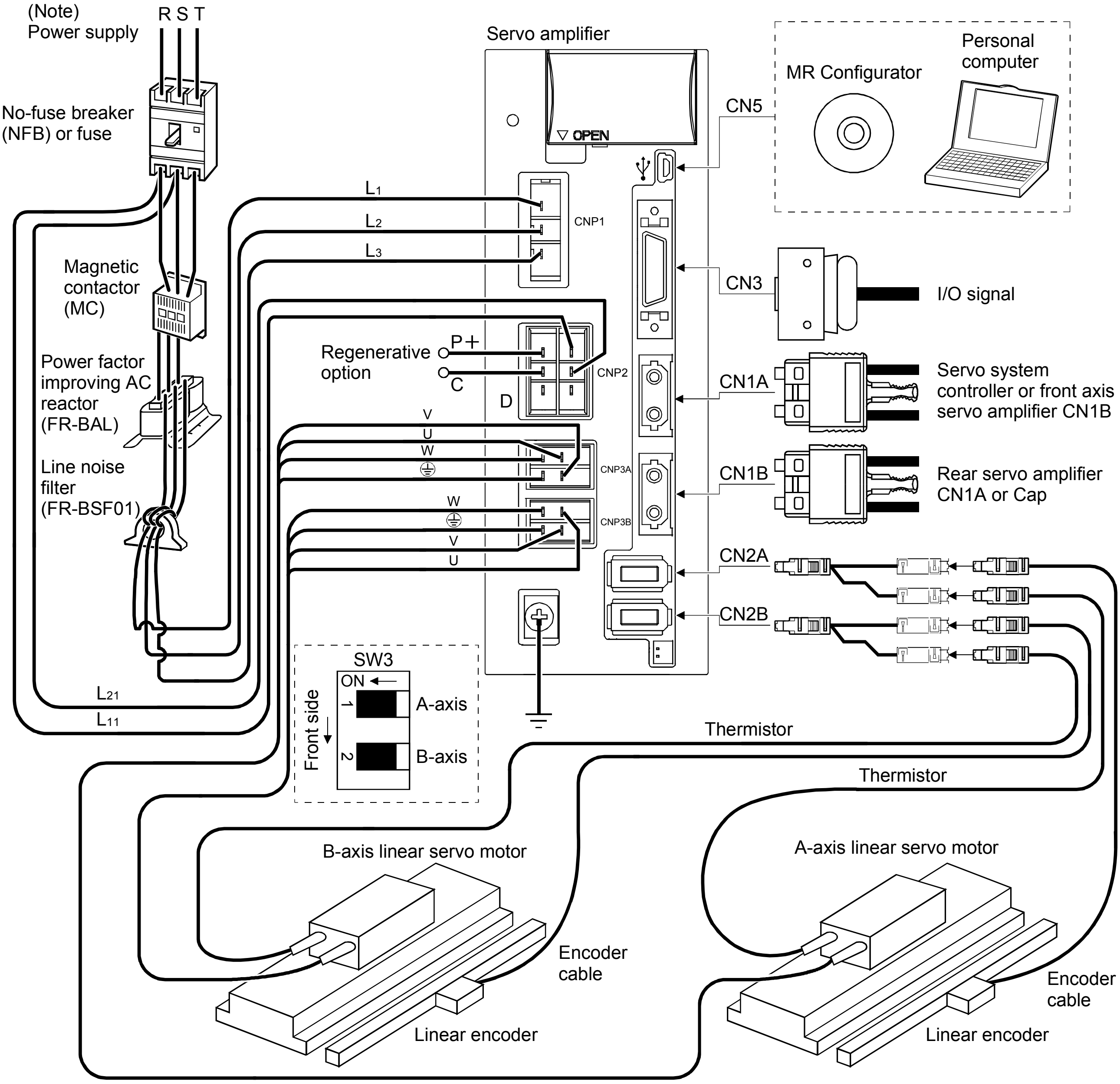
Note. This servo motor can be used by setting "☐☐1☐" to parameter No.Po04.

13.3.3 Configuration including auxiliary equipment

CAUTION	· Connecting an incorrect servo amplifier to CNP3A, CNP3B, CN2A, or CN2B causes unexpected movement or an alarm.

POINT

- Equipment other than the servo amplifier and the servo motor are optional or recommended products.
- To use a linear servo motor, turn SW3 on.



Note. For 1-phase 200V to 230VAC, connect the power supply to L_1 · L_2 and leave L_3 open. Refer to section 1.3 for the power supply specification.

13.4 Linear servo motor

The secondary side of the linear servo motor contains a strong permanent magnet. The wrong handling may cause serious accidents, which is extremely dangerous. Please read this chapter carefully beforehand and use it correctly.

13.4.1 Handling

(1) General instructions

⚠WARNING	・The linear servo motor uses a strong magnet on the secondary side. Therefore, not only the linear servo motor installation operators but also the machine operators must use abundance of caution. For example, one who uses a medical device like a pacemaker must keep away from the machine. ・The permanent magnet on the secondary side makes the magnetic bodies generate suction. Use caution with accidents so as not to get your hand stuck. ・The performance is not guaranteed if the specified servo amplifier and linear servo motor are not combined. If used with unspecified combination, the servo amplifier or linear servo motor may be damaged. Depending on the case, it can be out of control and operate unexpectedly, resulting in extremely dangerous condition.

⚠CAUTION	・The linear servo motor installation operators and machine operators must not work wearing electronic devices (watch, calculator, personal computer, etc.) and magnetic recording media (IC card, magnetic card, floppy disc, etc.) and must not bring them around a magnetic. The magnetic influence may cause the operation failure or malfunction. ・The protection method of the linear servo motor is IP00. Take necessary measures against dust, oil, etc. (Refer to section 13.4.1 (2) Installation direction.) ・When the linear servo motor is damaged, it must be replaced. Contact your local sales office. ・When the protective function is operated, turn off the power immediately and eliminate its cause, and then turn it on again. If the linear servo motor is continued operating without eliminating the cause, it may run unexpectedly and results in a damage and injury. ・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, linear 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. ・The primary side (coil) and secondary side (magnet) may be damaged by a fall or shock.

(2) Instructions on design

⚠ CAUTION

- The dynamic brake can be applied to the servo amplifier, but the coasting distance becomes longer when the moving body is heavy or when the speed is high. It may result in crashing into the stroke edge, which is highly dangerous. Install the anti-crash mechanism such as an air brake or an electric/mechanical stopper such as a shock absorber to reduce the shock of movable parts. (No linear servo motor with an electromagnetic brake is available.)
- The magnetic suction power acting between the primary side (coil) and the secondary (magnet) is always acting even when the motor power is not turned on. Because of this, the machine must be designed to be rigid enough to resist the magnetic suction power and maintain the accuracy.
- The running load by friction increases in proportion to the increase of the magnetic suction power, so the design must be made to decrease as much friction as possible, for example, by mounting guides with high accuracy.
- Do not use for vertical motion applications since magnetic poles cannot be detected with a vertical application.
- Install the linear servo motor the way in which the thrust acts on the gravity center of the movable part. When the thrust does not act on the gravity center of the movable part, the moment is generated.
- Design the mounting dimensions to be satisfied for the primary side (coil) and secondary side (magnet).
- The cables such as power cables deriving from the primary side (coil) cannot stand the long-term flexing action. Avoid the flexing action by fixing to the movable part, etc. Also, use the cable that stands the long-term flexing action for the wiring to the servo amplifier.
- Magnetic chips such as iron fragments can be attached to the permanent magnet on the secondary side, which may cause a malfunction. In the environment like this, take measures against the attachment and entry of magnetic chips.
- When the linear servo motor is operated over a long term under the condition where water for cutting or lubrication oil is splashed or where oil mist or dew condensation occurs due to supercooling or high humidity, insulation deterioration or other failures may be caused. Prevent the linear servo motor from oil and dust with a cover and take measures against dew condensation.
- More careful measures against oil and dust must be taken for the linear encoder than the linear servo motor. For details, please contact the linear encoder manufacturer individually.
- The moving direction of the linear servo motor and linear encoder must be matched. Otherwise, the motor may run unexpectedly.
- When two or more secondary side (magnet) is mounted, set the mounting screw accumulative pitch tolerance within ±0.2mm. Clearance may be left between the secondary sides (magnets) depending on the mounting method and the numbers.
- Do not hit the primary side (coil) on the stopper. The primary side may be damaged. Design the machine so that the stopper is hit on the top table attached to the primary side (coil).

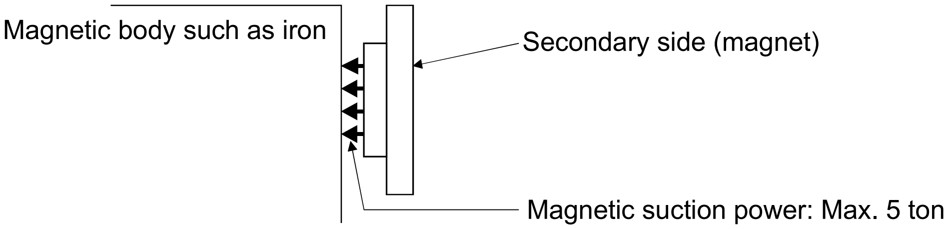
POINT

- To execute the high accuracy positioning, ensure as much rigidity of machine as possible and make the machine resonance point higher.
- Make the moving parts as light as possible and make the base parts heavier and sturdier.
- As the operation and accuracy of machine could have an adverse effect, design it in order to make the thrust center of the linear servo motor closer to a moving body's gravity center.
- When the mounting rigidity of the linear encoder is not enough, machine vibration, etc. affect the feedback signal, and the desired performance may not be satisfied. As it is also the same case when the linear encoder is susceptible to electric noise, set up and mount the linear encoder so that it is affected by as little vibration and noise as possible.
- Establish the structure to sustain the high-speed and the high acceleration and deceleration.

(3) Instructions on installation operation

⚠WARNING

- Under the packaged condition (cardboard) delivered from our company, the magnet on the secondary side does not have a serious effect on the outside. Before mounting to the machine, however, magnetic bodies (including tools) must be kept away from the secondary side (magnetic). The secondary side (magnetic) can have as double suction power as mounted normally, which may cause a serious injury. To avoid this, pay full attention to the ambience of workplace.



- The permanent magnet on the secondary side makes the magnetic bodies generate suction, which may cause troubles such as having hands pinched, etc. For the installation of the linear servo motor and the work around it, be sure to use nonmagnetic tools. These are required for the improvement of workability and safety ensuring. Use special caution with mounting the primary side (coil) after the secondary side (magnet) has mounted. Use the screw which strength must be a high tensile strength steel level of SCM435 for its material and the lower yield point 900 [N/mm^2] or more. (Example) Explosion-proof beryllium copper alloy safety tools: Manufactured by NGK Insulators, Ltd.
- To prevent electric shock, ground each equipment securely.

⚠CAUTION

- Do not install the servo motor, linear servo motor and regenerative resistor on or near combustibles. Otherwise a fire may cause.
- Securely attach the linear servo motor to the machine. If attach insecurely, it may come off during operation.
- Install the servo amplifier in a load-bearing place in accordance with the Instruction Manual.
- Do not subject the servo amplifier and linear servo motor to drop impact or shock loads as they are precision equipment.
- Do not install or operate a faulty servo amplifier and linear servo motor.
- Use the equipment within the specified environmental condition range. (For the environmental condition, refer to section 1.2.)
- Tap holes on the linear servo motor are for machine installation. Do not use for other purposes.
- Do not touch the linear servo motor with wet hands.
- For installation, use all screw halls and tap holes prepared on the linear servo motor.
- When two or more secondary side (magnet) is mounted, set the mounting screw accumulative pitch tolerance within ±0.2mm. Clearance may be left between the secondary sides (magnets) depending on the mounting method and the numbers.

(4) Instructions on storage

⚠CAUTION

- Do not climb or stand on servo equipment. Do not put heavy objects on equipment.
- Be sure to follow the storage conditions (ambient temperature and humidity, etc.).
- Store the product in the environment where the rain water is prevented from splashing on and dust, oil, and chemical materials from attaching on.
- Do not strike servo amplifier or linear servo motor.
- Do not modify the linear servo motor.
- When the equipment has been stored for an extended period of time, contact your local sales office.

13.4.2 Inspection items

⚠WARNING

- Before wiring or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, 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

- When executing a megger test (insulation resistance test), disconnect the servo amplifier. Otherwise, a fault may occur.
- Do not disassemble and/or repair the equipment on customer side.
- The molded resin of the linear servo motor may lose the color. Though a fault may not occur only for losing the color, make inspections.

It is not until the linear servo motor is mounted in equipment (built-in) that it has functions as motor. As the protection method is IP00, it is recommended to make inspections and clean periodically.

(1) Inspections on primary side (coil)

(a) Attachment of water and oil
Check that the primary side (coil) and secondary side (magnet) have not got wet with water and oil. When the linear servo motor has got wet, the insulation on the primary side (coil) is deteriorated, which may cause failure. Make sure to establish the mechanical structure in which water and oil are not attached to the linear motor.

(b) Molded resin
Check for missing or cracks of the molded resin on the primary side (coil). As the insulation deterioration and such may cause failure when missing or cracks are found in the molded resin on the primary side (coil), replace the primary side (coil).

(c) Scratches of primary side (coil) facing secondary side (magnet)
Check the scratches of the primary side (coil) facing the secondary side (magnet). When the primary side (coil) facing the secondary side (magnet) has scratches, replace the primary side (coil). When a foreign matter is caught in the empty clearance between the primary side (coil) and the secondary side (magnet), a scratch occurs on the primary side (coil). In such case, take away the corresponding matter and establish the mechanical structure which does not catch such matters.
However, if the scratches of the primary side (coil) facing the secondary side (magnet) result in no more than the protective coating peeled off, they can be repaired.

(d) Loose mounting screws
Check for loose mounting screws on the primary side (coil). When the mounting screws on the primary side (coil) are loose, tighten the corresponding screws.

(e) Scratches and cracks of linear servo motor cables
Check for scratches and cracks of the linear servo motor cables. If the linear servo motor cables have any scratches or cracks, replace the corresponding cables. Especially when the cables are moved, make inspections periodically.

(2) Inspections on secondary side (magnet)

(a) Attachment of water and oil

Check that the primary side (coil) and secondary side (magnet) have not got wet with water and oil. When the linear servo motor has got wet, the insulation on the primary side (coil) is deteriorated, which may cause failure. Make sure to establish the mechanical structure in which water and oil are not attached to the linear motor.

(b) Exposure and lift of magnet

Check for the exposure and lift of the magnet on the secondary side (magnet). If the magnet on the secondary side (magnet) is exposed or lifted, replace the secondary side (magnet) immediately.

(c) Molded resin

1) Check for missing or cracks of the mold resin on the secondary side (magnet). (a) When missing or cracks are found in the molded resin on the secondary side (magnet), replace the secondary side (magnet).

2) Check for the scratches of the molded resin on the secondary side (magnet). When the magnet is exposed by the scratches of the molded resin on the secondary side (magnet), replace the secondary side (magnet). When a foreign matter is caught in the empty clearance between the primary side (coil) and the secondary side (magnet), a scratch occurs on the secondary side (magnet). In such case, take away the corresponding matter and establish the mechanical structure which does not catch such matters.

(d) Loose mounting screws

Check for loose mounting screws on the secondary side (magnet). When the mounting screws on the secondary side (magnet) are loose, tighten the corresponding screws.

(3) Inspections of linear encoder

The inspections of the linear encoder may be required. For the inspections of the linear encoder, contact the linear encoder manufacturer.

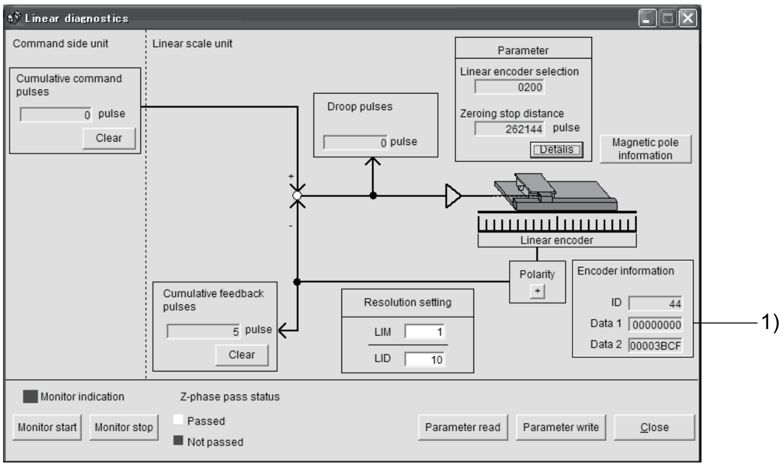
13.4.3 Replacement of linear servo motor on absolute position detection system

(1) Replacement of primary side (coil) or secondary side (magnet)
After replacing the primary side (coil) or the secondary side (magnet), perform the magnetic pole detecting operation again.

(2) Replacement of linear encoder
After replacing the linear encoder, perform the magnetic pole detecting operation again. When replacing the linear encoder, make sure to set a home position by controller.
The following indicates the procedures to check the mounting position.

(a) Checking mounting position of linear encoder
1) Before replacing the linear encoder, check the encoder information using the MR Configurator with the linear servo motor fixed at the specified position.
2) Replace the linear encoder so that the position gap should be ±0.1 mm, comparing before and after the replacement.
3) After replacing the linear encoder, check the encoder information using the MR Configurator again with the linear servo motor fixed at the specified position.
4) Check that the value calculated from the difference of the encoder information (resolution unit) before and after the replacement of the linear encoder is under ±0.1mm.

(b) Reading encoder information with MR Configurator
1) Select the "MR-J3-B Linear" from the system setting of MR Configurator.
2) Check that the personal computer is connected with the servo amplifier and select "Diagnostics" and then "Linear diagnostics".
The following window appears.



Cumulative command pulses 0 pulse
Droop pulses 0 pulse
Linear encoder selection 0200
Zeroing stop distance 262144 pulse
Cumulative feedback pulses 5 pulse
LIM 1
LID 10
ID 44
Data 1 00000000
Data 2 00003BCF

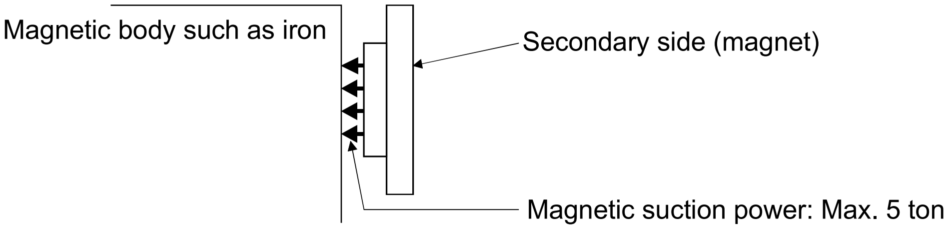
3) Data 1 (1) of the encoder information is read.

13.4.4 Instructions for discarding the linear servo motor

Demagnetize the secondary side (magnet) of the linear servo motor by heating over 300℃ (572℉), then discard it in accordance with Law for Promotion of Effective Utilization of Resources.

⚠ WARNING

- The linear servo motor uses a strong magnet on the secondary side. Therefore, not only the operators but also the people around the work place must use abundance of caution when the linear servo motor is disassembled or discarded. For example, one who uses a medical device like a pacemaker must keep away from the machine.
- The permanent magnet on the secondary side makes the magnetic bodies (primary side [coil] and secondary side [magnet]) generate suction.
  Use special caution with the handling of the secondary side which is demagnetized before/after disassembly.
- When the linear servo motor is disassembled or discarded, do not put magnetic bodies (including the primary side [coil], the other secondary sides [magnet] and tools) close to the secondary side (magnet). The secondary side (magnetic) can have as double suction power as mounted normally, which may cause a serious injury. In all cases, pay full attention to the ambience of workplace to avoid this.



- A suction power is generated when magnetic bodies (including tools) are put near the permanent magnet on the secondary side. Be sure to use nonmagnetic tools for the disassembly and disposal of the linear servo motor or the work around it. These are required for the improvement of workability and safety ensuring.

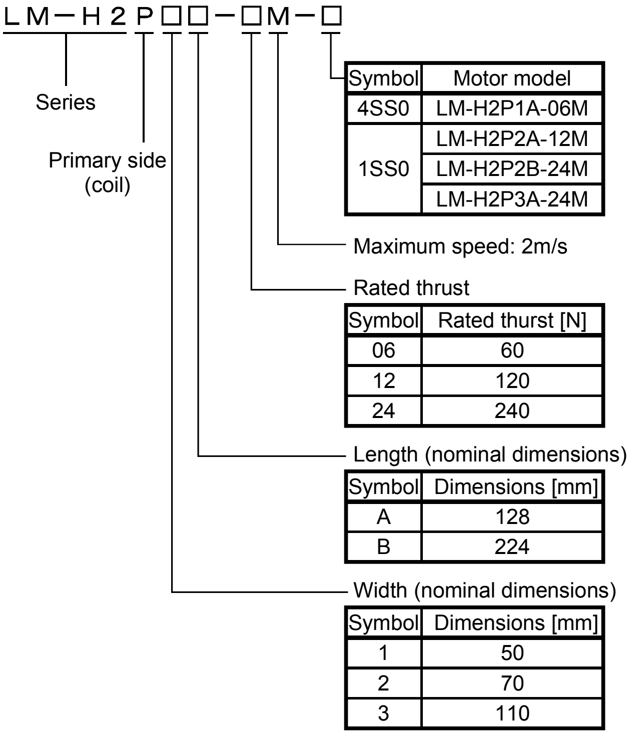
⚠ CAUTION

- The personnel who work for the disassembly or disposal of the linear servo motor or those who are around the workplace must not work wearing electronic devices (watch, calculator, personal computer, etc.) and magnetic recording media (IC card, magnetic card, floppy disc, etc.) and must not bring them around the secondary side (magnet). Magnetic influence may cause the operation failure or malfunction.
- When the linear servo motor is disassembled or discarded, use cautions in order to avoid accidents so as not to get your hand stuck.
- Do not touch the secondary side after the demagnetization of the secondary side (magnet) by heating over 300℃ (572℉) until it becomes cool enough. Otherwise, you may get burnt.

13.4.5 LM-H2 series

(1) Model code definition

(a) Primary side: coil



Symbol	Motor model
4SS0	LM-H2P1A-06M
1SS0	LM-H2P2A-12M
	LM-H2P2B-24M
	LM-H2P3A-24M

Rated thrust

Symbol	Rated thurst [N]
06	60
12	120
24	240

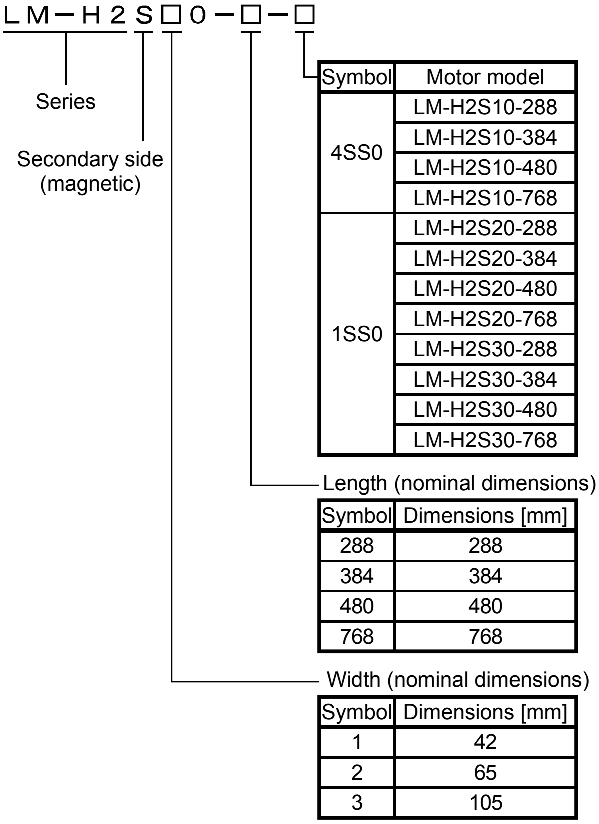
Length (nominal dimensions)

Symbol	Dimensions [mm]
A	128
B	224

Width (nominal dimensions)

Symbol	Dimensions [mm]
1	50
2	70
3	110

(b) Secondary side: magnet



Symbol	Motor model
4SS0	LM-H2S10-288
	LM-H2S10-384
	LM-H2S10-480
	LM-H2S10-768
1SS0	LM-H2S20-288
	LM-H2S20-384
	LM-H2S20-480
	LM-H2S20-768
	LM-H2S30-288
	LM-H2S30-384
	LM-H2S30-480
	LM-H2S30-768

Length (nominal dimensions)

Symbol	Dimensions [mm]
288	288
384	384
480	480
768	768

Width (nominal dimensions)

Symbol	Dimensions [mm]
1	42
2	65
3	105

(2) LM-H2 series specification list

Linear servo motor (Primary side) LM-H2☐				P1A-06M-4SS0	P2A-12M-1SS0	P2B-24M-1SS0	P3A-24M-1SS0
Linear servo motor (Secondary side) LM-H2☐				S10-288-4SS0 S10-384-4SS0 S10-480-4SS0 S10-768-4SS0	S20-288-1SS0 S20-384-1SS0 S20-480-1SS0 S20-768-1SS0		S30-288-1SS0 S30-384-1SS0 S30-480-1SS0 S30-768-1SS0
Servo amplifier model MR-J3W-☐				44B 77B (Note 4)	44B 77B (Note 4)	77B	
Power supply capacity (Note 3)			[kVA]	0.9	0.9	1.3	1.3
Thrust	Continuous (Note 2)		[N]	60	120	240	240
	Maximum		[N]	150	300	600	600
Maximum speed (Note 1)			[m/s]	2			
Magnetic suction			[N]	500	1000	1900	2000
Recommended load to motor mass ratio				Less than 30 times of mass of linear servo motor primary side			
Structure				Open (IP rating: IP00)			
Cooling system				Self-cooled			
Environmental conditions	Ambient temperature	In operation	[°C]	0 to 40 (non-freezing)			
			[°F]	32 to 104 (non-freezing)			
		In storage	[°C]	−15 to 70 (non-freezing)			
			[°F]	5 to 158 (non-freezing)			
	Ambient humidity	In operation		80%RH or less (non-condensing)			
		In storage		90%RH or less (non-condensing)			
	Ambience			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt.			
	Vibration		[m/s^2]	X, Y: 49 or less			
	Altitude			Max, 1000m above sea level			
Mass	Primary side (coil)		[kg]	0.9	1.4	2.5	2.4
			[lb]	1.98	3.09	5.51	5.29
	Secondary side (magnet)		[kg]	0.6 (288mm one magnet) 0.8 (384mm one magnet) 1.0 (480mm one magnet) 1.6 (768mm one magnet)	1.1 (288mm one magnet) 1.4 (384mm one magnet) 1.8 (480mm one magnet) 2.9 (768mm one magnet)		3.2 (288mm one magnet) 4.3 (384mm one magnet) 5.3 (480mm one magnet) 8.5 (768mm one magnet)
			[lb]	1.32 (288mm one magnet) 1.76 (384mm one magnet) 2.21 (480mm one magnet) 3.53 (768mm one magnet)	2.43 (288mm one magnet) 3.09 (384mm one magnet) 3.97 (480mm one magnet) 6.39 (768mm one magnet)		7.06 (288mm one magnet) 9.48 (384mm one magnet) 11.7 (480mm one magnet) 18.7 (768mm one magnet)

Note 1. Max. speed of the linear servo motor is smaller value of any max. speed of the linear servo motor and rated speed of the encoder.

2. Value in the case where the aluminum board of the following dimensions (L [mm] × W [mm] × H [mm]) is mounted on the primary side (coil). (Reference value)

LM-H2P1A-06M-4SS0: 192 × 225 × 30
LM-H2P2A-12M-1SS0: 192 × 315 × 30
LM-H2P2B-24M-1SS0: 336 × 315 × 30
LM-H2P3A-24M-1SS0: 192 × 495 × 30

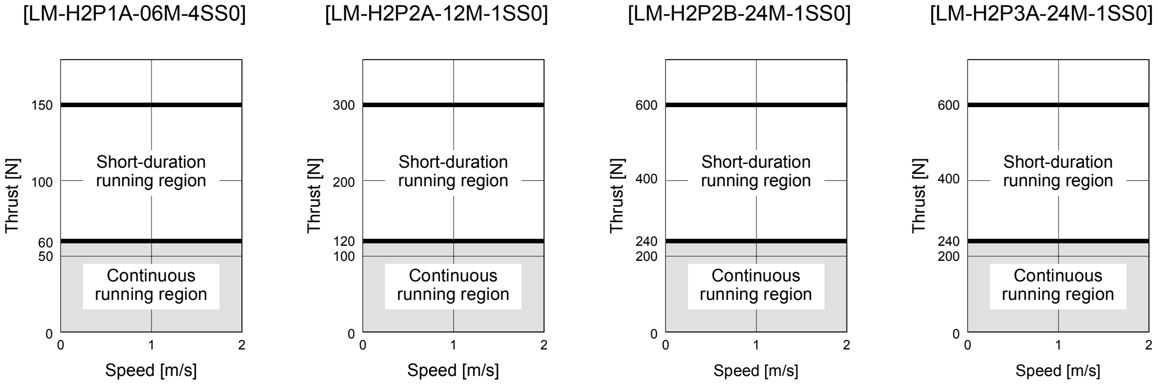
3. The power supply capacities shown here are the values for one linear servo motor axis. When using two axes, double the values.

4. This servo motor can be used by setting "☐☐1☐" to parameter No.Po04.

(3) Thrust characteristics

When the input power supply specifications of the servo amplifier are 3-phase 200VAC or 1-phase 200VAC, the thrust characteristic is indicated by the continuous line.

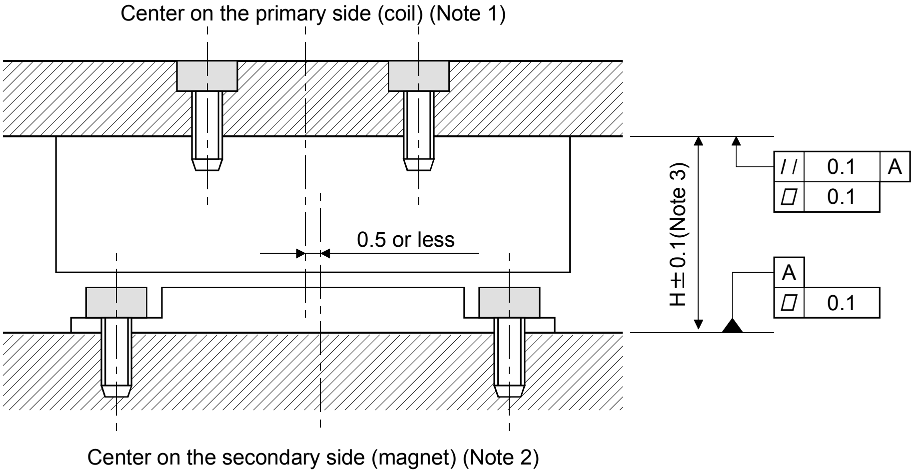
The continuous/max. thrust and max. speed of the linear servo motor are in the case of the rated power voltage and frequency of the combined servo amplifier.



(4) Installation

(a) Mounting dimensions

[Unit: mm]



Note 1. Centers on the primary side (coil) are as follows.

LM-H2P1□-□: Center mounting screw position

LM-H2P2□-□: Center of mounting screw pitch

2. Centers on the secondary side (magnet) is the center of mounting screw pitch.

3. H length indicates (height of primary side (coil))＋(height of secondary side (magnet))＋(length of empty clearance: 0.7mm).

LM-H2P1□-□: H＝43.0mm

LM-H2P2□-□: H＝43.0mm

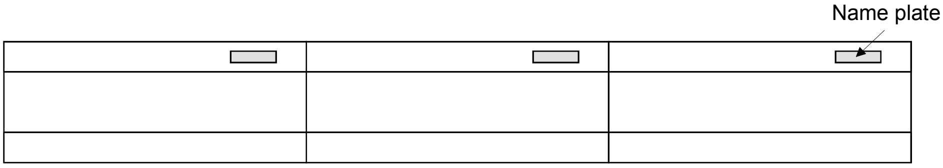
LM-H2P3□-□: H＝48.0mm

(b) Mounting the secondary side (magnet)

⚠WARNING	・The linear servo motor uses a strong magnet on the secondary side. Therefore, not only the servo motor installation operators but also the machine operators must use abundance of caution. For example, one who uses a medical device like a pacemaker must keep away from the machine.

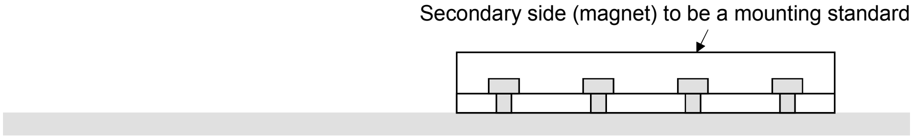
⚠CAUTION	・When mounting the secondary side (magnet), use nonmagnetic tools. ・When the additional secondary side (magnet) is mounted after one has been already set, slide the additional secondary side (magnet) to mount in the specified position after setting in the position away from the one already mounted as shown in this section. ・When two or more secondary side (magnet) is mounted, set the mounting screw accumulative pitch tolerance within ±0.2mm. Clearance may be left between the secondary sides (magnets) depending on the mounting method and the numbers.

When using multiple secondary sides (magnets), arrange the name plates attached to the products on the same side for keeping the layout of magnetic poles.

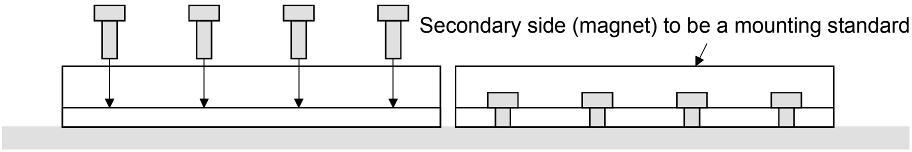


In order to decrease the clearance between the secondary sides (magnets), mount them with the following procedure.

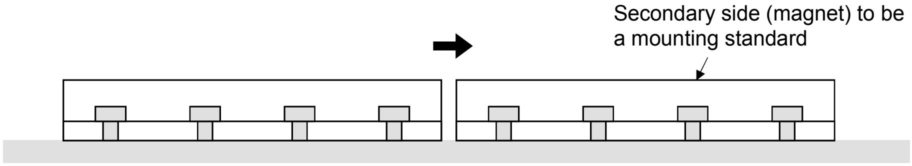
Procedure 1. Securely fix with bolts the secondary side (magnet) to be a mounting standard.



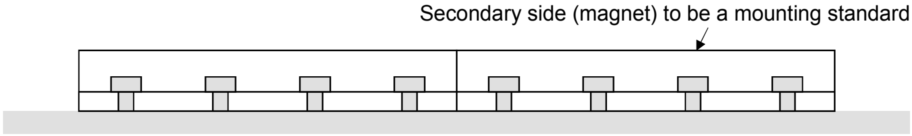
Procedure 2. Set the secondary side (magnet) on the mounting face and fix it with bolts as temporary joint.



Procedure 3. Press the secondary side (magnet) fixed as temporary joint toward that to be a mounting standard.



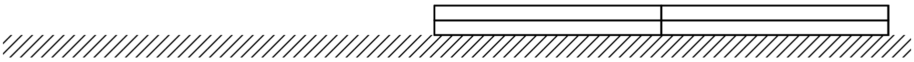
Procedure 4. Securely fix with bolts the secondary side (magnet) fixed as temporary joint.



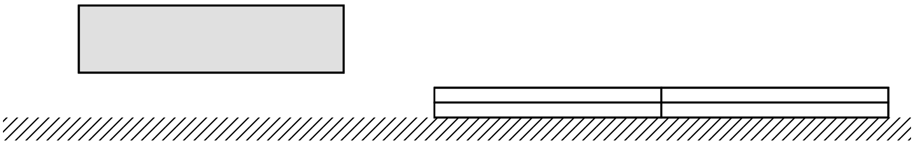
(c) Mounting the primary side (coil)

⚠ CAUTION	・To avoid the danger caused by suction, which is generated between the primary side (coil) and the secondary side (magnet) by the permanent magnet, it is recommended to mount the primary side (coil) in the position free from the secondary side (magnet) as shown in this section. ・When mounting the primary side (coil) over the secondary side (magnet) unavoidably, use the material handling equipment such as crane which is fully competent to sustain the load of suction, etc. ・When sliding the primary side (coil) to move over the secondary side (magnet) after setting, pay full attention to the suction generated.

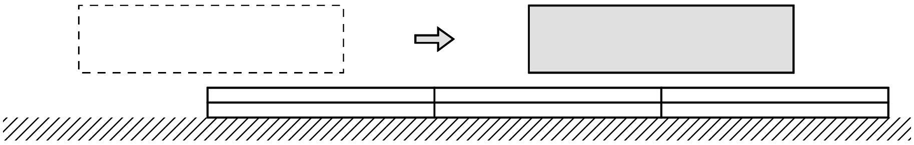
Procedure 1. Mount a part of the secondary side (magnet).



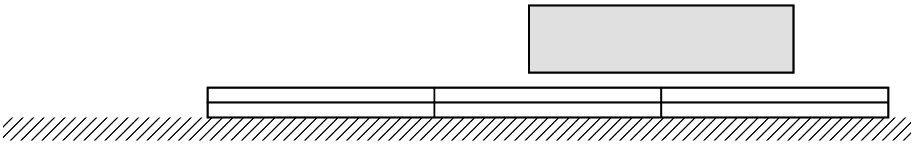
Procedure 2. Mount the primary side (coil) in the position free from the secondary side (magnet).



Procedure 3. Move the primary side (coil) over the secondary side (magnet) mounted.
Confirm that the primary side (coil) does not contact the secondary side (magnet).



Procedure 4. Mount the rest of the secondary side (magnet).

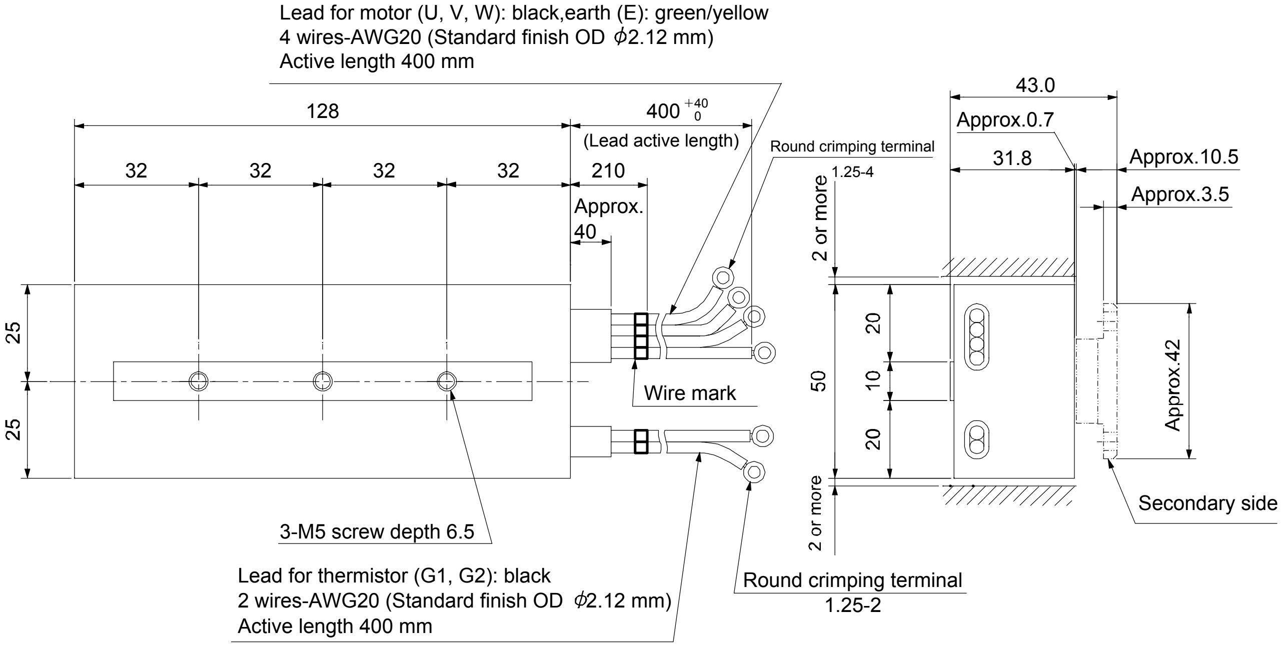


(5) Outline drawings

(a) Primary side (coil)

1) LM-H2P1A-06M-4SS0

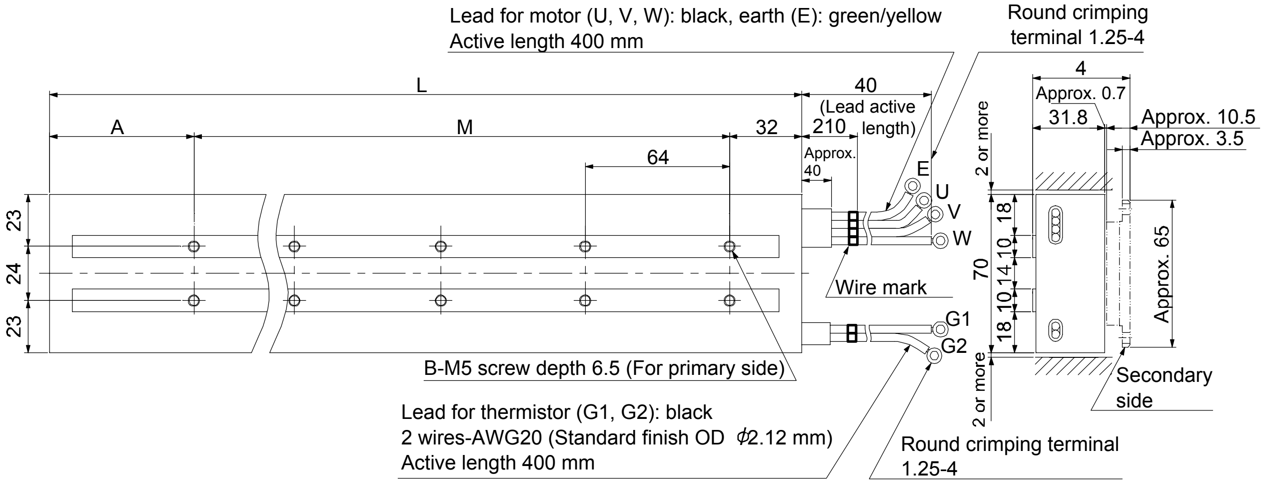
[Unit: mm]



2) LM-H2P2A-12M-1SS0 · LM-H2P2B-24M-1SS0

[Unit: mm]

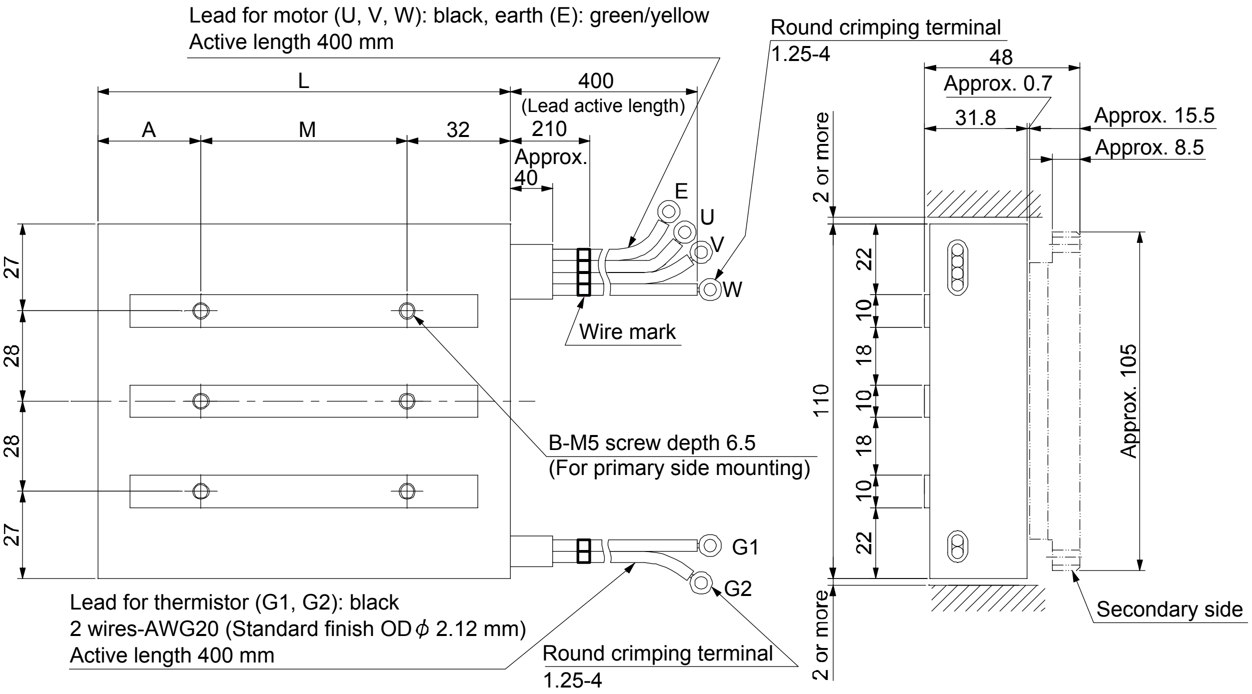
Model	Variable dimensions				Lead for motor	
	L	M	A	B	Size	Standard finish OD
LM-H2P2A-12M-1SS0	128	64	(32)	2 × 2	AWG20	ϕ2.12
LM-H2P2B-24M-1SS0	224	2 × 64 (=128)	(64)	3 × 2	AWG16	ϕ2.7



3) LM-H2P3A-24M-1SS0

[Unit: mm]

Model	Variable dimensions				Lead for motor	
	L	M	A	B	Size	Standard finish OD
LM-H2P3A-24M-1SS0	128	64	32	2 × 3	AWG20	ϕ2.12

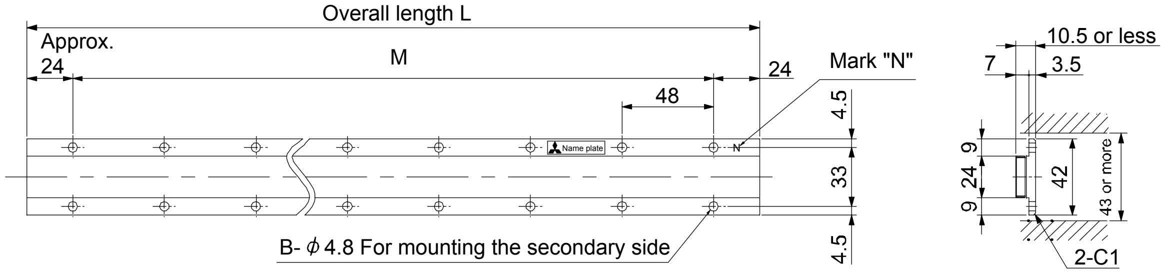


(b) Secondary side (magnet)

1) LM-H2S10-☐-1SS0

[Unit: mm]

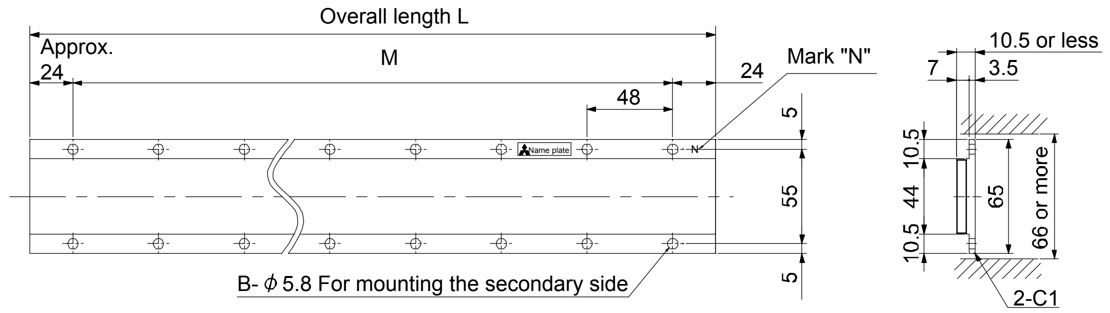
Model	Variable dimensions		
	L	M	B
LM-H2S10-288	288	5 × 48 (=240)	6 × 2
LM-H2S10-384	384	7 × 48 (=336)	8 × 2
LM-H2S10-480	480	9 × 48 (=432)	10 × 2
LM-H2S10-768	768	15 × 48 (=720)	16 × 2



2) LM-H2S20-□-1SS0

[Unit: mm]

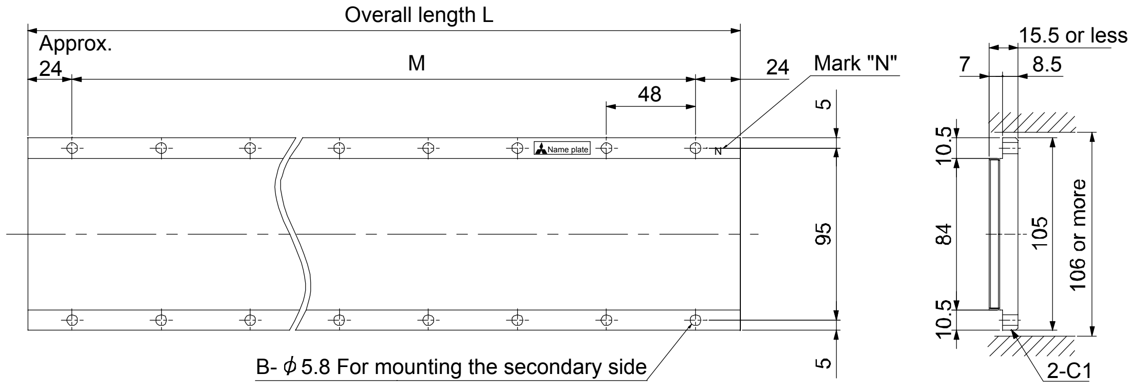
Model	Variable dimensions		
	L	M	B
LM-H2S20-288	288	5 × 48 (=240)	6 × 2
LM-H2S20-384	384	7 × 48 (=336)	8 × 2
LM-H2S20-480	480	9 × 48 (=432)	10 × 2
LM-H2S20-768	768	15 × 48 (=720)	16 × 2



3) LM-H2S30-□-1SS0

[Unit: mm]

Model	Variable dimensions		
	L	M	B
LM-H2S30-288	288	5 × 48 (=240)	6 × 2
LM-H2S30-384	384	7 × 48 (=336)	8 × 2
LM-H2S30-480	480	9 × 48 (=432)	10 × 2
LM-H2S30-768	768	15 × 48 (=720)	16 × 2



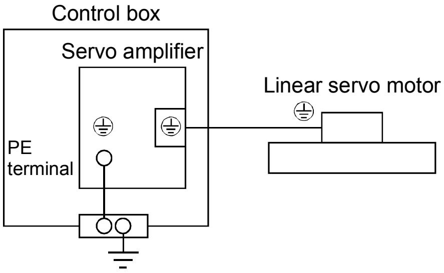
(6) Connection of servo amplifier and linear servo motor

(a) Connection instructions

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

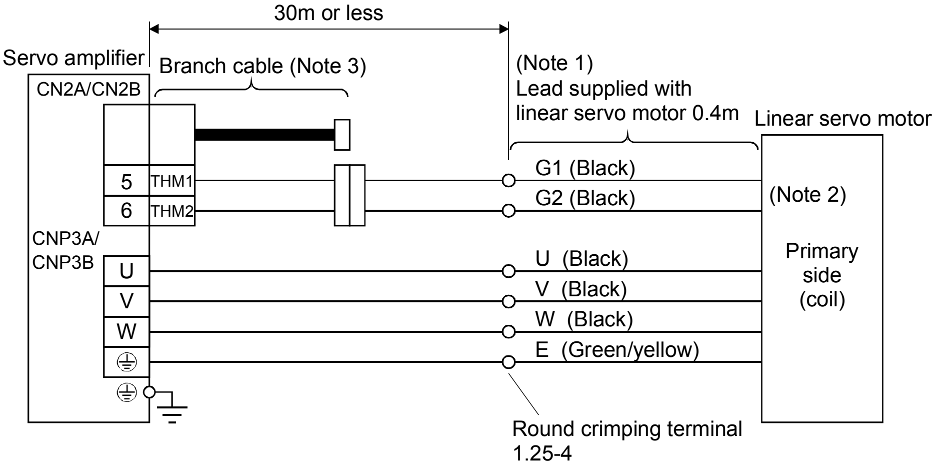
⚠ CAUTION	・Connect the wires to the correct phase terminals (U, V, W) of the servo amplifier and linear servo motor. Otherwise, the linear servo motor does not operate properly. ・Do not connect AC power supply directly to the linear servo motor. Otherwise, a fault may occur.

For grounding, connect the earth cable of the linear 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.



(b) Power supply cable wiring diagrams

Use the wires and connectors shown in the following figure. For the wires used for wiring, refer to section 11.5.



Note 1. The signal name (U, V, W, E, G1, G2) is attached on leads.

2. No polarity for the thermistors (G1 and G2)

3. Make the branch cable using the MR-J3THMCN2 connector set.

13.4.6 LM-U2 series

(1) Model code definition

(a) Primary side: coil

LM－U2P□□－□M－□

Series

Primary side (coil)

Symbol	Motor model
0SS0	LM-U2PAB-05M LM-U2PAD-10M LM-U2PAF-15M
1SS0	LM-U2PBB-07M LM-U2PBD-15M LM-U2PBF-22M

Maximum speed: 2m/s

Rated thrust

Symbol	Rated thurst [N]
05	50
07	75
10	100
15	150
22	225

Length (nominal dimensions)

Symbol	Dimensions [mm]
B	130
D	250
F	370

Width (nominal dimensions)

Symbol	Dimensions [mm]
A	66.5
B	86.5

(b) Secondary side: magnet

LM－U2S□0－□－□

Series

Secondary side (magnetic)

Symbol	Motor model
0SS0	LM-U2SA0-240 LM-U2SA0-300 LM-U2SA0-420
1SS0	LM-U2SB0-240 LM-U2SB0-300 LM-U2SB0-420

Length (nominal dimensions)

Symbol	Dimensions [mm]
240	240
300	300
420	420

Width (nominal dimensions)

Symbol	Dimensions [mm]
A	62
B	82

(2) LM-U2 series specification list

Linear servo motor (Primary side) LM-U2□				PAB-05M-0SS0	PAD-10M-0SS0	PAF-15M-0SS0	PBB-07M-1SS0	PBD-15M-1SS0	PBF-22M-1SS0
Linear servo motor (Secondary side) LM-U2□				SA0-240-0SS0 SA0-300-0SS0 SA0-420-0SS0			SB0-240-1SS0 SB0-300-1SS0 SB0-420-1SS0		
Servo amplifier MR-J3W-□				22B	44B 77B (Note 4)	44B 77B (Note 4)	22B	77B	77B
Power supply capacity (Note 3)			[kVA]	0.5	0.9	0.9	0.5	1.0	1.3
Thrust	Continuous (Note 2)		[N]	50	100	150	75	150	225
	Maximum		[N]	150	300	450	225	450	675
Maximum speed (Note 1)			[m/s]	2.0					
Magnetic suction			[N]	0					
Recommended load to motor mass ratio				Less than 30 times of mass of linear servo motor primary side					
Structure				Open (IP rating: IP00)					
Cooling system				Self-cooled					
Environmental conditions	Ambient temperature	In operation	[℃]	0 to 40 (non-freezing)					
			[°F]	32 to 104 (non-freezing)					
		In storage	[℃]	−15 to 70 (non-freezing)					
			[°F]	5 to 158 (non-freezing)					
	Ambient humidity	In operation		80%RH or less (non-condensing)					
		In storage		90%RH or less (non-condensing)					
	Ambience			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt.					
	Vibration		$[m/s^2]$	X, Y: 49 or less					
	Altitude			Max, 1000m above sea level					
Mass	Primary side (coil)		[kg]	0.3	0.6	0.8	0.4	0.8	1.1
			[lb]	0.66	1.32	1.76	0.88	1.76	2.43
	Secondary side (magnet)		[kg]	2.0(240mm One magnet) 2.5(300mm One magnet) 3.5(420mm One magnet)			2.6(240mm One magnet) 3.2(300mm One magnet) 4.5(420mm One magnet)		
			[lb]	4.41(240mm One magnet) 5.51(300mm One magnet) 7.72(420mm One magnet)			5.74(240mm One magnet) 7.06(300mm One magnet) 9.92(420mm One magnet)		

Note 1. Max. speed of the linear servo motor is smaller value of any max. speed of the linear servo motor and rated speed of the encoder.

2. Value in the case where the aluminum board of the following dimensions (L[mm] × W[mm] × H[mm]) is mounted on the primary side (coil). (Reference value)

LM-U2PAB-05M-0SS0: 300 × 400 × 15
LM-U2PAD-10M-0SS0: 400 × 500 × 15
LM-U2PAF-15M-0SS0: 500 × 600 × 15
LM-U2PBB-07M-1SS0: 300 × 400 × 15
LM-U2PBD-15M-1SS0: 400 × 500 × 15

3. The power supply capacities shown here are the values for one linear servo motor axis. When using two axes, double the values.

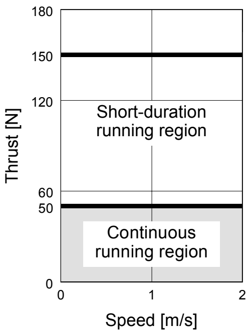
4. This servo motor can be used by setting "□□1□" to parameter No.Po04.

(3) Thrust characteristics

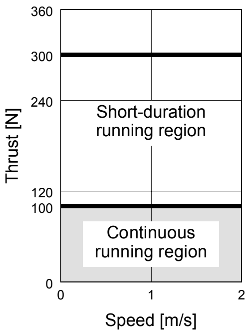
When the input power supply specifications of the servo amplifier are 3-phase 200VAC or 1-phase 230VAC, the thrust characteristic is indicated by the continuous line.

The continuous/max. thrust and max. speed of the linear servo motor are in the case of the rated power voltage and frequency of the combined servo amplifier.

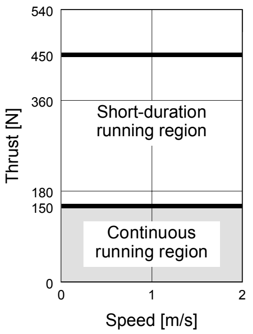
[LM-U2PAB-05M-0SS0]



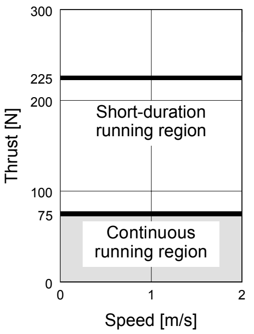
[LM-U2PAD-10M-0SS0]



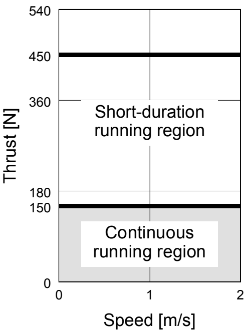
[LM-U2PAF-15M-0SS0]



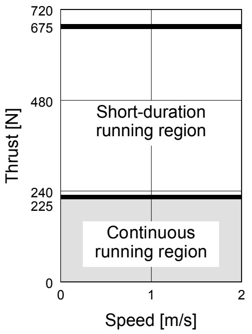
[LM-U2PBB-07M-1SS0]



[LM-U2PBD-15M-1SS0]

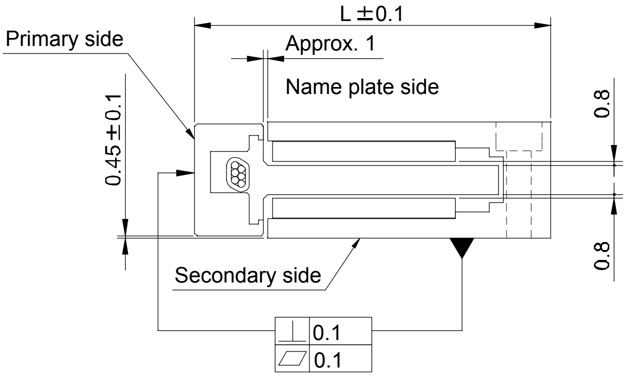


[LM-U2PBF-22M-1SS0]



(4) Installation

(a) Mounting dimensions



[Unit: mm]

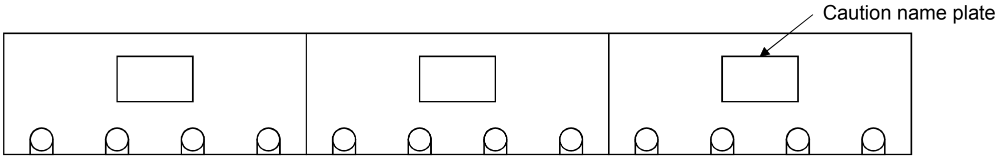
Linear servo motor	Variable dimensions L
LM-U2PAB-05M-0SS0	78
LM-U2PAD-10M-0SS0	
LM-U2PAF-15M-0SS0	
LM-U2PBB-07M-1SS0	98
LM-U2PBD-15M-1SS0	
LM-U2PBF-22M-1SS0	

(b) Mounting the secondary side (magnet)

⚠WARNING	・The linear servo motor uses a strong magnet on the secondary side. Therefore, not only the servo motor installation operators but also the machine operators must use abundance of caution. For example, one who uses a medical device like a pacemaker must keep away from the machine.

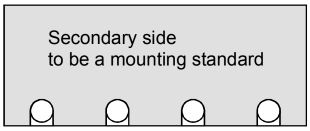
⚠CAUTION	・When mounting the secondary side (magnet), use nonmagnetic tools. ・When the additional secondary side (magnet) is mounted after one has been already set, slide the additional secondary side (magnet) to mount in the specified position after setting in the position away from the one already mounted as shown in this section. ・When two or more secondary side (magnet) is mounted, set the mounting screw accumulative pitch tolerance within ±0.2mm. Clearance may be left between the secondary sides (magnets) depending on the mounting method and the numbers.

When using multiple secondary sides (magnets), arrange the name plates attached to the products on the same side for keeping the layout of magnetic poles.

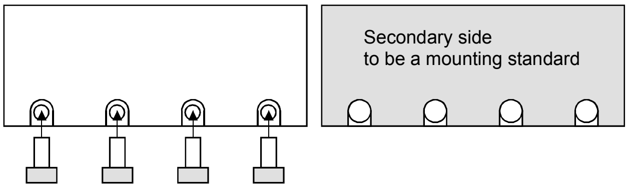


In order to decrease the clearance between the secondary sides (magnets), mount them with the following procedure.

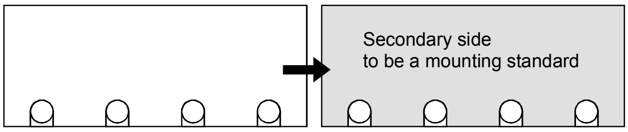
Procedure 1. Securely fix with bolts the secondary side (magnet) to be a mounting standard.



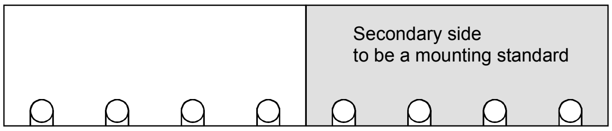
Procedure 2. Set the secondary side (magnet) on the mounting face and fix it with bolts as temporary joint.



Procedure 3. Press the secondary side (magnet) fixed as temporary joint toward that to be a mounting standard.

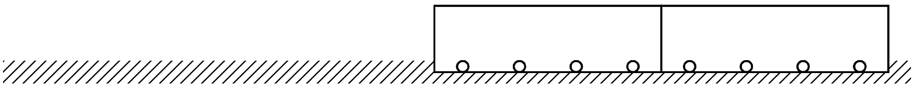


Procedure 4. Securely fix with bolts the secondary side (magnet) fixed as temporary joint.

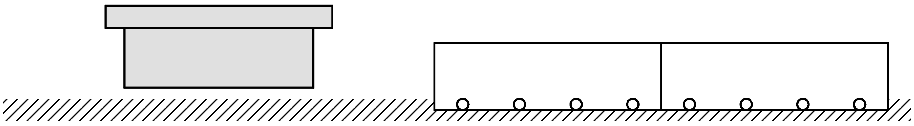


(c) Mounting the primary side (coil)

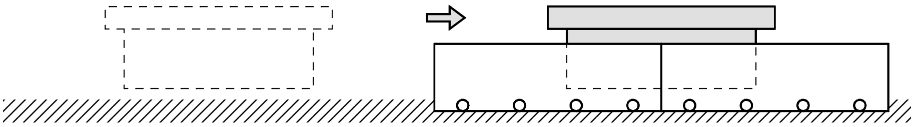
Procedure 1. Mount a part of the secondary side (magnet).



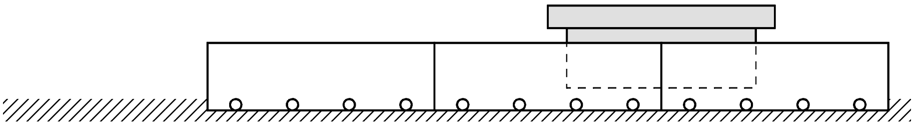
Procedure 2. Mount the primary side (coil) in the position free from the secondary side (magnet).



Procedure 3. Move the primary side (coil) over the secondary side (magnet) mounted.
Confirm that the primary side (coil) does not contact the secondary side (magnet).



Procedure 4. Mount the rest of the secondary side (magnet).



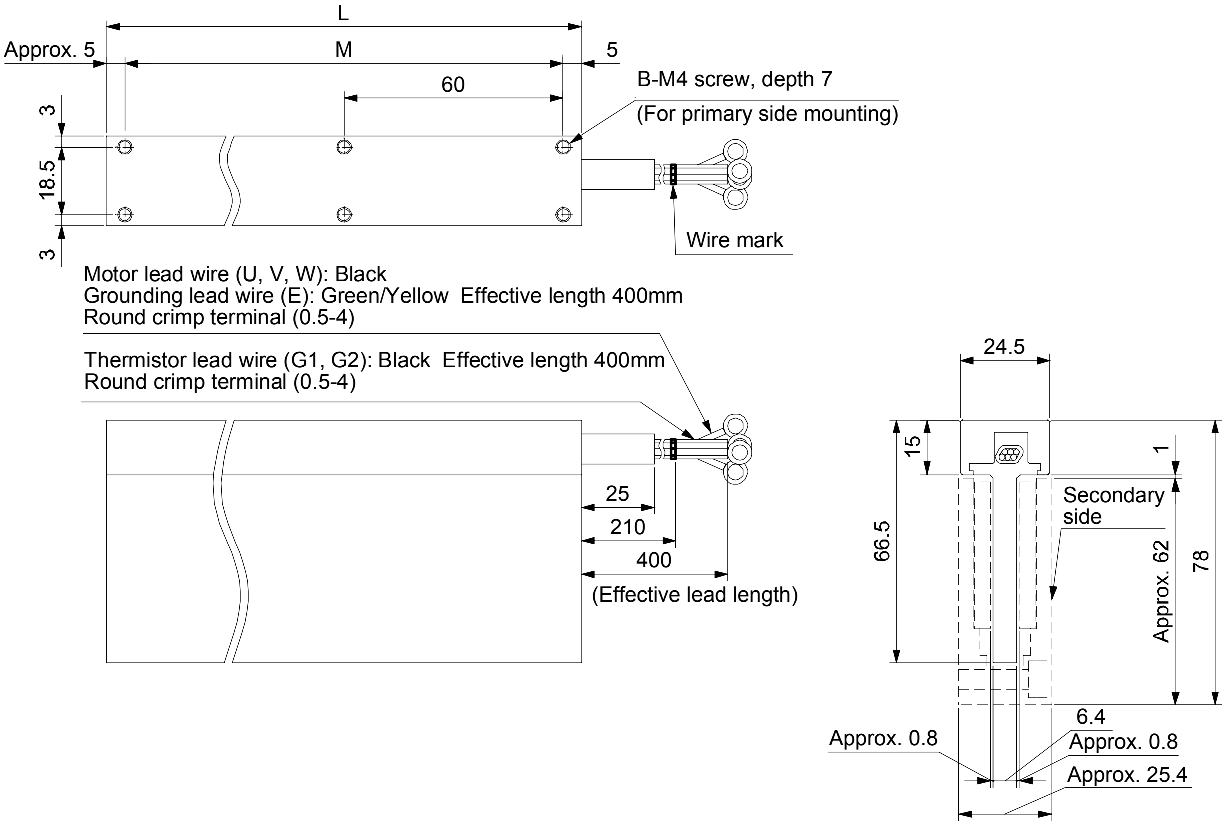
(5) Outline drawings

(a) Primary side (coil)

1) LM-U2PAB-05M-0SS0・LM-U2PAD-10M-0SS0・LM-U2PAF-15M-0SS0

[Unit: mm]

Model	Variable dimensions			Lead	
	L	M	B	U・V・W・E	G1・G2
LM-U2PAB-05M-0SS0	130	2 × 60 (=120)	2 × 3	0.14mm^2 (AWG26) (Standard finish ϕ1.6mm)	0.14mm^2 (AWG26) (Standard finish ϕ1.6mm)
LM-U2PAD-10M-0SS0	250	4 × 60 (=240)	2 × 5		
LM-U2PAF-15M-0SS0	370	6 × 60 (=360)	2 × 7		



B-M4 screw, depth 7
(For primary side mounting)

Wire mark

Motor lead wire (U, V, W): Black
Grounding lead wire (E): Green/Yellow Effective length 400mm
Round crimp terminal (0.5-4)

Thermistor lead wire (G1, G2): Black Effective length 400mm
Round crimp terminal (0.5-4)

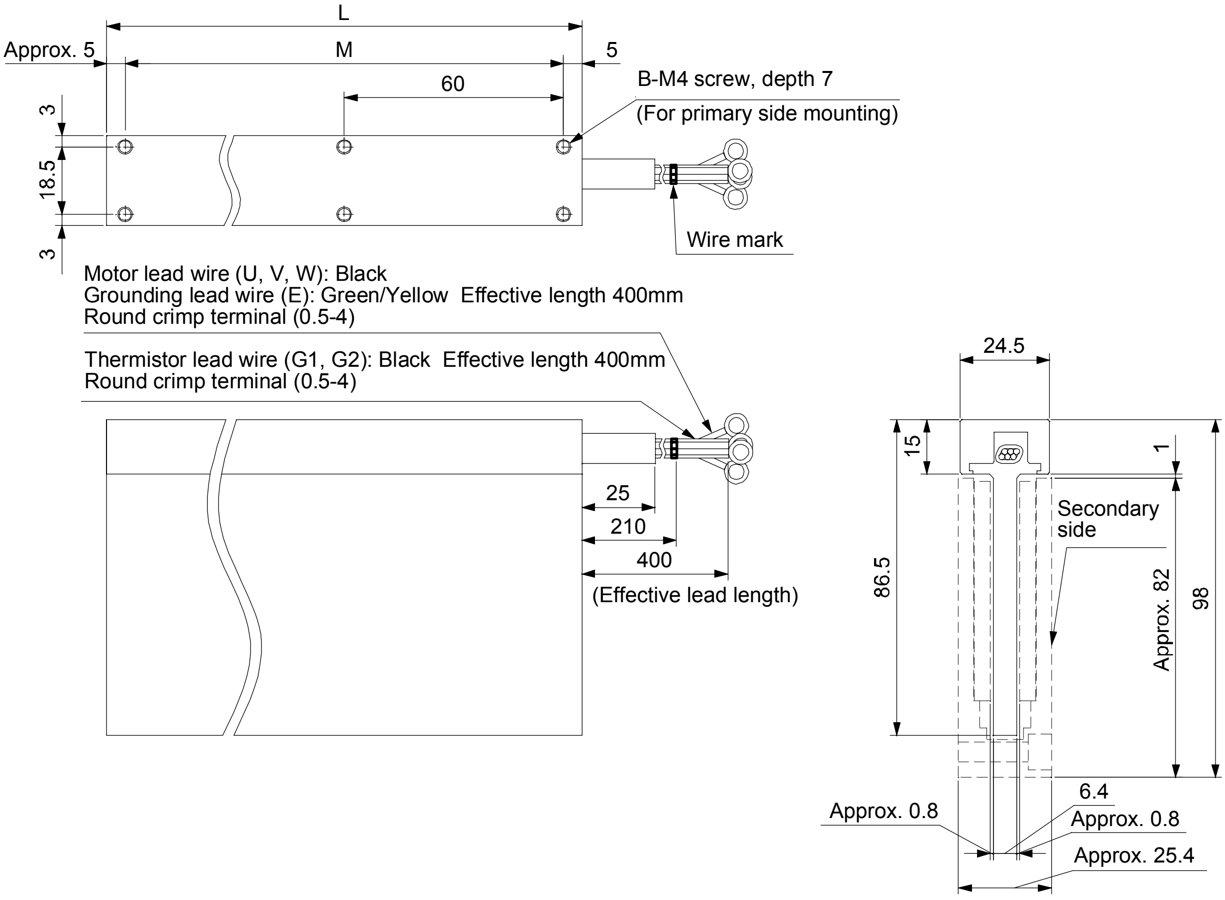
(Effective lead length)

Secondary side

2) LM-U2PBB-07M-1SS0・LM-U2PBD-15M-1SS0・LM-U2PBF-22M-1SS0

[Unit: mm]

Model	Variable dimensions			Lead	
	L	M	B	U・V・W・E	G1・G2
LM-U2PBB-07M-1SS0	130	2 × 60 (=120)	2 × 3	0.14mm^2 (AWG26) (Standard finish ϕ1.6mm)	0.14mm^2 (AWG26) (Standard finish ϕ1.6mm)
LM-U2PBD-15M-1SS0	250	4 × 60 (=240)	2 × 5		
LM-U2PBF-22M-1SS0	370	6 × 60 (=360)	2 × 7		

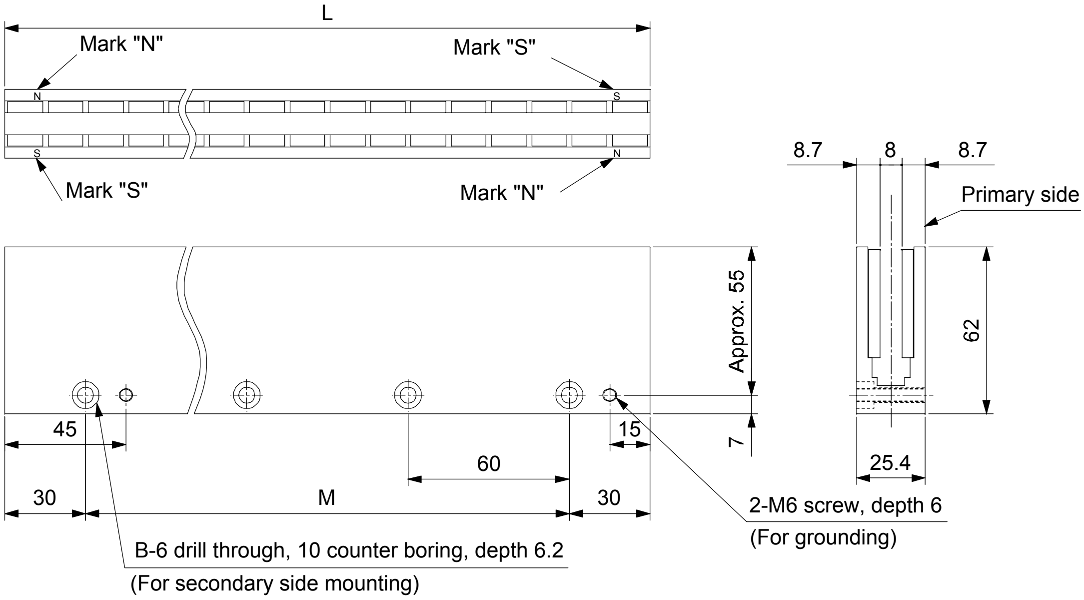


(b) Secondary side (magnet)

1) LM-U2SA0-240-0SS0 · LM-U2SA0-300-0SS0 · LM-U2SA0-420-0SS0

[Unit: mm]

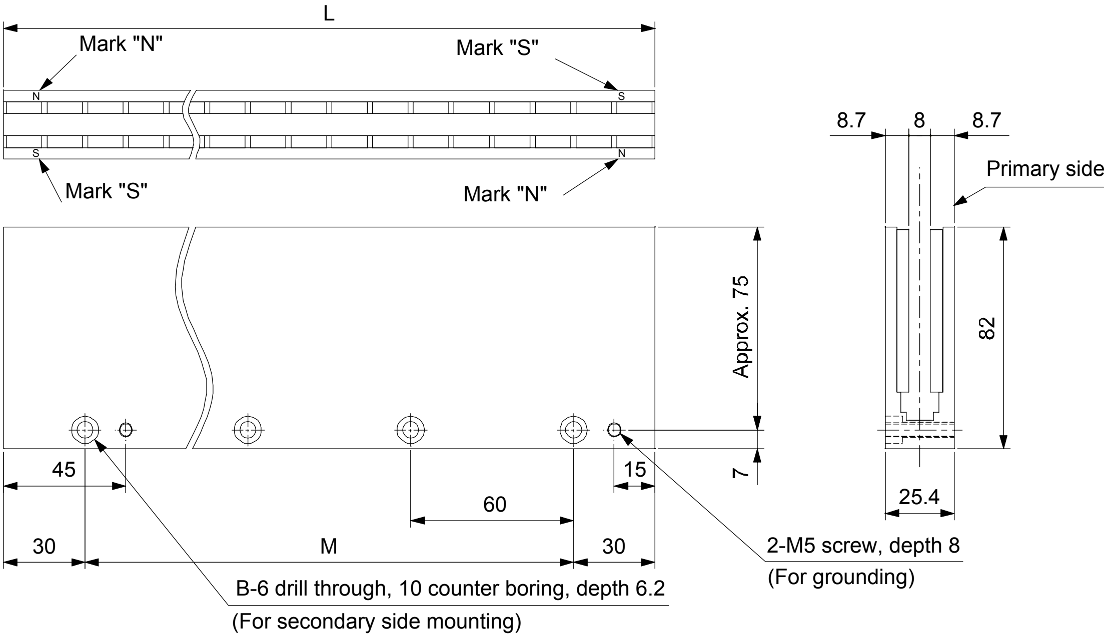
Model	Variable dimensions		
	L	M	B
LM-U2SA0-240-0SS0	240	3 × 60 (=180)	4
LM-U2SA0-300-0SS0	300	4 × 60 (=240)	5
LM-U2SA0-420-0SS0	420	6 × 60 (=360)	7



2) LM-U2SB0-240-1SS0・LM-U2SB0-300-1SS0・LM-U2SB0-420-1SS0

[Unit: mm]

Model	Variable dimensions		
	L	M	B
LM-U2SB0-240-1SS0	240	3×60 (=180)	4
LM-U2SB0-300-1SS0	300	4×60 (=240)	5
LM-U2SB0-420-1SS0	420	6×60 (=360)	7



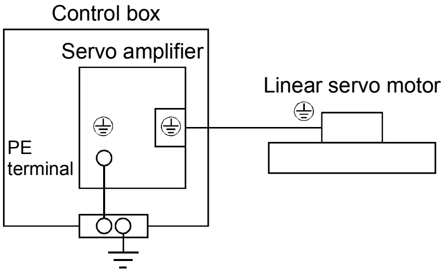
(6) Connection of servo amplifier and linear servo motor

(a) Connection instructions

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

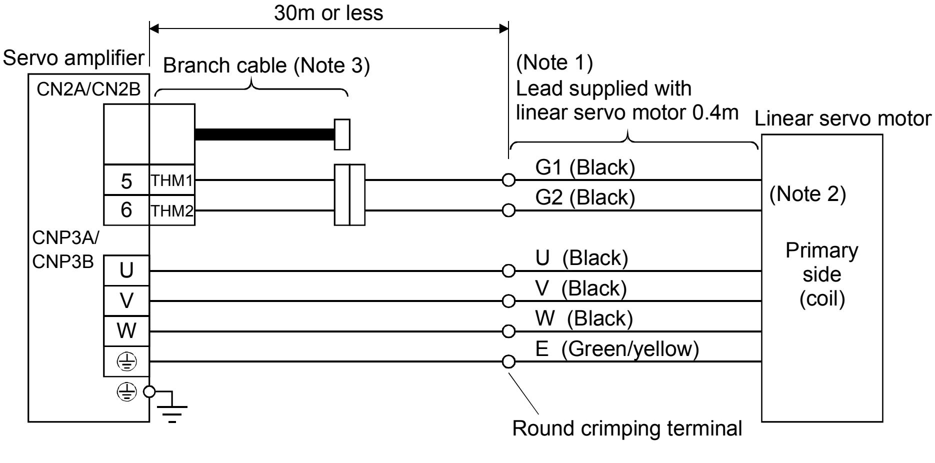
⚠CAUTION	・Connect the wires to the correct phase terminals (U, V, W) of the servo amplifier and linear servo motor. Otherwise, the linear servo motor does not operate properly. ・Do not connect AC power supply directly to the linear servo motor. Otherwise, a fault may occur.

For grounding, connect the earth cable of the linear 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.



(b) Power supply cable wiring diagrams

Use the wires and connectors shown in the following figure. For the wires used for wiring, refer to section 11.5.



Note 1. The signal name (U, V, W, E, G1, G2) is attached on leads.

2. No polarity for the thermistors (G1 and G2)

3. Make the branch cable using the MR-J3THMCN2 connector set.

13.5 Linear encoder

POINT

- Always use the encoder cable introduced in this section. If the other products are used, a faulty may occur.
- For details of the linear encoder specifications, performance and assurance, contact each linear encoder manufacturer.

13.5.1 Compatible linear encoder list

Scale type		Manufacturer	Model	Resolution	Rated speed	Effective measurement length (Maximum)	Communication system	Absolute position detection system
Mitsubishi serial interface compatibility	Absolute type	Mitutoyo Corporation	AT343A	0.05μm	2.0m/s	3000mm	2 wire type	○
			AT543A-SC		2.5m/s	2200mm		
			ST741A	0.5μm	4.0m/s	6000mm		
			ST743A	0.1μm				
		Heidenhain Corporation	LC 493M	0.05μm	2.0m/s	2040mm	4 wire type	○
				0.01μm				
			LC 193M	0.05μm	3.0m/s	4240mm		
				0.01μm				
	Incremental type	Magnescale Co., Ltd. (Note 2)	SL710 +PL101R/RH +MJ830 or MJ831	0.2μm (Note 1)	6.4m/s	3000mm	2 wire type	×
		Renishaw Inc.	RGH26P	5.0μm	4.0m/s	70000mm	2 wire type	×
			RGH26Q	1.0μm	3.2m/s			×
			RGH26R	0.5μm	1.6m/s			×
		Heidenhain Corporation	LIDA485 +APE391M	0.005μm (20/4096μm)	4.0m/s	30040mm	4 wire type	×
			LIDA487 +APE391M			6040mm		
A/B/Z phase differential output	Incremental type	Not specified		Remissible resolution range	Encoder dependent	Encoder dependent	Differential 3 pair type	×

Note 1. Varies depending on the setting of the interpolator (MJ830/MJ831: Manufactured by Magnescale Co., Ltd.).
2. Production of the SH13 has been discontinued. For details, please contact Magnescale Co., Ltd.

POINT

- When the linear encoder is incorrectly installed, an alarm or a positioning mismatch may occur. In this case, refer to the following general checking points for the linear encoder to confirm the installation, etc.
  (a) Check that the gap between the head and scale is proper.
  (b) Check the scale head for rolling and yawing (looseness of scale head section).
  (c) Check the scale surface for contamination and scratches.
  (d) Check that the vibration and temperature are within the specified range.
  (e) Check that the speed is within the permissible range without overshooting.

13.5.2 Mitsubishi serial interface compatible linear encoder

(1) Linear scales manufactured by Mitutoyo Corporation (absolute type)

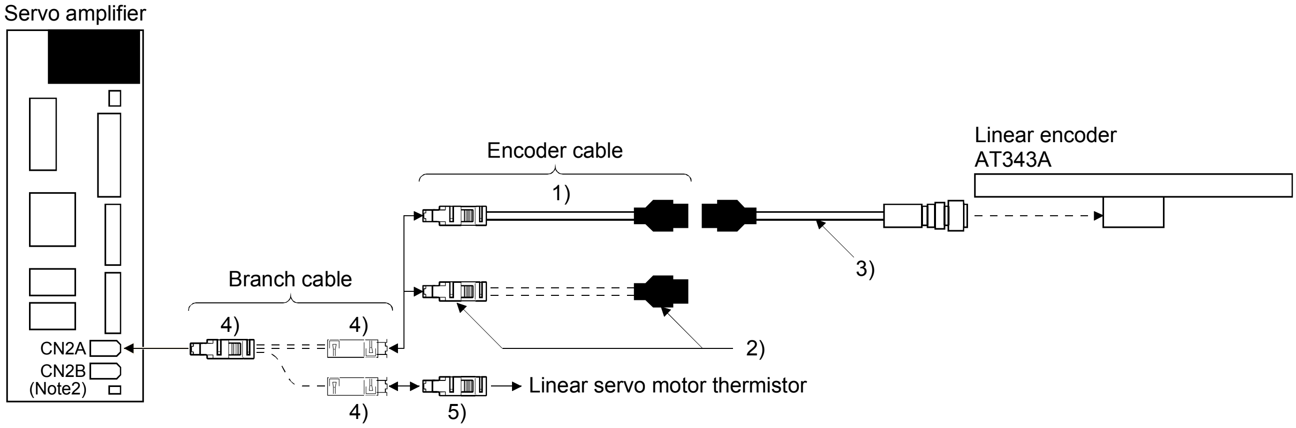
POINT

- When the absolute position detection system is configured, the MR-BTCASE battery case and MR-BAT battery is not required.

(a) For AT343A

1) Cable composition

Prepare a cable based on the following structure diagram.



	Cable			
	Load side encoder cable	Output cable	Branch cable	Thermistor cable
When using an optional cable	1) MR-EKCBL☐M-H (Option) 2m・5m・10m (Refer to section 13.5.3.)	3) Options manufactured by Mitutoyo Corporation (Note 1) (This should be prepared by the customer.) Part No.09BAA598A: 0.2m Part No.09BAA598B: 2m Part No.09BAA598C: 3m	4) Connector set MR-J3THMCN2 (Option)	5) Connector set MR-J3CN2 (Option)
When producing a load side encoder cable	2) Connector set MR-ECNM (Option) (Refer to section 13.3.5.)			

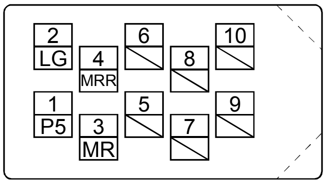
Note 1. For details, contact with Mitutoyo Corporation.

2. Configure the B-axis in the same way as for the A-axis.

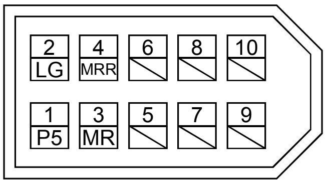
2) Production of encoder cable

Produce the encoder cable using MR-EKCBL□M-H (10m or less) or MR-ECNM as shown below. The encoder cable can be produced as the length of max. 30m. The following diagram shows a connecting example of more than 5m to 10m.

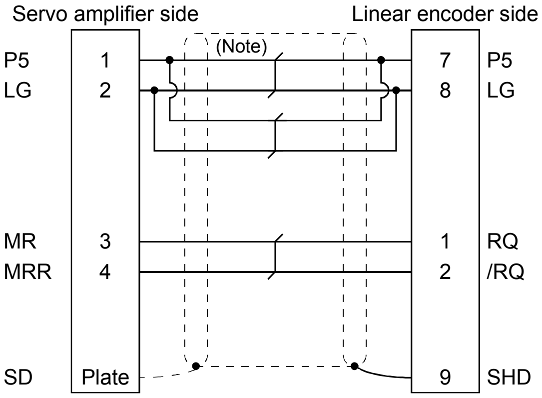
Pin layout is one of the following.

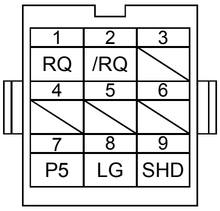


View seen from wiring side.



View seen from wiring side.





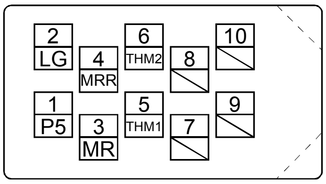
View seen from wiring side.

Note. The following table shows the cable size to be used and the number of paired connections of LG and P5.

Wiring length	Number of LG and P5 connections (when the output cable is 3m or less)	Cable size
to 5m	1-pair	AWG22
to 10m	2-pair	
to 20m	4-pair	
to 30m	6-pair	

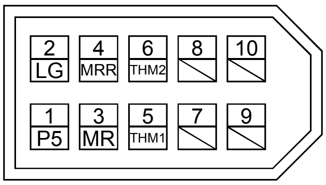
3) Production of branch cable

Produce the branch cable using the MR-J3THMCN2 connector set as shown below. Keep the branch cable length 0.5m or shorter. Use the AWG22 cable for the wiring.

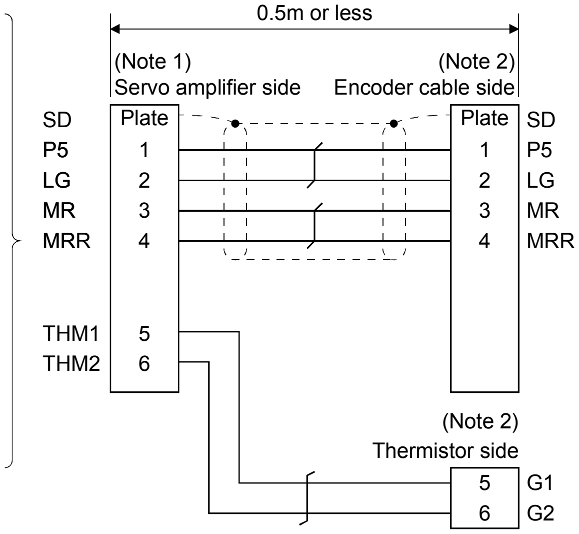


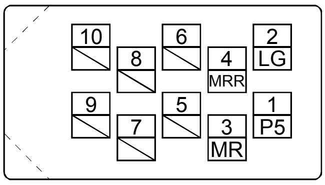
View seen from wiring side.

or

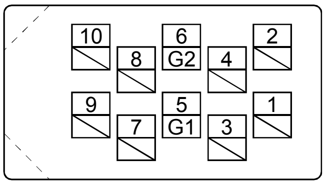


View seen from wiring side.





View seen from wiring side.



View seen from wiring side.

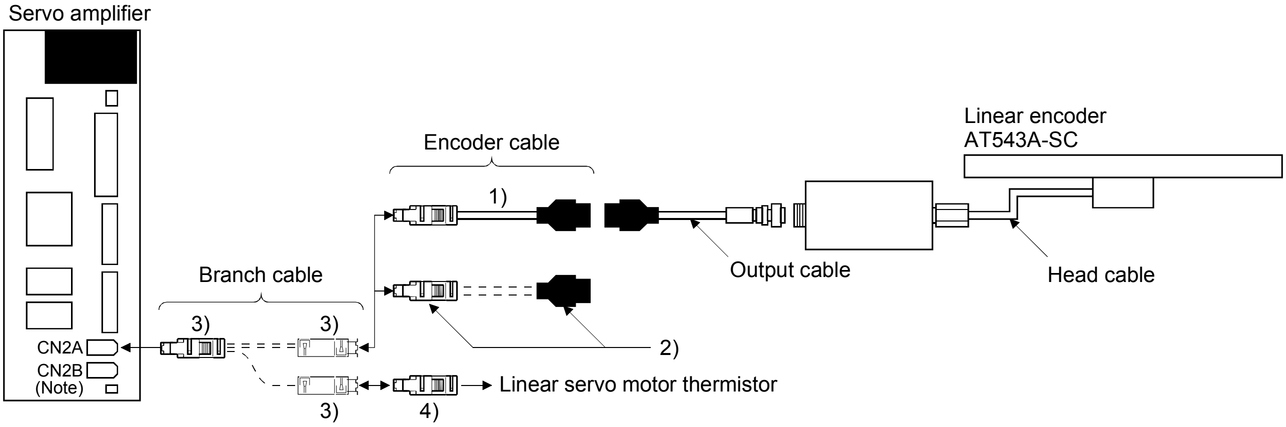
Note 1. Receptacle: 36210-0100PL, Shell kit: 36310-3200-008 (3M), or Connector set: 54599-1019 (Molex)

2. Plug: 36110-3000FD, Shell kit: 36310-F200-008 (3M)

(b) For AT543A-SC

1) Cable composition

Prepare a cable based on the following structure diagram.

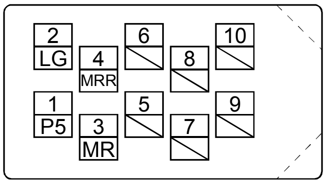


	Cable				
	Load side encoder cable	Output cable	Head cable	Branch cable	Thermistor cable
When using an optional cable	1) MR-EKCBL☐M-H (Option) 2m・5m・10m (Refer to section 13.5.3.)	Accessories for linear encoder Cable length: 3m	Accessories for linear encoder Cable length: 2m	3) Connector set MR-J3THMCN2 (Option)	4) Connector set MR-J3CN2 (Option)
When producing a load side encoder cable	2) Connector set MR-ECNM (Option) (Refer to section 13.5.3.)				

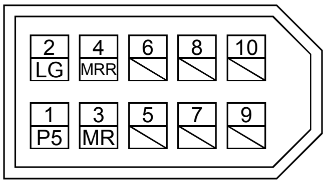
Note. Configure the B-axis in the same way as for the A-axis.

2) Production of encoder cable
Produce the encoder cable using MR-EKCBL□M-H (10m or less) or MR-ECNM as shown below. The encoder cable can be produced as the length of max. 30m. The following diagram shows a connecting example of more than 5m to 10m.

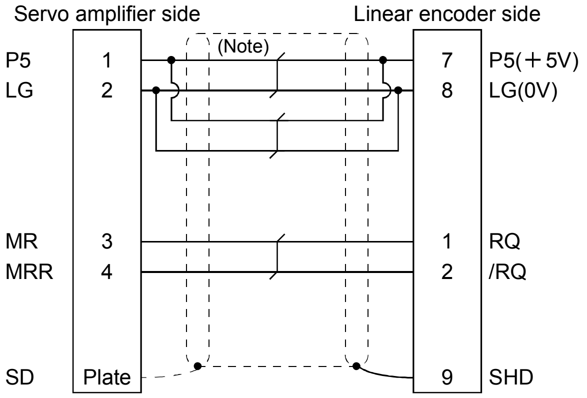
Pin layout is one of the following.

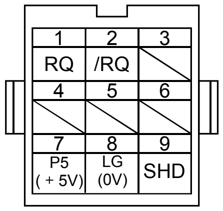


View seen from wiring side.



View seen from wiring side.



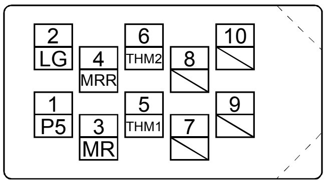


View seen from wiring side.

Note. The following table shows the cable size to be used and the number of paired connections of LG and P5.

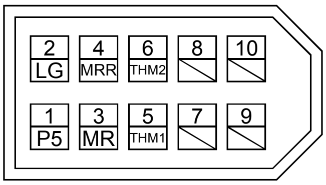
Wiring length	Number of LG and P5 connections (when the output cable is 3m or less)	Cable size
to 5m	1-pair	AWG22
to 10m	2-pair	
to 20m	4-pair	
to 30m	6-pair	

3) Production of branch cable
Produce the branch cable using the MR-J3THMCN2 connector set as shown below. Keep the branch cable length 0.5m or shorter. Use the AWG22 cable for the wiring.

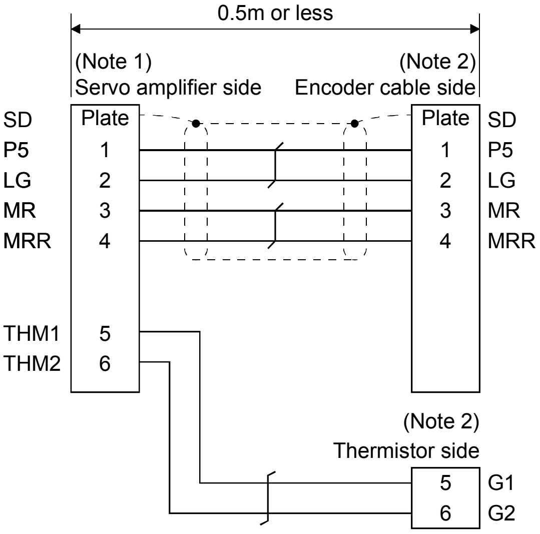


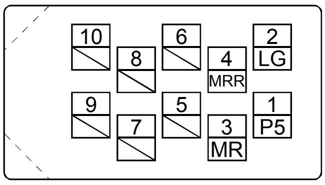
View seen from wiring side.

or

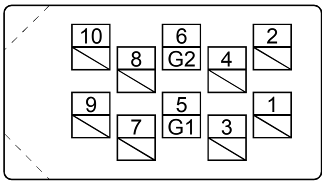


View seen from wiring side.





View seen from wiring side.



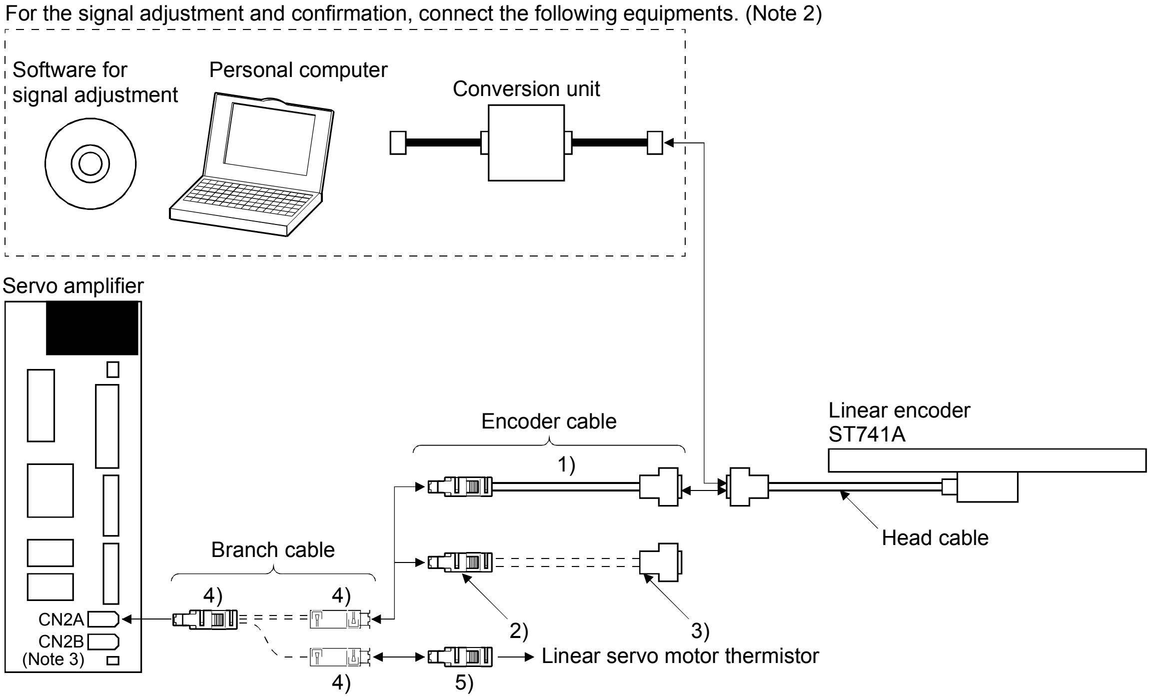
View seen from wiring side.

Note 1. Receptacle: 36210-0100PL, Shell kit: 36310-3200-008 (3M), or Connector set: 54599-1019 (Molex)
2. Plug: 36110-3000FD, Shell kit: 36310-F200-008 (3M)

(c) For ST741A or ST743A

1) Cable structure

Prepare a cable based on the following structure diagram.



	Cable				
	Load side encoder cable		Head cable	Branch cable	Thermistor cable
When using an optional cable	1) Options manufactured by Mitutoyo Corporation (This should be prepared by the customer.) (Note 1) Part No.06ACF117A: 5m Part No.06ACF117B: 10m		Accessories for linear encoder Cable length: 1m	4) Connector set MR-J3THMCN2 (Option)	5) Connector set MR-J3CN2 (Option)
When producing a load side encoder cable	2) Connector set MR-J3CN2 (Option) (Refer to section 13.5.3.)	3) Junction connector (This should be prepared by the customer.) D-SUB (female) 15 Pin shell: HDAB-15S' Plug case: HDA-CTH (manufactured by HIROSE ELECTRIC CO., LTD)			

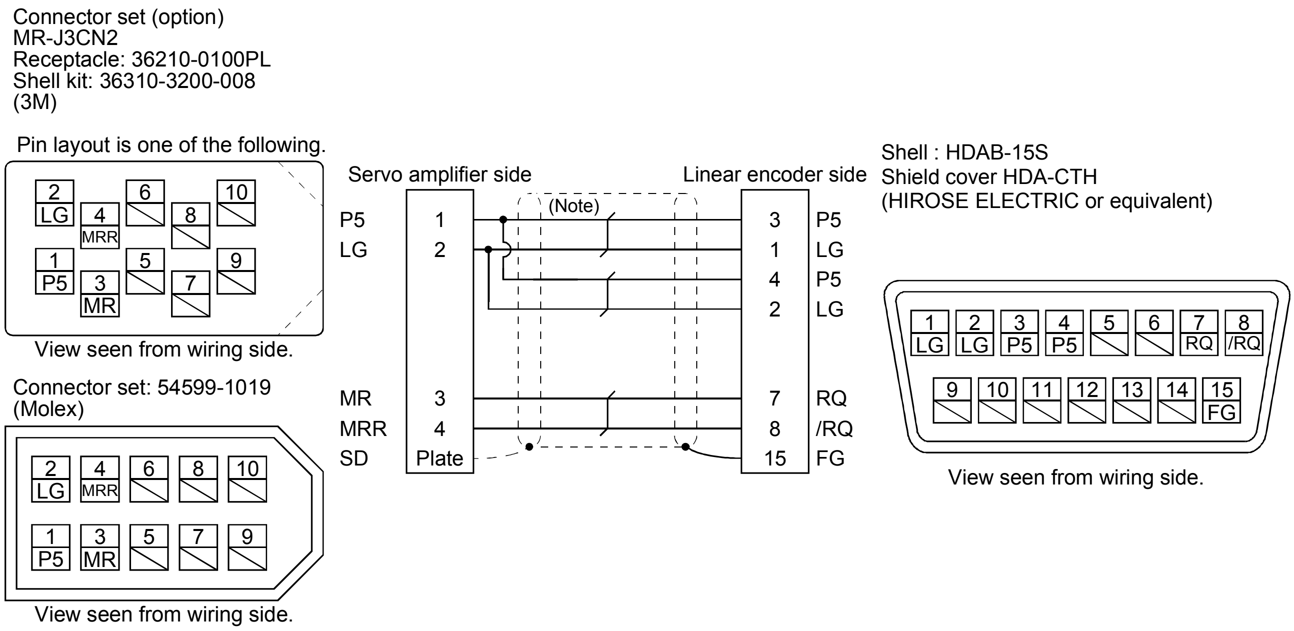
Note 1. For details, contact with Mitutoyo Corporation.

2. When mounting ST741A・ST743A, a personal computer (with RS-232C port) for the signal adjustment and confirmation, and a software and conversion unit for signal adjustment are required. For details, contact with Mitutoyo Corporation.

3. Configure the B-axis in the same way as for the A-axis.

2) Production of encoder cable

Produce the encoder cable using MR-J3CN2 or a junction connector as shown below. The encoder cable can be produced as the length of max. 30m. The following diagram shows a connecting example of more than 5m to 10m.

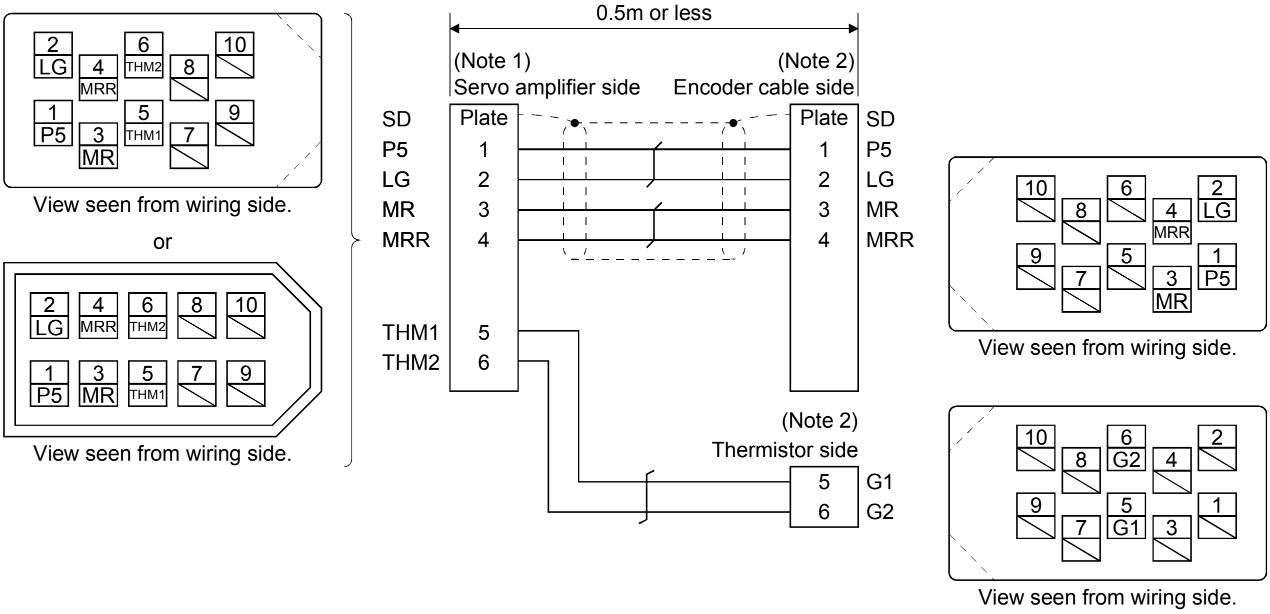


Note. The following table shows the cable size to be used and the number of paired connections of LG and P5.

Wiring length	Number of LG and P5 connections (when the head cable is 1m or less)	Cable size
to 5m	1-pair	AWG22
to 10m	2-pair	
to 20m	3-pair	
to 30m	4-pair	

3) Production of branch cable

Produce the branch cable using the MR-J3THMCN2 connector set as shown below. Keep the branch cable length 0.5m or shorter. Use the AWG22 cable for the wiring.



Note 1. Receptacle: 36210-0100PL, Shell kit: 36310-3200-008 (3M), or Connector set: 54599-1019 (Molex)

2. Plug: 36110-3000FD, Shell kit: 36310-F200-008 (3M)

(2) Linear encoder manufactured by Heidenhain Corporation

POINT

- When the absolute position detection system is configured, the MR-BTCASE battery case and MR-BAT battery are not required.

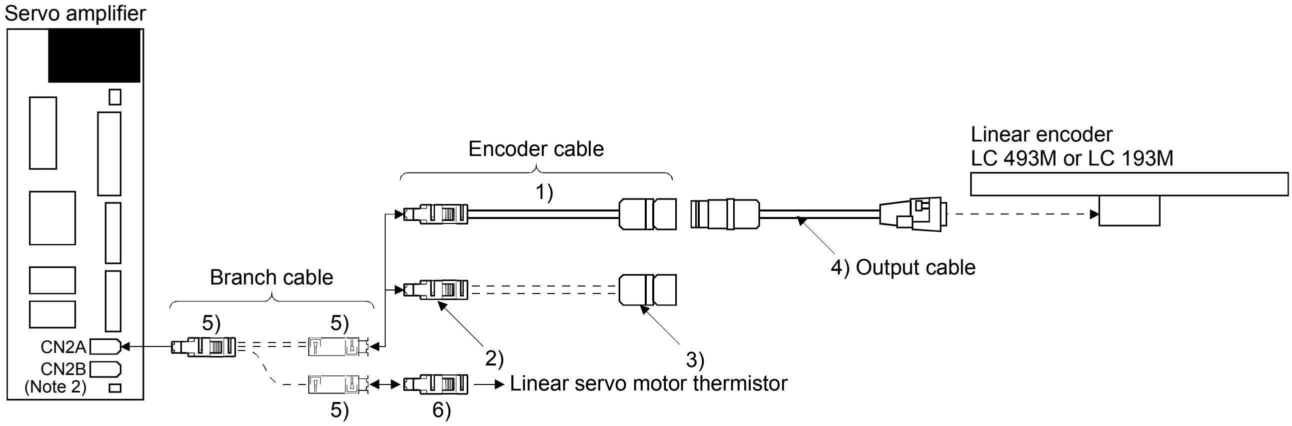
(a) For LC 493M or LC 193M (Absolute type)

POINT

- This linear encoder is of four-wire type. When using any of these encoder, set parameter No.PC04 to "1□□□" to select the four-wire type.

1) Cable structure

Prepare a cable based on the following structure diagram.



	Cable					
	Load side encoder cable		Output cable		Branch cable	Thermistor cable
			LC 493M	LC 193M		
When using an optional cable	1) Option manufactured by Heidenhain Corporation (This should be prepared by the customer.) (Note 1)		4) 337 439-××・・・□m (manufactured by Heidenhain Corporation) (This should be prepared by the customer.)	4) 343 421-××・・・□m (manufactured by Heidenhain Corporation) (This should be prepared by the customer.)	5) Connector set MR-J3THMCN2 (Option)	6) Connector set MR-J3CN2 (Option)
When producing a load side encoder cable	2) Connector set MR-J3CN2 (Option) (Refer to section 13.5.3.)	3) Junction connector (This should be prepared by the customer.) 17-pin coupling (female) 291697-26 (manufactured by Heidenhain Corporation)				

Note 1. For details, contact with Heidenhain Corporation.

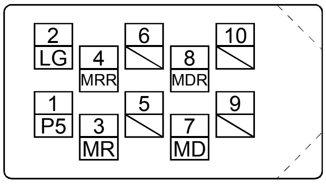
2. Configure the B-axis in the same way as for the A-axis.

2) Production of encoder cable

Produce the encoder cable using MR-J3CN2 or a junction connector as shown below. The encoder cable can be produced as the length of max. 30m. The following diagram shows a connecting example of more than 5m to 10m.

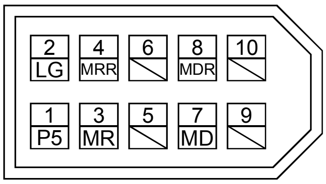
Connector set (option)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M)

Pin layout is one of the following.

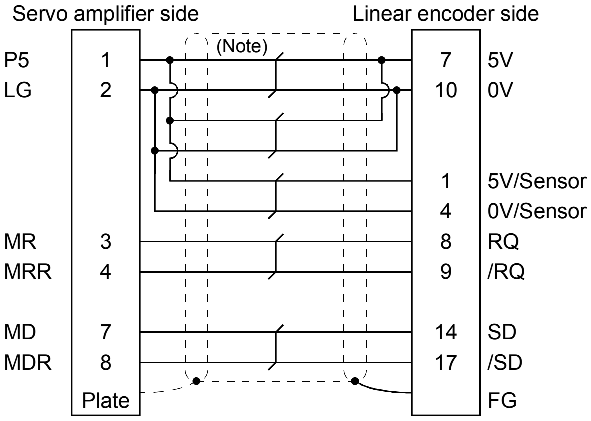


View seen from wiring side.

Connector set: 54599-1019
(Molex)



View seen from wiring side.



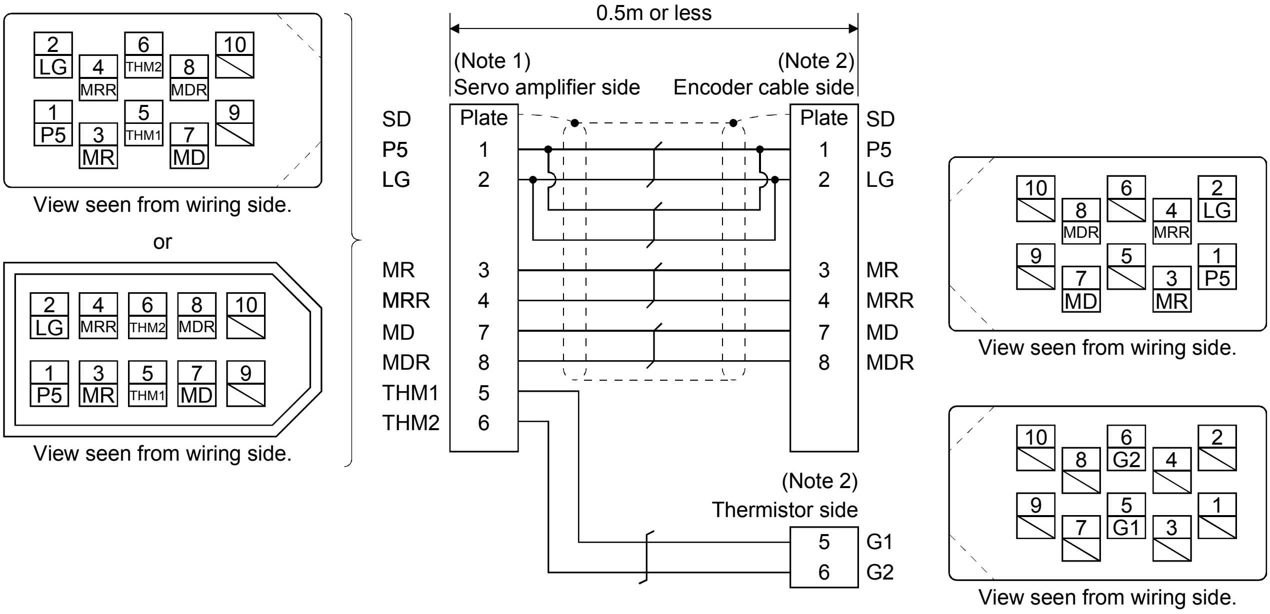
Connector: 17-pin coupling
291697-26 (female)
(manufactured by
Heidenhain Corporation)

Note. The following table shows the cable size to be used and the number of paired connections of LG and P5.

Wiring length	Number of LG and P5 connections (when the output cable is 1m or less)	Cable size
to 5m	2-pair	AWG22
to 10m	3-pair	
to 20m	5-pair	
to 30m	7-pair	

3) Production of branch cable

Produce the branch cable using the MR-J3THMCN2 connector set as shown below. Keep the branch cable length 0.5m or shorter. Use the AWG22 cable for the wiring.



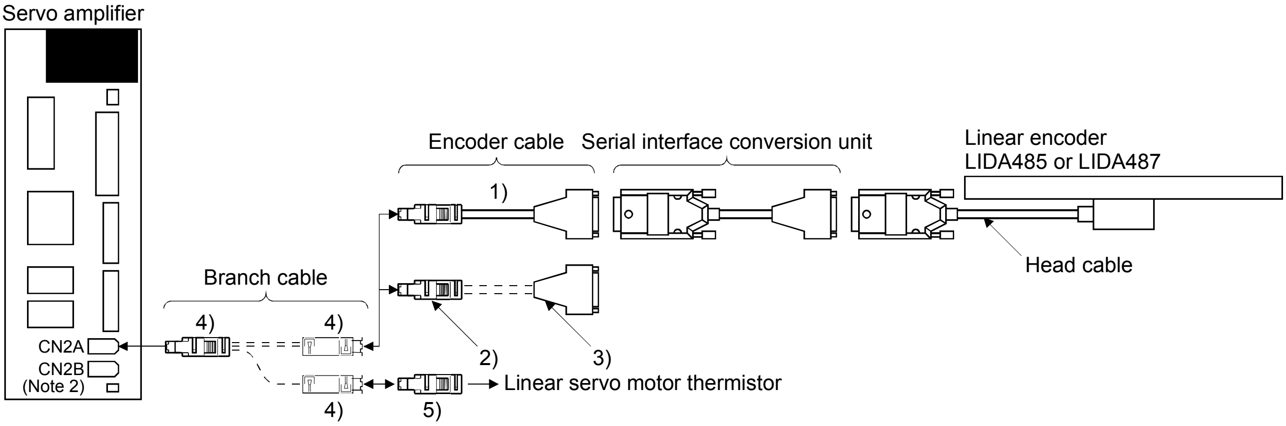
Note 1. Receptacle: 36210-0100PL, Shell kit: 36310-3200-008 (3M), or Connector set: 54599-1019 (Molex)

2. Plug: 36110-3000FD, Shell kit: 36310-F200-008 (3M)

(b) For LIDA485 or LIDA487 (Incremental type)

1) Cable structure

Prepare a cable based on the following structure diagram.



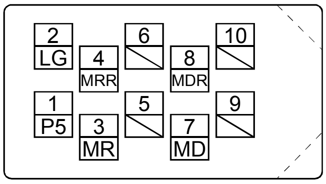
	Cable					
	Load side encoder cable		Serial interface conversion unit	Head cable	Branch cable	Thermistor cable
When using an optional cable	1) Option manufactured by HEIDENHAIN CORPORATION 630 856-××・・・□m (This should be prepared by the customer.) (Note 1)		APE391M Cable length: 0.5m (manufactured by Heidenhain Corporation) (This should be prepared by the customer.)	Accessories for linear encoder Cable length: 3m	4) Connector set MR-J3THMCN2 (Option)	5) Connector set MR-J3CN2 (Option)
When producing a load side encoder cable	2) Connector set MR-J3CN2 (Option) (Refer to section 13.5.3.)	3) Junction connector (This should be prepared by the customer.) D-SUB15 pin (female)				

Note 1. For details, contact with Heidenhain Corporation.
2. Configure the B-axis in the same way as for the A-axis.

2) Production of encoder cable
Produce the encoder cable using MR-J3CN2 or a junction connector as shown below. The encoder cable can be produced as the length of max. 30m. The following diagram shows a connecting example of more than 5m to 10m.

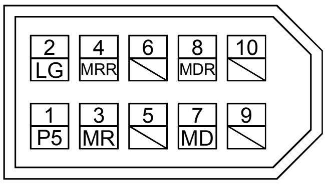
Connector set (option)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M)

Pin layout is one of the following.

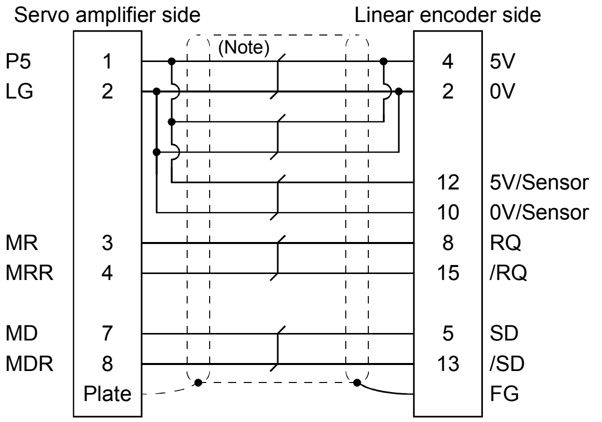


View seen from wiring side.

Connector set: 54599-1019
(Molex)



View seen from wiring side.



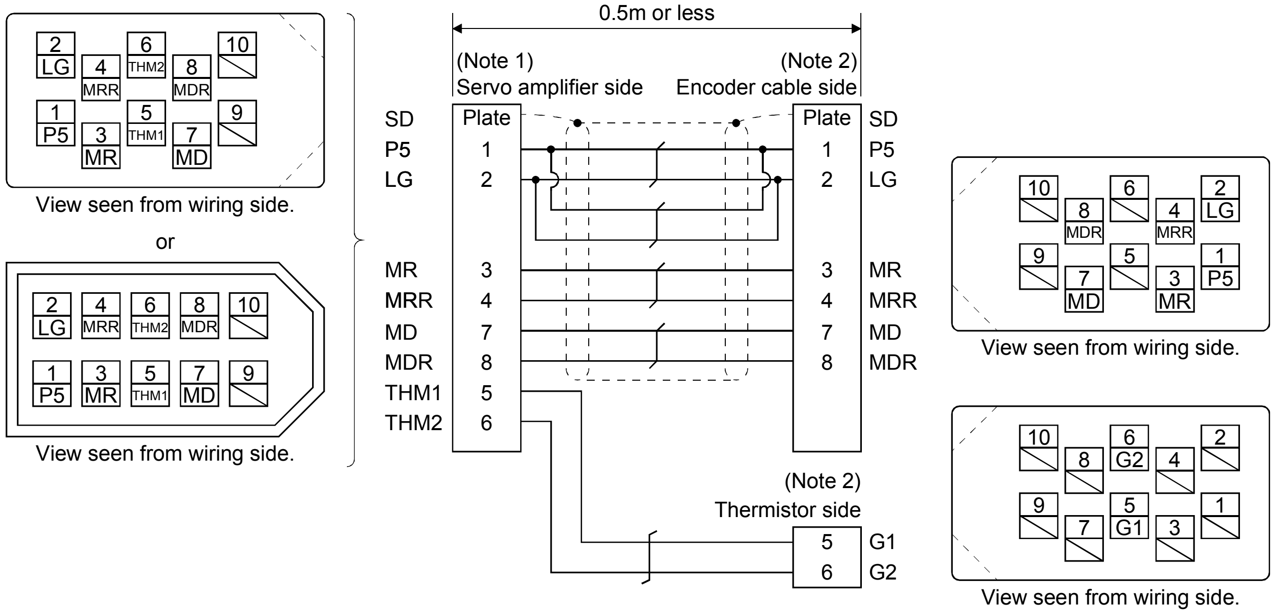
Connector: D-SUB (female) 15 pin

Note. The following table shows the cable size to be used and the number of paired connections of LG and P5.

Wiring length	Number of LG and P5 connections	Cable size
to 5m	2-pair	AWG22
to 10m	3-pair	
to 20m	6-pair	
to 30m	8-pair	

3) Production of branch cable

Produce the branch cable using the MR-J3THMCN2 connector set as shown below. Keep the branch cable length 0.5m or shorter. Use the AWG22 cable for the wiring.



Note 1. Receptacle: 36210-0100PL, Shell kit: 36310-3200-008 (3M), or Connector set: 54599-1019 (Molex)

2. Plug: 36110-3000FD, Shell kit: 36310-F200-008 (3M)

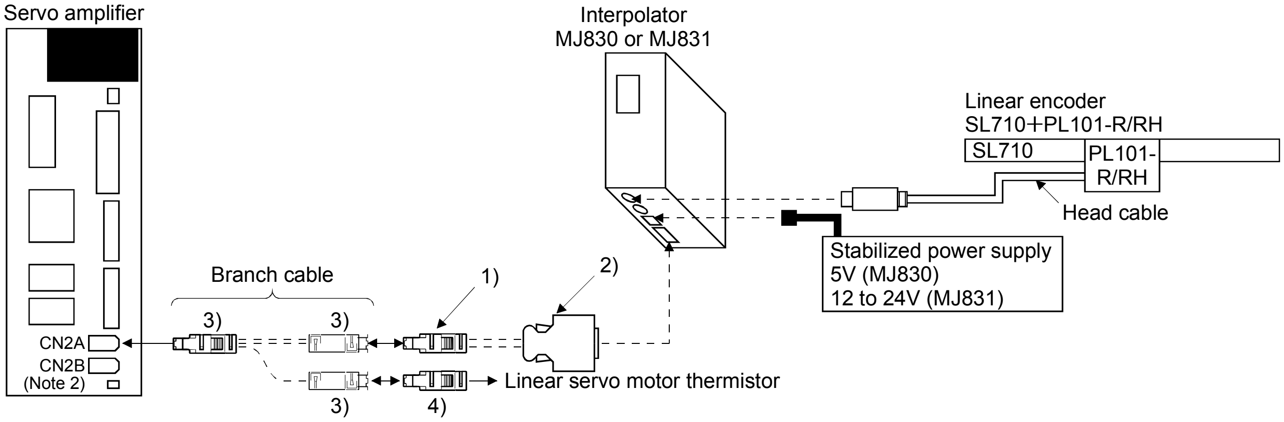
(3) Linear encoder manufactured by Magnescale Co., Ltd. (Incremental type)

(a) Cable structure

POINT

- When turning on the power, turn on the interpolator and then turn on the servo amplifier. When turning off the power, turn off the servo amplifier and then turn off the interpolator.

Prepare a cable based on the following structure diagram.



Linear encoder	Cable					Interpolator (This should be prepared by the customer.)
	Load side encoder cable (Note 1)		Head cable	Branch cable	Thermistor cable	
SL710＋PL101-R/RH	1) Connector set MR-J3CN2 (Option) (Refer to section 13.5.3.)	2) Connector for Interpolator (This should be prepared by the customer.) Connector: 10114-3000PE Shell kit: 10314-52F0-008 (3M or equivalent)	Accessories for linear encoder Cable Length PL101-R: 0.3m PL101-RH: 3m	3) Connector set MR-J3THMCN2 (Option)	4) Connector set MR-J3CN2 (Option)	MJ830 or MJ831

Note 1. Produce an encoder cable. An optional cable is not provided.

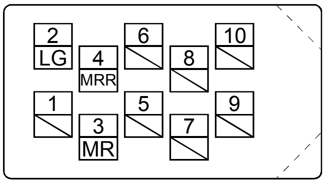
2. Configure the B-axis in the same way as for the A-axis.

(b) Production of encoder cable

Produce the encoder cable using MR-J3CN2 or a connector for interpolator as shown below. The encoder cable can be produced as the length of max. 30m. Supply linear encoder power from external.

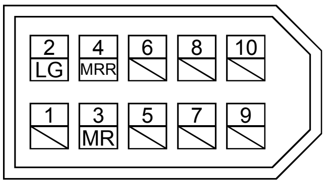
Connector set (option)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M)

Pin layout is one of the following.

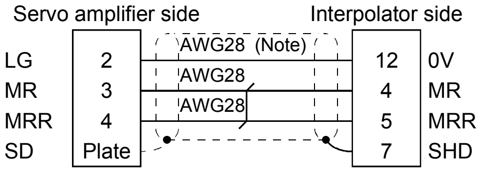


View seen from wiring side.

Connector set: 54599-1019
(Molex)



View seen from wiring side.

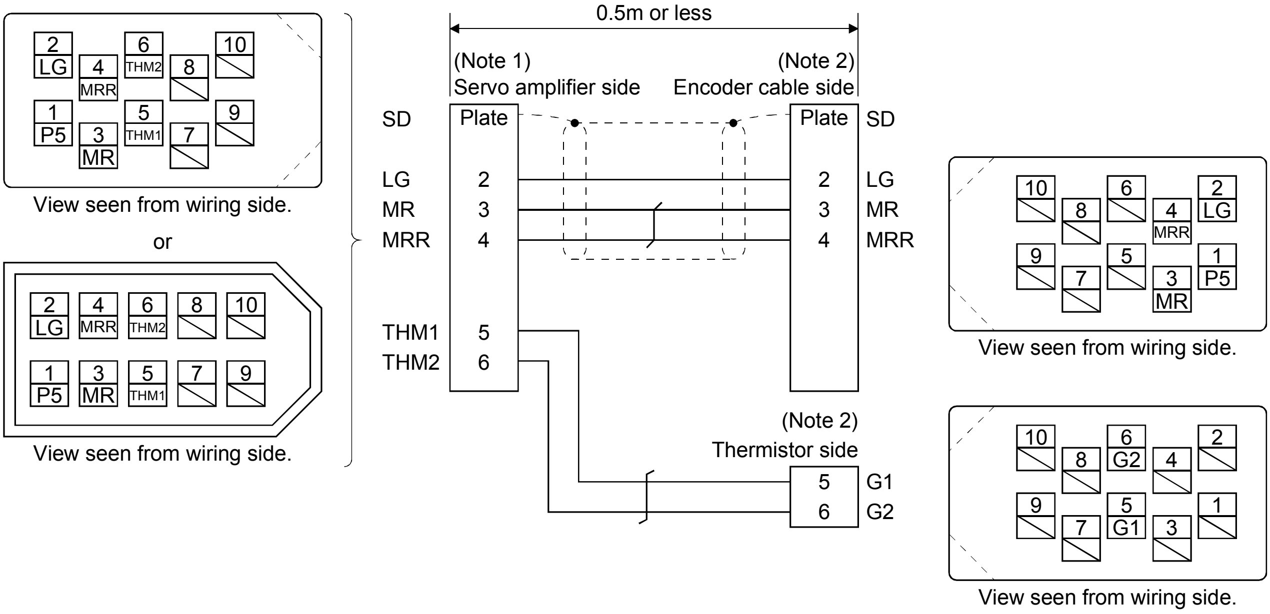


Connector: 10114-3000PE
: 10314-52F0-008
(3M or equivalent)

Note. Connect the LG of the servo amplifier to the 0V of the load side encoder.
In addition, it is not necessary to increase the number of connections according to the wiring length.

(c) Production of branch cable

Produce the branch cable using the MR-J3THMCN2 connector set as shown below. Keep the branch cable length 0.5m or shorter. Use the AWG22 cable for the wiring.



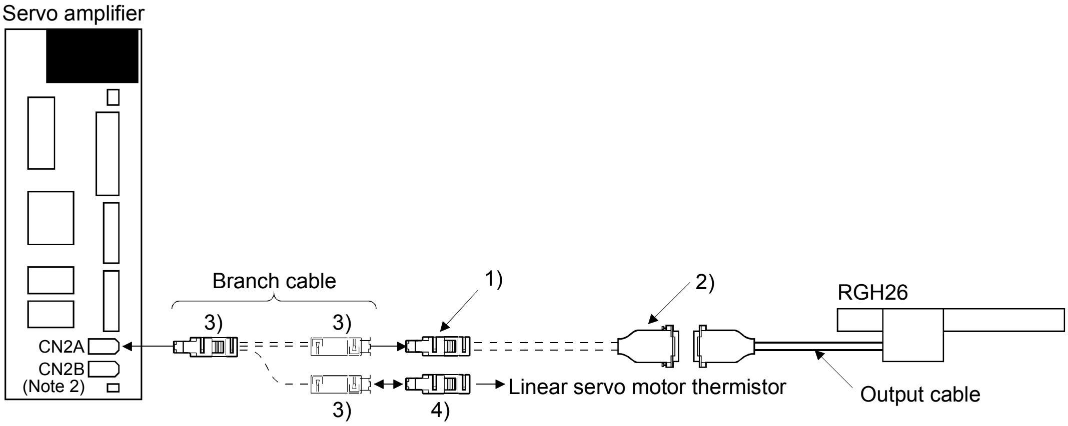
Note 1. Receptacle: 36210-0100PL, Shell kit: 36310-3200-008 (3M), or Connector set: 54599-1019 (Molex)

2. Plug: 36110-3000FD, Shell kit: 36310-F200-008 (3M)

(4) Linear encoder manufactured by Renishaw Inc. (Incremental type)

(a) Cable structure

Prepare a cable based on the following structure diagram.



Cable				
Encoder cable (Note 1)		Output cable	Branch cable	Thermistor cable
1) Connector set (Option) (Refer to section 13.5.3.)	2) Junction connector (This should be prepared by the customer.) D-SUB15 pin (female)	Accessories for linear encoder Cable Length 0.5m	3) Connector set MR-J3THMCN2 (Option)	4) Connector set MR-J3CN2 (Option)

Note 1. Produce an encoder cable. An optional cable is not provided.

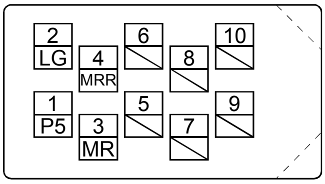
2. Configure the B-axis in the same way as for the A-axis.

(b) Production of encoder cable

Produce the encoder cable using MR-J3CN2 or a junction connector as shown below. The encoder cable can be produced as the length of max. 30m.

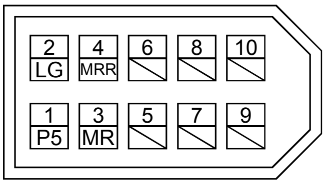
Connector set (option)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M)

Pin layout is one of the following.

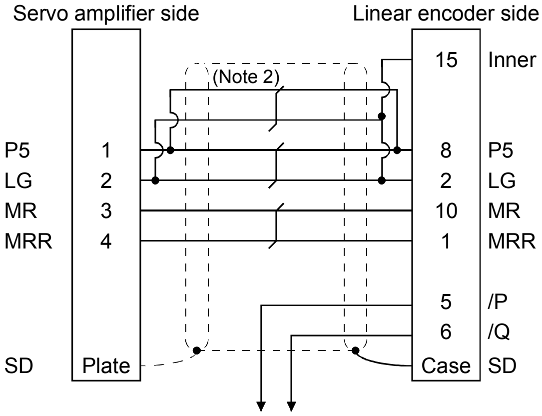


View seen from wiring side.

Connector set: 54599-1019
(Molex)



View seen from wiring side.



(Note 1) Limit switch output

Connector: D-SUB (female) 15 pin

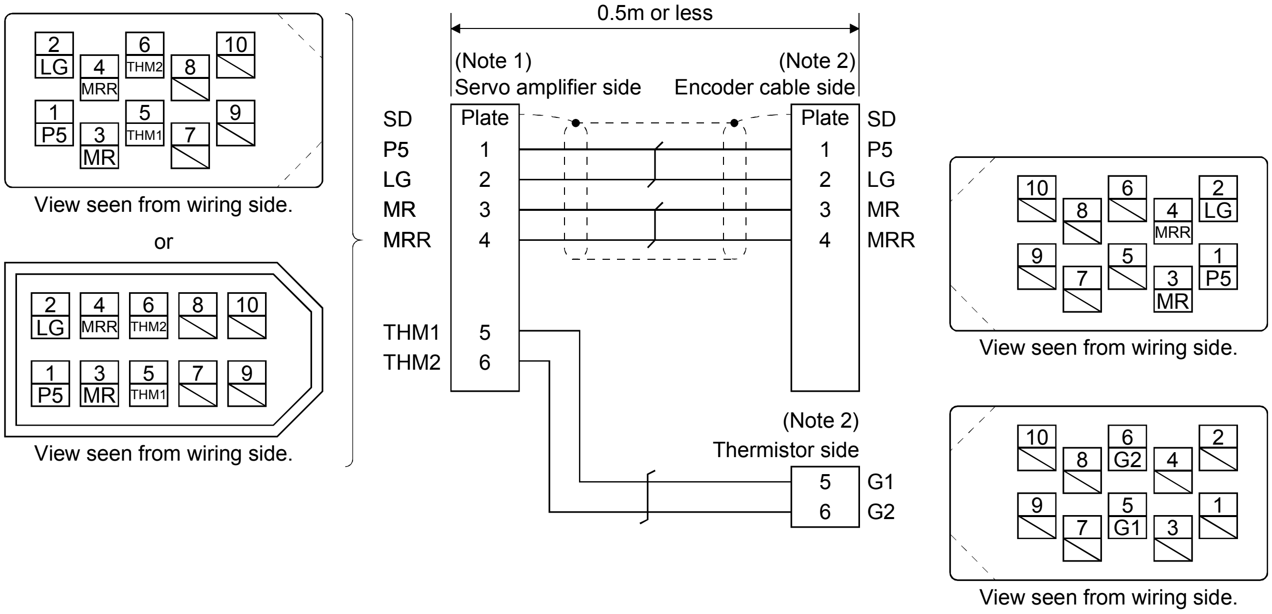
Note 1. A limit switch output signal can be connected. For details, contact with Renishaw Inc.

2. The following table shows the cable size to be used and the number of paired connections of LG and P5.

Wiring length	Number of LG and P5 connections (when the output cable is 0.5m or less)	Cable size
to 5m	1-pair	AWG22
to 10m	2-pair	
to 20m	4-pair	
to 30m	6-pair	

(c) Production of branch cable

Produce the branch cable using the MR-J3THMCN2 connector set as shown below. Keep the branch cable length 0.5m or shorter. Use the AWG22 cable for the wiring.



Note 1. Receptacle: 36210-0100PL, Shell kit: 36310-3200-008 (3M), or Connector set: 54599-1019 (Molex)

2. Plug: 36110-3000FD, Shell kit: 36310-F200-008 (3M)

13.5.3 Mitsubishi optional cable・connector sets

POINT

- The IP rating indicated is the cable's or connector's protection against ingress of dust and water when the cable or connector is connected to a servo amplifier or servo motor. If the IP rating of the cable, connector, servo amplifier or servo motor vary, the overall IP rating depends on the lowest IP rating of all components.

(1) MR-EKCBL□M-H

(a) Model explanations

Model : MR－EKCBL□M－H

Long flex life

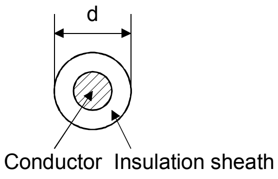
Symbol	Cable length [m]
2	2
5	5
10	10

(b) Cable structure

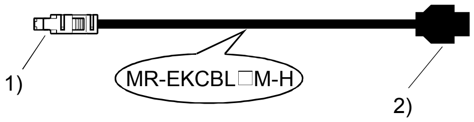
The table shows this optional cable structure.

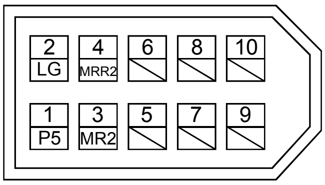
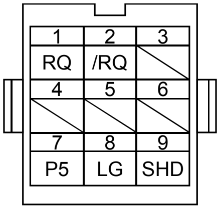
IP rating	Flex life	Length [m]	Core size [mm^2]	Number of cores	Characteristics of one core			(Note 2) Finishing OD [mm]	Wire model
					Structure [Wires/mm]	Conductor resistance [Ω/mm]	Insulation coating OD d [mm] (Note 1)		
IP20	Long flex life	2・5・10	0.2mm^2	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	(Note 3) A14B2339 6P

Note 1. d is as shown below.

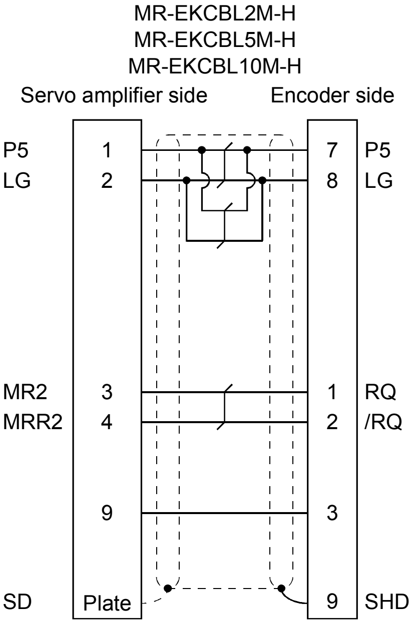


2. Standard OD. Max. OD is about 10% greater.
3. Purchased from Toa Electric Industry.



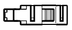
Cable model	1) CN2 connector	2) Junction connector
MR-EKCBL □ M-H	Connector set: 54599-1019 (Molex or equivalent) (Note) Signal layout  View seen from wiring side. Note. Keep open the pins shown with ⧅. Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, 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.

(c) Internal wiring diagram



(2) MR-ECNM

The following shows the connector combination for this connector set.

Parts	Description
Connector set	MR-ECNM  For CN2A and CN2B connector Connector set: 54599-1019 (Molex)  Junction connector Housing: 1-172161-9 Connector pin: 170359-1 (Tyco Electronics or equivalent) Cable clamp: MTI-0002 (Toa Electric Industries)

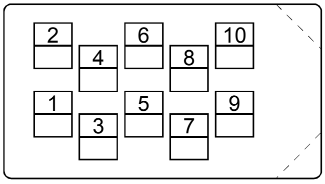
(3) MR-J3CN2

The following shows the details of this connector set.

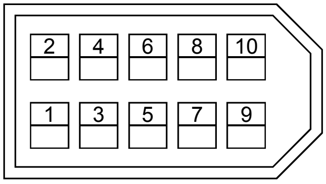
Connector set (option)
MR-J3CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M)

Connector set: 54599-1019
(Molex)

Pin layout is one of the following.



View seen from wiring side.



View seen from wiring side.

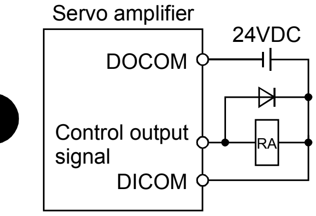
13.6 Signals and wiring

WARNING

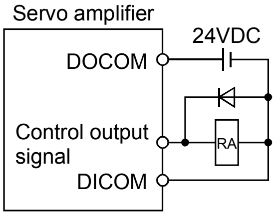
- Any person who is involved in wiring should be fully competent to do the work.
- Before wiring or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, always confirm from the front of the servo amplifier, whether the charge lamp is off or not.
- Ground the servo amplifier and the linear servo motor securely.
- Do not attempt to wire the servo amplifier and linear 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 linear servo motor may misoperate, 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 for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



For the sink output interface



For the source output interface

- 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 option) with the power line of the linear servo motor.
- When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a transistor fault or the like may overheat the regenerative resistor, causing a fire.
- During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.
- Do not modify the equipment.
- The cables such as power cables deriving from the primary side (coil) cannot stand the long-term flexing action. Avoid the flexing action by fixing to the movable part, etc. Also, use the cable that stands the long-term flexing action for the wiring to the servo amplifier.

13.6.1 Precautions on this chapter

The following items are not described in this chapter. For details of these items, refer to the below item.

Item	Reference
Explanation of Power Supply System	Section 3.3
Signal (device) explanations	Section 3.5
Alarm occurrence timing chart	Section 3.6
Interfaces	Section 3.7 (excluding the internal connection diagram)
Processing of cable shield external conductor	Section 3.8
SSCNETⅢ cable connection	Section 3.9
Grounding	Section 3.12
Control axis selection	Section 3.13

13.6.2 Power supply system circuit connection example

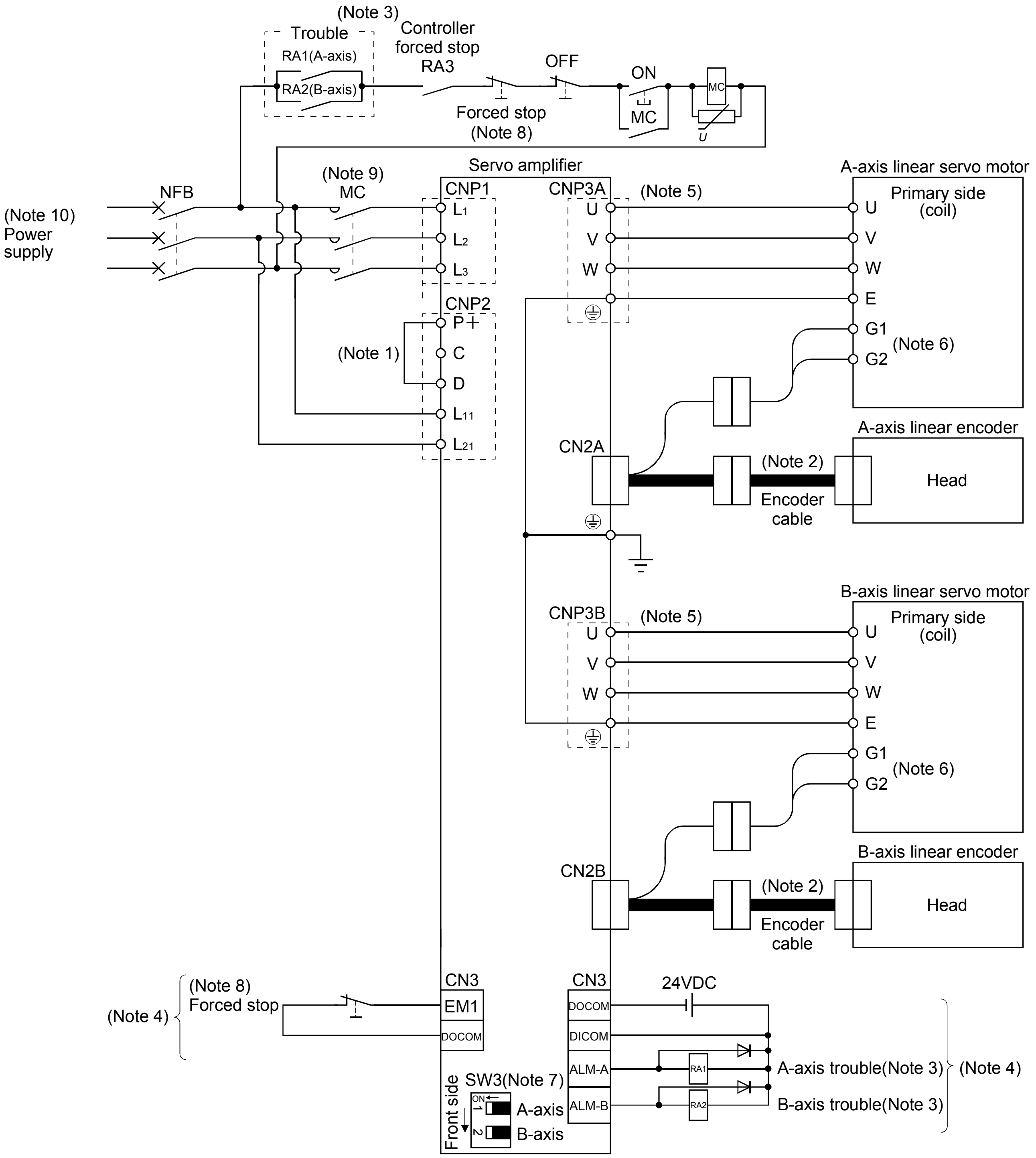
⚠CAUTION

- Always connect a magnetic contactor 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 is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.
- Shut off the main circuit power supply when alarms are occurring in both of the A-axis and the B-axis. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

POINT

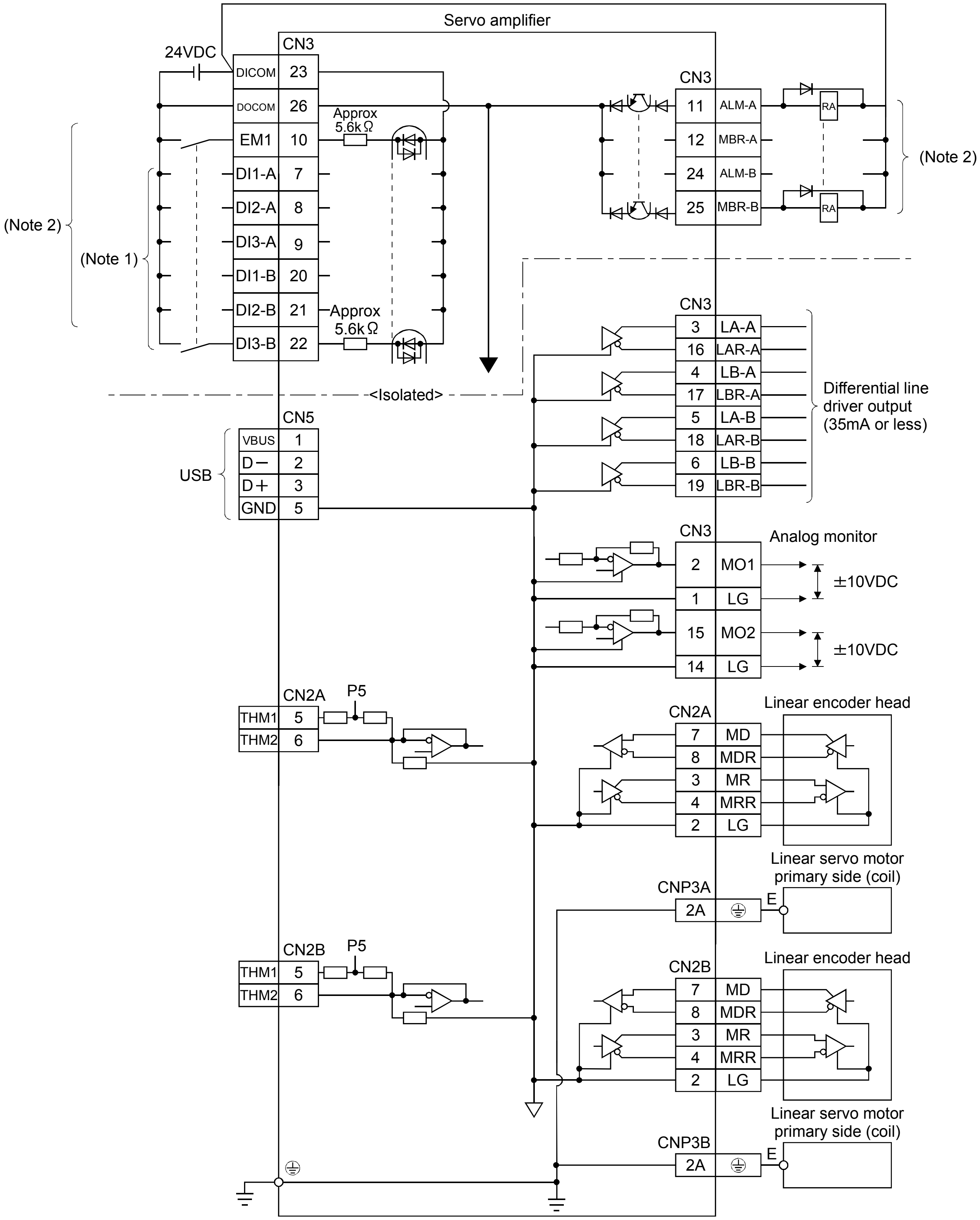
- Even if alarm has occurred, do not switch off the control circuit power supply. When the control circuit power supply has been switched off, optical module does not operate, and optical transmission of SSCNETⅢ communication is interrupted. Therefore, the servo amplifier on the rear axis displays "AA" at the indicator and turns into base circuit shut-off. The linear servo motor stops with starting dynamic brake.
- For details of each signal, refer to section 3.3.

Wire the power supply/main circuit as shown below so that power is shut off and the servo-on command turned off as soon as an alarm occurs, a servo forced stop is made valid, or a controller forced stop is made valid. A no-fuse breaker (NFB) must be used with the input cables of the main circuit power supply.


(Note 3)
Trouble
RA1(A-axis)
RA2(B-axis)
Controller
forced stop
RA3
OFF
ON
MC
MC
U
Forced stop
(Note 8)
Servo amplifier
A-axis linear servo motor
(Note 9)
MC
NFB
(Note 10)
Power
supply
CNP1
L1
L2
L3
CNP3A
U
V
W
(Note 5)
Primary side
(coil)
U
V
W
E
G1
G2
(Note 6)
CNP2
P+
C
D
L11
L21
(Note 1)
A-axis linear encoder
CN2A
(Note 2)
Head
Encoder
cable
B-axis linear servo motor
CNP3B
U
V
W
(Note 5)
Primary side
(coil)
U
V
W
E
G1
G2
(Note 6)
B-axis linear encoder
CN2B
(Note 2)
Head
Encoder
cable
CN3
CN3
24VDC
(Note 8)
Forced stop
(Note 4)
EM1
DOCOM
DOCOM
DICOM
ALM-A
ALM-B
RA1
RA2
A-axis trouble(Note 3)
B-axis trouble(Note 3)
(Note 4)
SW3(Note 7)
Front side
ON
1
2
A-axis
B-axis

Note 1. Always connect P＋ and D. When using the regenerative option, refer to section 11.2.
2. For the encoder cable, use of the option cable is recommended. Refer to section 11.1 for selection of the cable.
3. If deactivating output of trouble (ALM-A/ALM-B) with parameter change, configure up the power supply circuit which switches off the magnetic contactor after detection of alarm occurrence on the controller side. In this connection example, the operation continues in the other axis when an alarm occurs in the A-axis or the B-axis. To stop both axes in an alarm occurrence, connect RA1 and RA2 in series.
4. For the sink I/O interface. For the source I/O interface, refer to section 3.7.3.
5. Refer to section 3.10.
6. There may not be a thermistor output.
7. This connection example is a connection using linear servo motors. Turn SW3 on. (Refer to section 3.14.)
8. Configure the circuit to shut down the main circuit power supply simultaneously with the turn off of forced stop (EM1) using the external sequence.
9. Be sure to use a magnetic contactor with an operation delay time of 80ms or less. The operation delay time is the time interval between current being applied to the coil until closure of contacts.
10. For 1-phase 200V to 230VAC, connect the power supply to L_1 ・ L_2 and leave L_3 open. Refer to section 1.3 for the power supply specification.

13.6.3 Internal connection diagram



Note 1. Signal can be assigned for these pins with host controller setting.

For contents of signals, refer to the instruction manual of host controller.

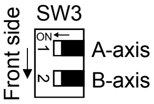
2. For the sink I/O interface. For the source I/O interface, refer to section 3.7.3.

13.7 Operation and functions

13.7.1 Startup

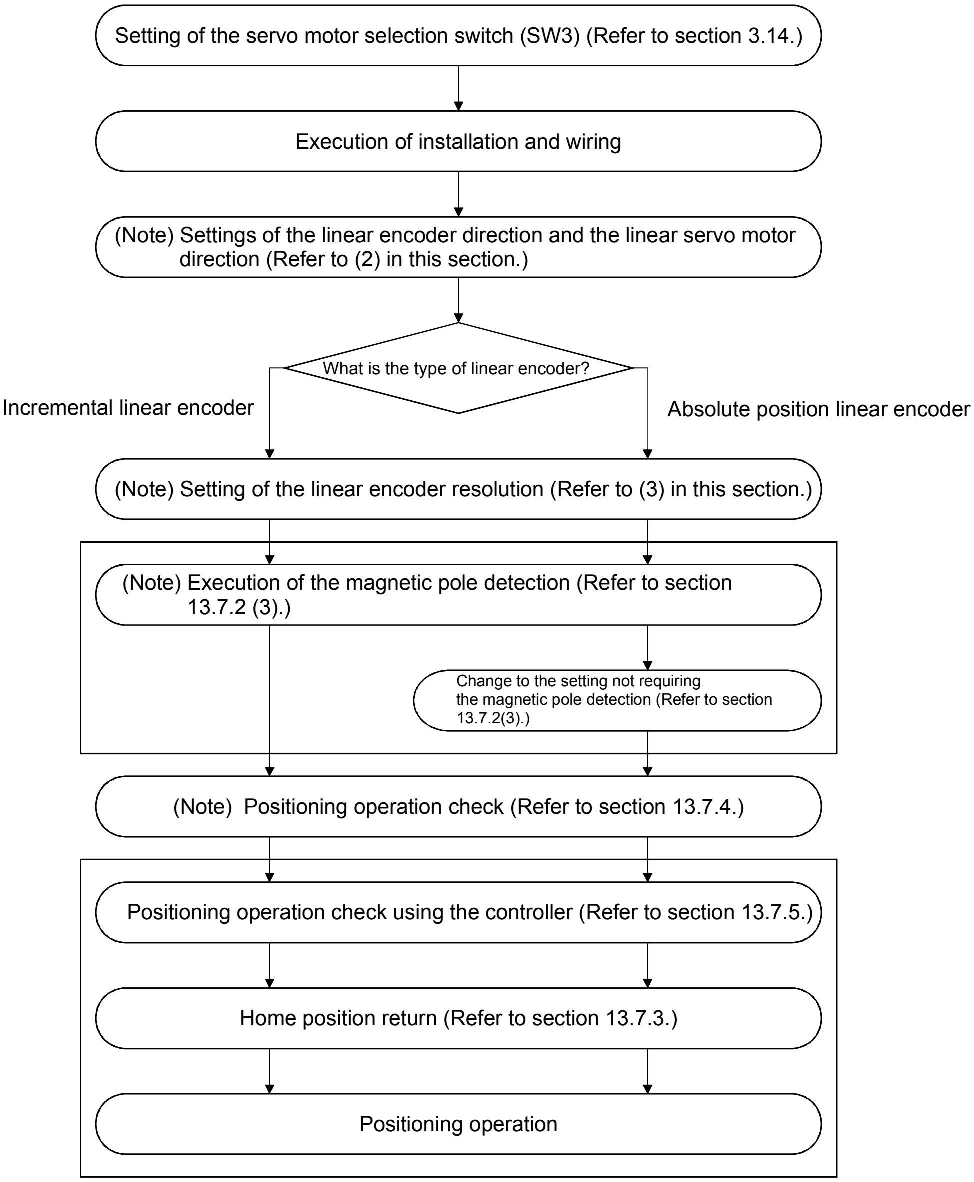
POINT

- To use a linear servo motor, turn SW3 on.



(1) Startup procedure

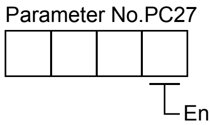
Start up the linear servo referring to the following procedure.



Note. MR Configurator is used.

(2) Settings of the linear encoder direction and the linear servo motor direction

Set the positive direction of linear servo motor to match with the increase direction of linear encoder feedback using the first digit (Encoder pulse count polarity selection) of the parameter No.PC27.



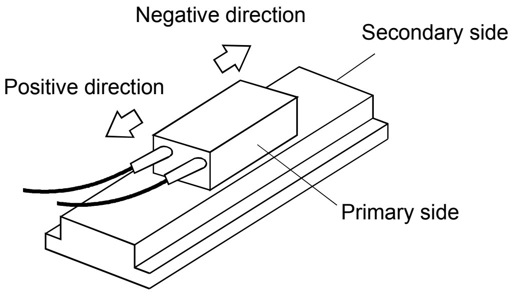
Encoder pulse count polarity selection
0: Linear servo motor positive direction and linear encoder increase direction
1: Linear servo motor positive direction and linear encoder decrease direction

(a) Parameter setting method

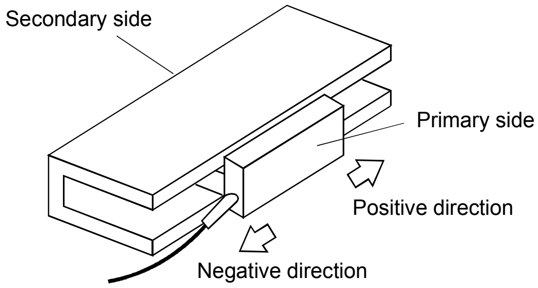
1) Confirm the positive direction of linear servo motor the relationship of the moving direction of linear servo motor to commands is determined by the setting of the parameter No.PA14 as follows.

Parameter No.PA14 setting value	Moving direction of linear servo motor	
	Address increase command	Address decrease command
0	Positive direction	Negative direction
1	Negative direction	Positive direction

The positive/negative directions of the linear servo motor are as shown below.



LM-H2 and LM-F series



LM-U2 series

2) Confirm the increase direction of linear encoder.

3) If the positive direction of the linear servo motor matches with the increase direction of linear encoder, set the parameter No.PC27 to "□□□0". If not, set the parameter to "□□□1".

(b) Confirmation method

Confirm the positive direction of linear servo motor and the increase direction of linear encoder using the following procedure.

1) Move the linear servo motor manually to the positive direction in the servo off status.

2) Confirm the motor speed (positive and negative) at that time using MR Configurator.

3) If the parameter No.PC27 is set to "□□□0" and the positive direction of linear servo motor matches with the increase direction of linear encoder, the motor speed will be a positive value by making the linear servo motor work to the positive direction. If the positive direction of linear servo motor does not match with the increase direction of linear encoder, the motor speed will be a negative value. If the parameter No.PC27 is set to "□□□1" and the positive direction of linear servo motor matches with the increase direction of linear encoder, the motor speed will be a negative value by making the linear servo motor work to the positive direction.

(3) Setting of the linear encoder resolution

Set the ratio to the linear encoder resolution using the parameter No.PS02 (Linear encoder resolution setting numerator) and parameter No.PS03 (Linear encoder resolution setting denominator).

POINT

- When using this parameter, turn the power off once after setting the parameter No.PA19 to "□□□D", and then turn it on again.
- Turn off the power and then on again after setting the parameter to validate the parameter value.

(a) Parameter setting

Set the value as the following equation.

$$\frac{\text{Parameter No.PS02 (Linear encoder resolution setting numerator)}}{\text{Parameter No.PS03 (Linear encoder resolution setting denominator)}} = \text{Linear encoder resolution } [\mu\text{m}]$$

(b) Parameter setting example

When the linear encoder resolution is 0.5 μ m

$$\frac{\text{Parameter No.PS02}}{\text{Parameter No.PS03}} = \text{Linear encoder resolution} = 0.5\ \mu\text{m} = \frac{1}{2}$$

The following shows the simplified chart for the setting value of parameter Nos.PS02 and PS03.

		Linear encoder resolution (μm)							
		0.01	0.02	0.05	0.1	0.2	0.5	1.0	2.0
Setting value	Parameter No.PS02	1	1	1	1	1	1	1	2
	Parameter No PS03	100	50	20	10	5	2	1	1

POINT

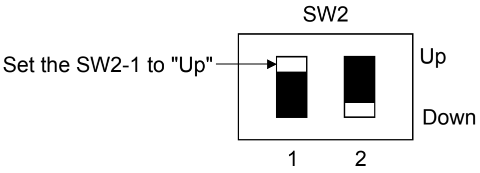
- When setting the wrong value to the parameter Nos. PS02 and PS03, they may not operate properly.
- Servo alarm (27.□ and 42.□) may occur at positioning operation or magnetic pole detection.

13.7.2 Magnetic pole detection

Make sure to perform the magnetic pole detection before starting the positioning operation in order to match the positional relationship between the linear servo motor and the linear encoder.

(1) Preparation for the magnetic pole detection

For the magnetic pole detection, the test operation mode (positioning operation) of MR Configurator is used. Turn the power of servo amplifier off and set the test operation select switch (SW2-1) as shown below. By turning the power on, it switches to the test operation mode.



(2) Magnetic pole detection

⚠WARNING	・Note that the magnetic pole detection is automatically started simultaneously with turning ON the servo-on command.

⚠CAUTION	・If the magnetic pole detection is not executed properly, the linear servo motor may run unexpectedly.

POINT

- Establish the machine configuration using the stroke limits (FLS and RLS). If the stroke limits (FLS and RLS) do not exist, it may cause the machine damage by a collision.
- At the magnetic pole detection, it is not predictable whether it moves to the positive direction or the negative direction.
- Setting the parameter No.PS09 (Magnetic pole detection voltage level) may cause the occurrence of overload, overcurrent, magnetic pole detection alarm, etc.
- When performing the positioning operation from the positioning controller, set the sequence which confirms the normal completion of magnetic pole detection and the servo-on status, then outputs the positioning command. If outputting the positioning command before the Ready (RD-A/RD-B) turns ON, the command may not be accepted or the servo alarm may occur.
- After the magnetic pole detection, check the accuracy of position with the test operation (positioning operation) of MR Configurator.
- If a gap is generated to the positional relationship between the linear encoder and the linear servo motor when using the absolute position linear encoder, carry out the magnetic pole detection again.
- The accuracy of magnetic pole detection will be improved by being operated in the no-load condition.
- The servo alarm may occur when the linear encoder is not mounted properly or when the setting (parameter Nos. PS02 and PS03) of linear encoder resolution or the setting value of parameter No.PS09 (magnetic detection voltage level) is not correct.
- On the machine of which friction becomes 30% or more than the rated thrust, it may not operate properly after the magnetic pole detection.
- On the machine of which imbalance thrust becomes 20% or more than the rated thrust at the horizontal axis, it may not operate properly after the magnetic pole detection.

For the following cases, the magnetic pole detection is required.

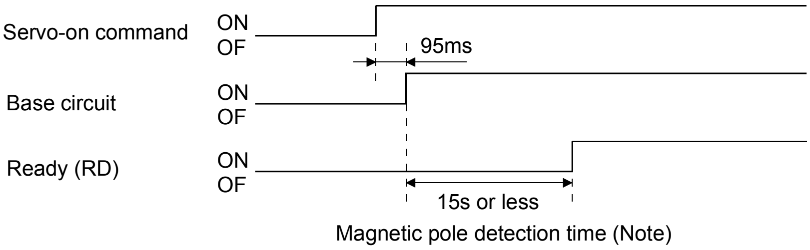
1) When using the incremental linear encoder (Refer to (2) (a) in this section)

2) When using the absolute position linear encoder and matching with the cases indicated below (Refer to (2) (b) in this section)
    - At the system setup (at the first startup of equipment)
    - When the servo amplifier is replaced
    - When the linear servo motor (primary side (coil) or secondary side (magnet)) is replaced
    - When the linear encoder (scale or head) is replaced or its installation is changed

(a) For the incremental linear encoder

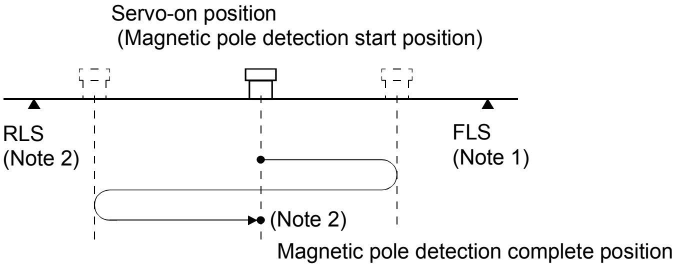
For the incremental linear encoder, the magnetic pole detection is required every time the power is turned on. By turning ON the servo-on command from the controller after the power-on, the magnetic pole detection is automatically carried out. Therefore, there is no need to set the parameter (first digit of parameter No.PS01) for executing the magnetic pole detection.

1) Timing chart



Note. The magnetic pole detection time indicates the operation time when the stroke limits (FLS and RLS) is ON.

2) Linear servo motor movement (when FLS and RLS are ON)

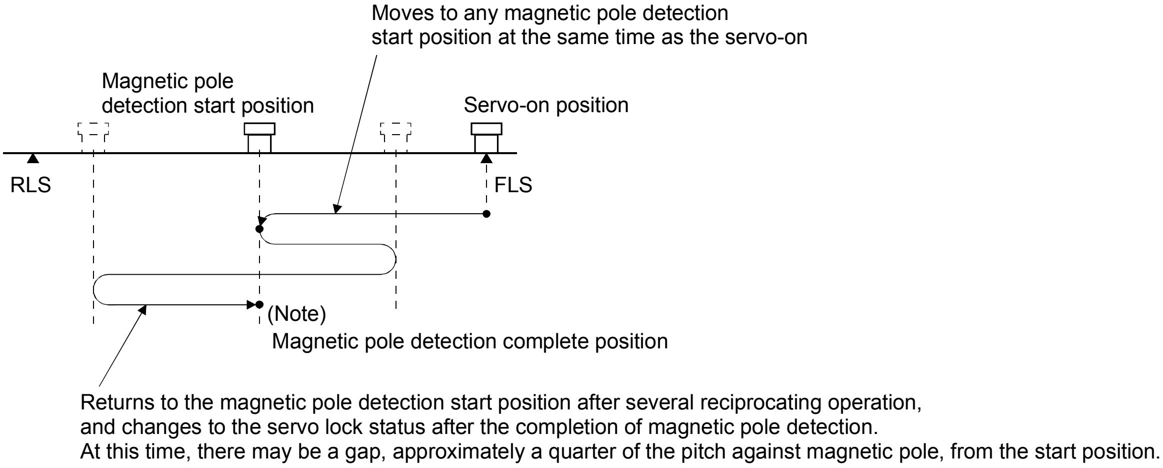


Note 1. When the stroke limit (FLS or RLS) turns OFF during the magnetic pole detection, the operation of magnetic pole detection is carried on to the opposite direction. When both FLS and RLS are OFF, the magnetic pole detection error (27.□) occurs.

2. The following shows the pitch against magnetic pole.

Linear servo motor series	LM-H2	LM-U2 (Medium thrust)
Pitch against magnetic pole [mm]	48	30

3) Linear servo motor operation (when FLS or RLS is OFF)
   When the FLS or RLS is OFF at the servo-on, the magnetic pole detection is carried out as follows.



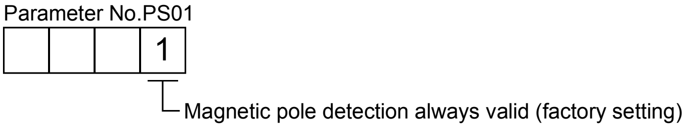
Note. For the pitch against magnetic pole, refer to (2) (a) 2) Note 2 in this section.

(b) For the absolute position linear encoder

POINT
· If a gap is generated to the positional relationship between the linear encoder and the linear servo motor when using the absolute position linear encoder, carry out the magnetic pole detection again.

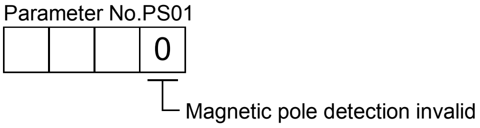
Carry out the magnetic pole detection referring the following procedure.

1) Set the parameter No.PS01 (Linear function selection 1) to "□□□1 (Magnetic pole detection always valid)".



2) Execute the magnetic pole detection. (Refer to (2) (a) 1) and 2) in this section)

3) Change the parameter No.PS01 to "□□□0 (Magnetic pole detection not valid)" after the normal completion of magnetic pole detection.



By making the magnetic pole detection function invalid with the parameter No.PS01 after the magnetic pole detection, the magnetic pole detection for each power-on will be unnecessary.

(3) Setting of the magnetic pole detection voltage level

For the positioning detection method, set the magnetic pole detection voltage level with the parameter No.PS09 (magnetic pole detection voltage level). Voltage level setting is not required when detecting magnetic poles by the minute position detection method.

(a) Guideline of parameter settings

Set the parameters referring to the following table.

Parameter No.PS09 setting value (Guide value) / Servo status	Small ← Medium → Large (Less than 10 (factory setting) More than 50)	
Thrust at operation	Small	Large
Overload, overcurrent alarm	Not frequently occurred	Frequently occurred
Magnetic pole detection alarm	Frequently occurred	Not frequently occurred
Magnetic pole detection accuracy	Low	High

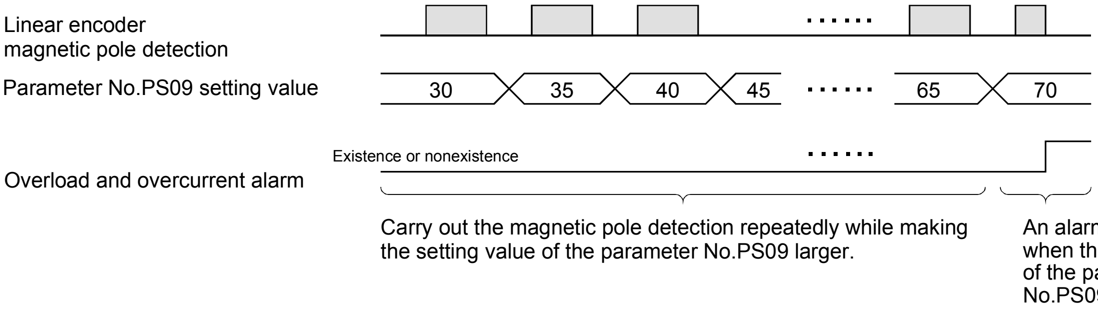
(b) Setting procedure

1) By carrying out the magnetic pole operation, make the setting of parameter No.PS09 (magnetic pole detection voltage level) larger until the overload 1 (50.☐), overload 2 (51.☐), overvoltage (33.1), overload warning 1 (E1.☐) and overload warning 2 (EC.1) occur. To get a rough idea, make it lager in "5". When these alarms and warnings occur during the magnetic pole detection by MR Configurator, the test operation of MR Configurator is automatically completed and servo off status established.

2) Set the final setting value to approximately 70% of the value which is set at the occurrence of the overload 1 (50.☐), overload 2 (51.☐), overvoltage (33.1), overload warning 1 (E1.☐) and overload warning 2 (EC.1). However, in the case where the initial magnetic pole detection error (27.☐) occurs with this setting value, set the final setting value to the value intermediate between the setting value at the occurrence of the overload 1 (50.☐), overload 2 (51.☐), overvoltage (33.1), overload warning 1 (E1.☐), overload warning 2 (EC.1) and the setting value at the occurrence of the magnetic pole detection alarm.

3) Carry out the magnetic pole detection again with the final setting value.

(c) Setting example

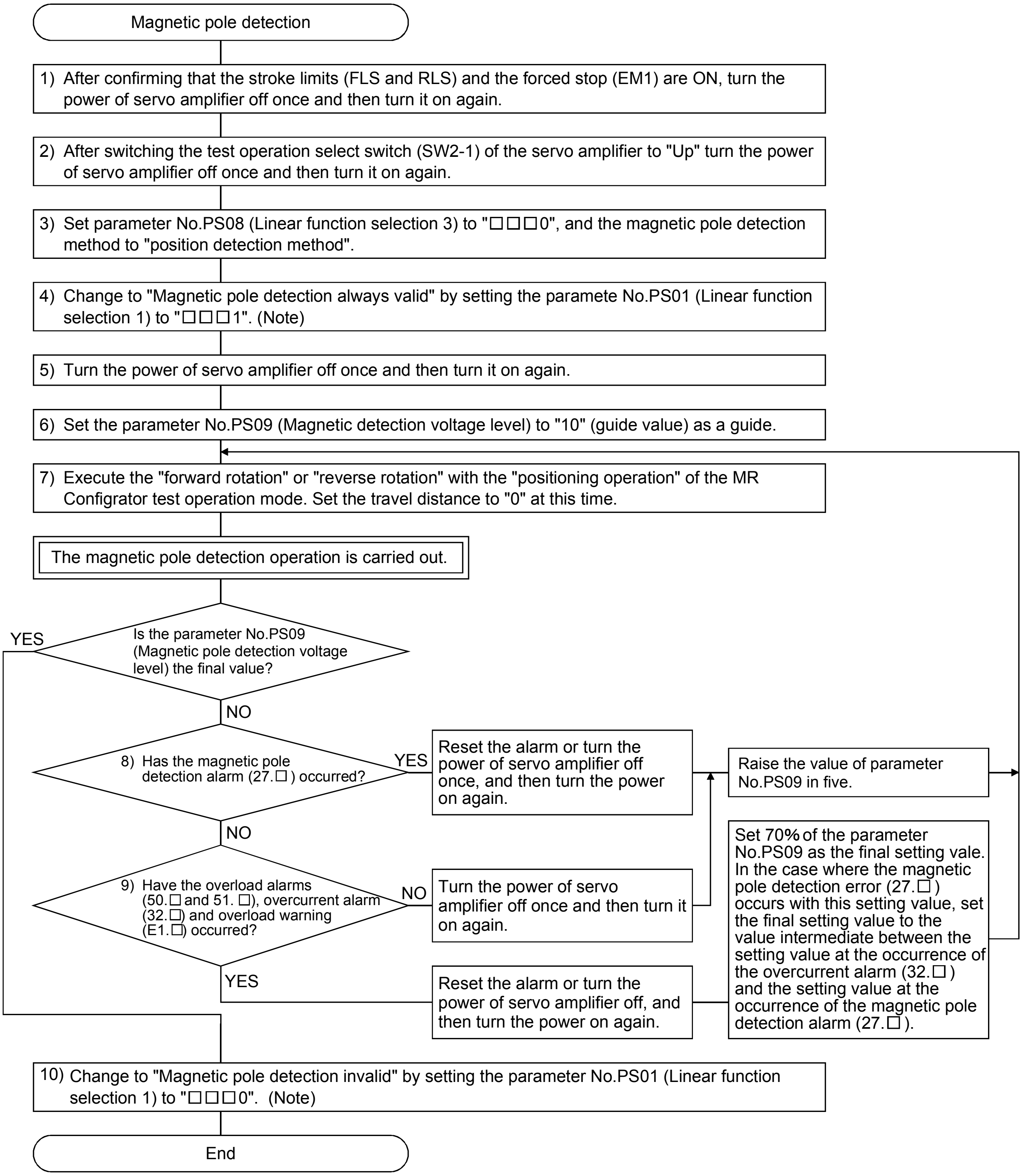


Here, the final setting value of the parameter No.PS09 is set to 49 (the setting value at the occurrence of the overload and overcurrent alarm＝70 × 0.7).

(4) Magnetic pole detection method using MR Configurator

The following shows the procedure of the magnetic pole detection using MR Configurator.

(a) Magnetic pole detection of the positioning detection method.



Magnetic pole detection

1) After confirming that the stroke limits (FLS and RLS) and the forced stop (EM1) are ON, turn the power of servo amplifier off once and then turn it on again.

2) After switching the test operation select switch (SW2-1) of the servo amplifier to "Up" turn the power of servo amplifier off once and then turn it on again.

3) Set parameter No.PS08 (Linear function selection 3) to "□□□0", and the magnetic pole detection method to "position detection method".

4) Change to "Magnetic pole detection always valid" by setting the paramete No.PS01 (Linear function selection 1) to "□□□1". (Note)

5) Turn the power of servo amplifier off once and then turn it on again.

6) Set the parameter No.PS09 (Magnetic detection voltage level) to "10" (guide value) as a guide.

7) Execute the "forward rotation" or "reverse rotation" with the "positioning operation" of the MR Configrator test operation mode. Set the travel distance to "0" at this time.

The magnetic pole detection operation is carried out.

Is the parameter No.PS09 (Magnetic pole detection voltage level) the final value?

8) Has the magnetic pole detection alarm (27.□) occurred?

Reset the alarm or turn the power of servo amplifier off once, and then turn the power on again.

Raise the value of parameter No.PS09 in five.

9) Have the overload alarms (50.□ and 51. □), overcurrent alarm (32.□) and overload warning (E1.□) occurred?

Turn the power of servo amplifier off once and then turn it on again.

Reset the alarm or turn the power of servo amplifier off, and then turn the power on again.

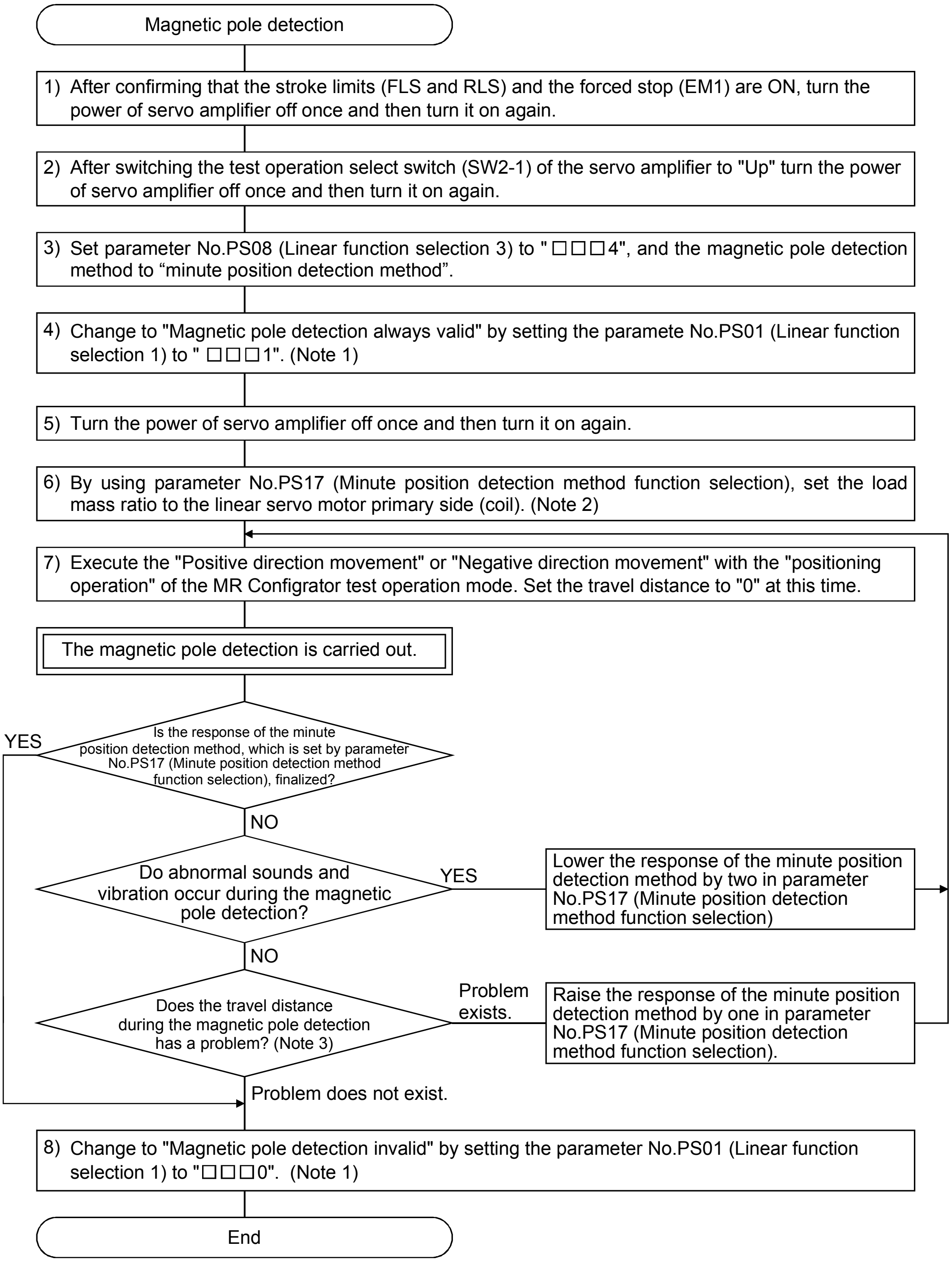
Set 70% of the parameter No.PS09 as the final setting vale. In the case where the magnetic pole detection error (27.□) occurs with this setting value, set the final setting value to the value intermediate between the setting value at the occurrence of the overcurrent alarm (32.□) and the setting value at the occurrence of the magnetic pole detection alarm (27.□).

10) Change to "Magnetic pole detection invalid" by setting the parameter No.PS01 (Linear function selection 1) to "□□□0". (Note)

End

Note. When using an incremental type linear scale, the parameter No.PS01 setting is not required.

(b) pole detection by the minimal position detection method



Magnetic pole detection

1) After confirming that the stroke limits (FLS and RLS) and the forced stop (EM1) are ON, turn the power of servo amplifier off once and then turn it on again.

2) After switching the test operation select switch (SW2-1) of the servo amplifier to "Up" turn the power of servo amplifier off once and then turn it on again.

3) Set parameter No.PS08 (Linear function selection 3) to "□□□4", and the magnetic pole detection method to “minute position detection method”.

4) Change to "Magnetic pole detection always valid" by setting the paramete No.PS01 (Linear function selection 1) to " □□□1". (Note 1)

5) Turn the power of servo amplifier off once and then turn it on again.

6) By using parameter No.PS17 (Minute position detection method function selection), set the load mass ratio to the linear servo motor primary side (coil). (Note 2)

7) Execute the "Positive direction movement" or "Negative direction movement" with the "positioning operation" of the MR Configrator test operation mode. Set the travel distance to "0" at this time.

The magnetic pole detection is carried out.

Is the response of the minute position detection method, which is set by parameter No.PS17 (Minute position detection method function selection), finalized?

Do abnormal sounds and vibration occur during the magnetic pole detection?

Lower the response of the minute position detection method by two in parameter No.PS17 (Minute position detection method function selection)

Does the travel distance during the magnetic pole detection has a problem? (Note 3)

Raise the response of the minute position detection method by one in parameter No.PS17 (Minute position detection method function selection).

8) Change to "Magnetic pole detection invalid" by setting the parameter No.PS01 (Linear function selection 1) to "□□□0". (Note 1)

End

Note 1. When using the incremental system, parameter No.PS01 setting is not required.

2. When the load mass ratio to the linear servo motor primary side (coil) is unknown, detect magnetic poles with the position detection method, perform auto tuning, and set an estimated value.

3. When detecting magnetic poles with the minute position detection method, the maximum travel distance of 0.5mm or less during the magnetic pole detection is acceptable. To shorten the travel distance, increase the response of the minute position detection method in parameter No.PS17 (Minute position detection method function selection).

(5) Magnetic pole detection at the replacement of servo amplifier

When replacing the servo amplifier, carry out the magnetic pole detection again. If the magnetic pole detection cannot be performed unavoidably, write the magnetic pole information from the servo amplifier before the replacement to the one after the replacement using MR Configurator.

(a) Procedures

1) Read the magnetic pole information of the servo amplifier before the replacement.

2) Write the read magnetic pole information to the servo amplifier after the replacement.

3) Perform the test operation with the torque limit for ensuring the safety, and confirm that there is no trouble.

(b) Transplant method of the magnetic pole information

1) How to read the magnetic pole information from the servo amplifier before the replacement

a) Select "MR-J3-B Linear" from the system setting of MR Configurator.

b) Confirm that the personal computer is connected to the servo amplifier, and select "Diagnostic" and then "Linear diagnostic".

c) Click the "Magnetic pole information" button (1) in Figure) to open the magnetic pole information window.

d) Click "Read All" of the magnetic pole information window. (2) in Figure)

e) Confirm the data 1 and data 2 (3) in Figure) of the magnetic pole information window and take notes.

2) How to write the magnetic pole information to the servo amplifier after the replacement

a) Select "MR-J3-B Linear" from the system setting of MR Configurator.

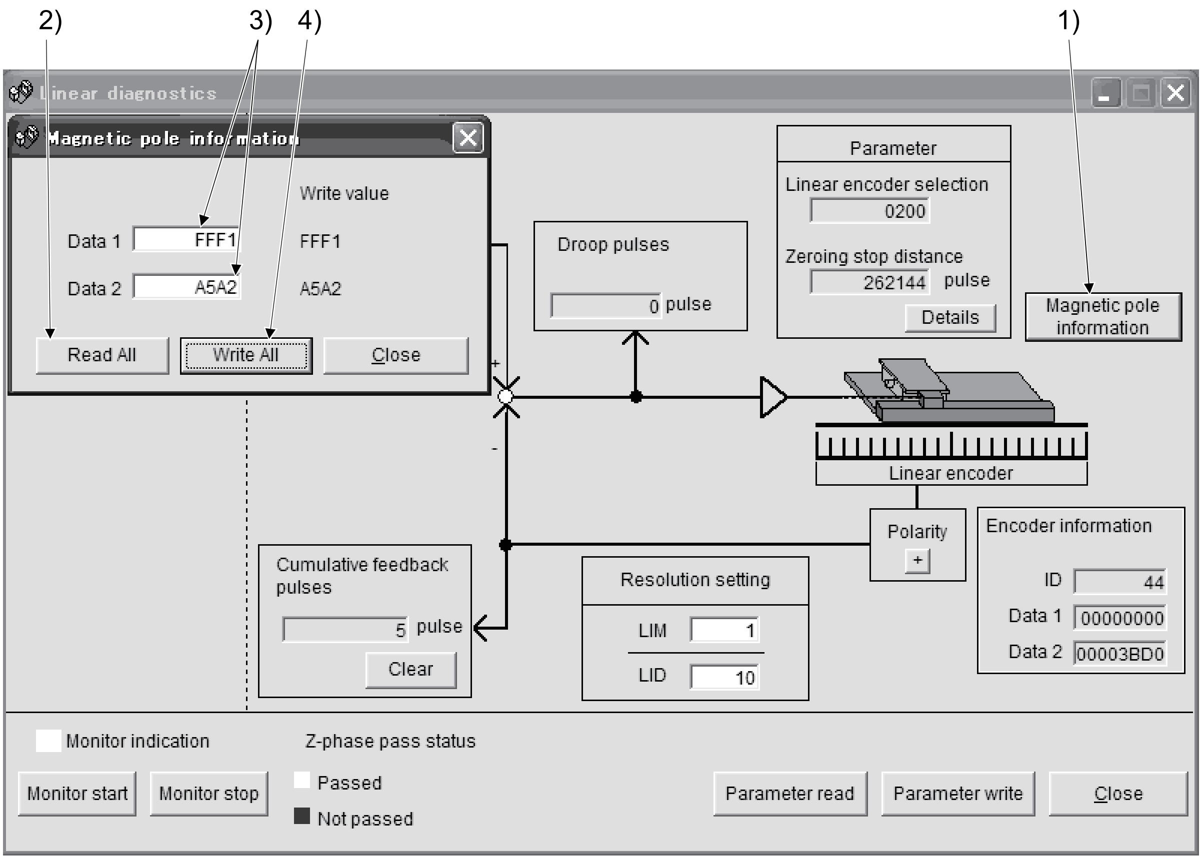
b) Confirm that the personal computer is connected to the servo amplifier, and select "Diagnostic" and then "Linear diagnostic".

c) Click the "Magnetic pole information" button (1) in Figure) to open the magnetic pole information window.

d) Input the value of the magnetic pole information taken notes to the data 1 and data 2 (3) in Figure) of the magnetic pole information window.

e) Click "Write All" (4) in Figure) of the magnetic pole information window.

f) Turn the power of servo amplifier off once, and then turn it on again.



Magnetic pole information

		Write value
Data 1	FFF1	FFF1
Data 2	A5A2	A5A2

Parameter

Linear encoder selection: 0200

Zeroing stop distance: 262144 pulse

Droop pulses: 0 pulse

Cumulative feedback pulses: 5 pulse

Polarity: +

Resolution setting

LIM: 1

LID: 10

Encoder information

ID: 44

Data 1: 00000000

Data 2: 00003BD0

☐ Monitor indication

Z-phase pass status

☐ Passed

■ Not passed

13.7.3 Home position return

POINT

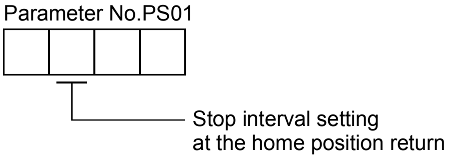
- The incremental linear encoder and the absolute position linear encoder have different home position reference positions at the home position return.

(1) Incremental linear encoder

⚠ CAUTION

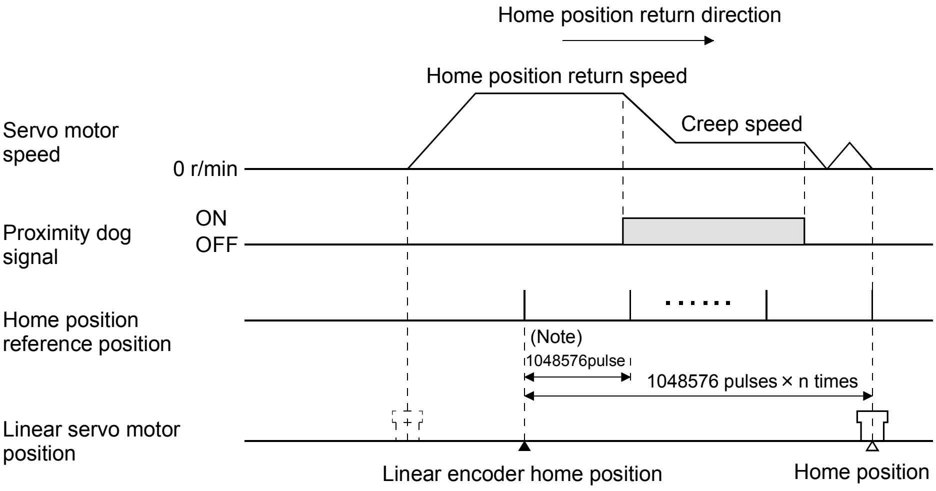
- If the resolution or stop interval (the third digit of the parameter No.PS01) of the linear encoder is too large, it is very dangerous since it may crash into the stroke end.

(a) When the linear encoder home position (reference mark) exists in the home position return direction
The home position on the incremental linear encoder is a position per 1048576 pulses (changeable with the third digit of the parameter No.PS01), which is based on the linear encoder home position (reference mark) passed primarily after the start of home position return. Change the setting value of the parameter No.PS01 according to the linear encoder resolution.



Setting value	Stop interval [pulse]
0	8192
1	131072
2	262144
3	1048576
4	4194304
5	16777216
6	67108864

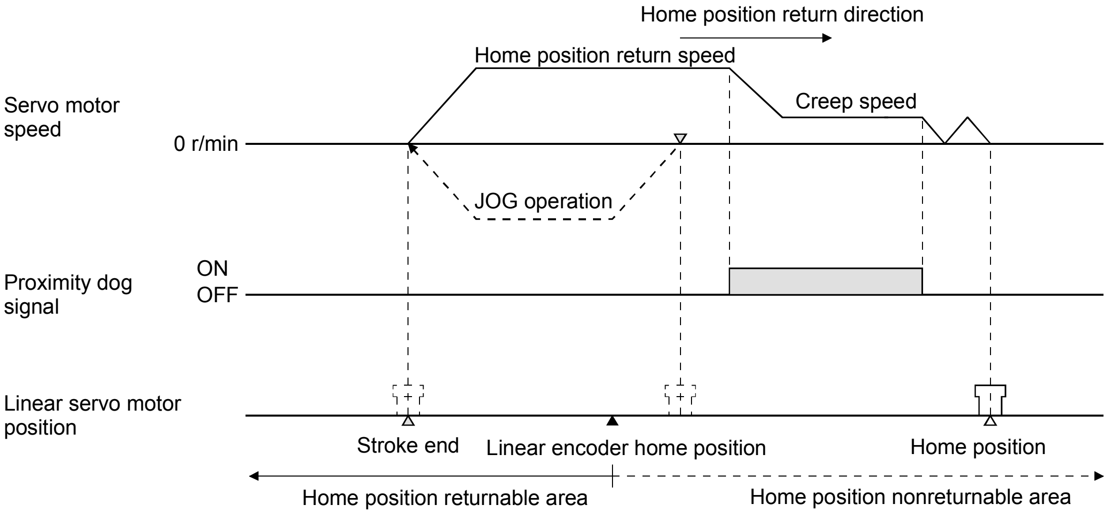
For the proximity dog type home position return, the nearest home position reference position after turning the proximity dog signal off will be the home position.
The linear encoder home position must be set to only one during the whole stroke and to the position to be surely passed after the start of home position return. The encoder Z phase pulse (LZ) cannot be used.



Note. Can be changed with the parameter No.PS01.

(b) When the linear encoder home position does not exist in the home position return direction

If the home position return is performed from the position where the linear encoder does not exist in the home position return direction, the controller will be a home position return error. Error contents differ depending on types of controller. In this chase, move it once with the JOG operation from the controller, etc. to the stroke end on the opposite side of the home position return direction, and then perform the home position return.



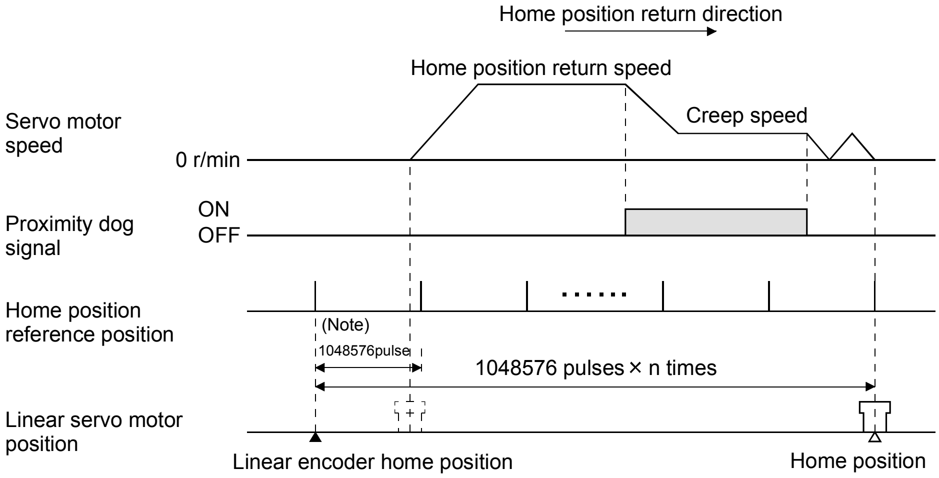
POINT

- For surely carrying out the home position return, make sure to execute the home position return after moving it to the stroke end on the opposite side with the JOG operation from the controller, etc.
- Change the setting value for the third digit of parameter No.PS01 according to the linear encoder resolution.

(2) Absolute position linear encoder

The home position reference position on the absolute position linear encoder is a position per 1048576 pulses (changeable with the third digit of the parameter No.PS01), which is based on the linear encoder home position (absolute position data＝0).

For the proximity dog type home position return, the nearest home position reference position after turning the proximity dog signal off will be the home position. There is no restriction on the setting position for the home position of linear encoder. The encoder Z phase pulse (LZ) cannot be used.



Note. Can be changed with the parameter No.PS01.

POINT

- The data set type home position return can be also carried out.

13.7.4 Test operation mode in MR Configurator

⚠CAUTION

- The test operation mode is designed for servo operation confirmation and not for machine operation confirmation. Do not use this mode with the machine. Always use the linear servo motor alone.
- If an operation fault occurred, use the forced stop (EM1) to make a stop.

POINT

- The content described in this section indicates the environment that servo amplifier and personal computer are directly connected.
- When using MR-J3W-□B, both of the A-axis and the B-axis go into the test operation mode, but only one of them can be operated.

By using a personal computer and the MR Configurator, you can execute, positioning operation, DO forced output program operation without connecting the servo system controller.

(a) Test operation mode

1) Positioning operation

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

a) Operation pattern

Item	Initial value	Setting range
Travel distance [pulse]	1048576	0 to 99999999
Speed [r/min]	200	0 to max. speed
Acceleration/deceleration time constant [ms]	1000	0 to 50000
Repeat pattern	Positive dir. → Negative dir.	Positive dir. → Negative dir. Positive dir. → Positive dir. Negative dir. → Positive dir. Negative dir. → Negative dir.
Dwell time	2.0	0.5 to 50.0
Number of repeat	1	1 to 9999

b) Operation method

Operation	Screen control
Forward rotation start	Click the "Positive direction movement" button.
Reverse rotation start	Click the "Negative direction movement" button.
Pause	Click the "Pause" button.

2) Output signal (DO) forced output

Output signals can be switched on/off forcibly independently of the servo status. Use this function for output signal wiring check, etc.
Exercise control on the DO forced output screen of the MR Configurator.

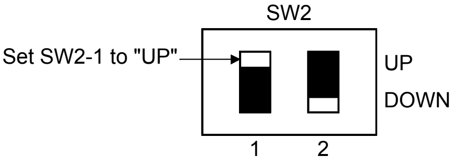
3) Program operation
Positioning operation can be performed in two or more operation patterns combined, without using the servo system controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on or off and whether the servo system controller is connected or not.
Exercise control on the programmed operation screen of the MR Configurator. For full information, refer to the MR Configurator Installation Guide.

Operation	Screen control
Start	Click the "Start" button.
Stop	Click the "Reset" button.

(b) Operation procedure

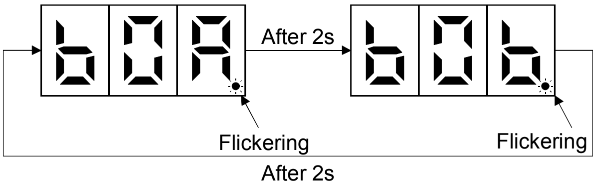
1) Switch power off.

2) Set SW2-1 to "UP".



Changing the SW2-1 setting to the "UP" position during power-on will not start the test operation mode.

3) Switch servo amplifier power on.
When initialization is over, the display shows the following screen.



4) Perform operation with the personal computer.

13.7.5 Operation from the controller

When establishing the absolute position detection system, the absolute position linear encoder is required.
A MR-BTCASE battery case and eight MR-BAT batteries are not required.
The linear servo motor can be used in combination with the following controllers.

Servo system controller	Model
Motion controller	Q17□DCPU/Q17□HCPU/Q170MCPU
Positioning module	QD75MH□/QD74MH□

(1) Operation method
For the system using the incremental linear encoder, however, the magnetic pole detection is automatically performed at the first servo-on after turning the power on. For this reason, when performing the positioning operation, configure the sequence which surely confirms the servo-on status as the inter lock condition of the positioning command.
Also, some parameter settings and home position return method varies depending on types of controllers.

(2) Servo system controller setting

(a) Setting instructions

When using the linear servo, set it as described in this section.

The following servo parameters will be valid by turning the power of servo amplifier off once and then turning it on again after writing to the servo amplifier from the controller.

Setting item					Setting description	
					Motion controller Q17☐DCPU/ Q17☐HCPU/Q170MCPU	(Note 3) Positioning QD75MH☐/QD74MH☐
Command resolution					Linear encoder resolution unit	
Servo parameters	Amplifier setting				MR-J3-B Linear	MR-J3-B Linear
	Motor setting				Automatic setting	
	No.	(Note 1) Symbol	Name	Factory setting	Set as necessary.	Set as necessary.
	PA01		For manufacturer setting (Note 2)	0040h		
	PC01	ERZ	Error excessive alarm level	100		
	PC03	*ENRS	Encoder output pulse selection	0010h		
	PC26	**COP8	Function selection C-8	0100h		
	PC27	**COP9	Function selection C-9	0000h		
	PS01	**LIT1	Linear function selection 1	0301h		
	PS02	**LIM	Linear encoder resolution setting Numerator	1000		
	PS03	**LID	Linear encoder resolution setting Denominator	1000		
	PS04	*LIT2	Linear function selection 2	0003h		
	PS05	LB1	Linear servo motor control position deviation error detection level	50		
	PS06	LB2	Linear servo motor control speed deviation error detection level	1000		
	PS07	LB3	Linear servo motor control thrust deviation error detection level	100		
	PS08	*LIT3	Linear function selection 3	0010h		
	PS09	LPWM	Magnetic pole detection voltage level	30		
	PS10	LFH	At magnetic pole detection current detection method Identification signal frequency	5		
	PS11	LIDH	At magnetic pole detection current detection method Identification signal amplitude	100		
	PS12		For manufacturer setting (Note 2)	500		
Parameter for positioning control	Unit setting				mm	mm
	Number of pulses (AP) Travel distance (AL)				Refer to (2) (b) in this section.	

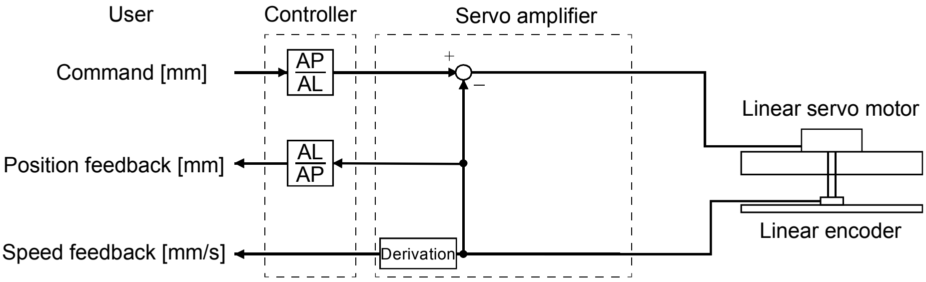
Note 1. The parameter whose symbol preceded by * can be validated with the following conditions.

* : Turn off the power and then on again, or reset the controller after setting the parameter.

**: Turn off the power and then on again after setting the parameter.

2. For the QD75 MH☐, make sure to set the factory setting.
3. GX Configurator-QP(SW2D5C-QD75P) of Ver.2.29F or later supports the MR-J3-☐B linear.

(b) Setting for the number of pulses (AP) and travel distance (AL)



The number of pulses (AP) and travel distance (AL) of the linear encoder are calculated in the following condition.

When the linear encoder resolution is 0.05 μm

$$\frac{\text{Number of pulses (AP) [pulse]}}{\text{Travel distance (AL) [}\mu\text{m]}} = \frac{1}{0.05} = \frac{20}{1}$$

13.7.6 Functions

(1) Linear servo control error detection function

POINT

- For the linear servo control error detection function, the position and speed deviation error detections are enabled as factory-set. (Parameter No.PS04: □□□3)

If the linear servo control gets unstable for some reasons, the linear servo motor may not operate properly. The protective function for detecting this before happens and stopping the operation is the linear servo control error detection function.

As the linear servo control error detection function, there are three types of detection methods: position deviation, speed deviation and thrust deviation. An error is detected when each error detection function is enabled with the setting of the parameter No.PS04 (Linear function selection 2). The detection level can be changed with the parameter Nos. PS05, PS06 and PS07.

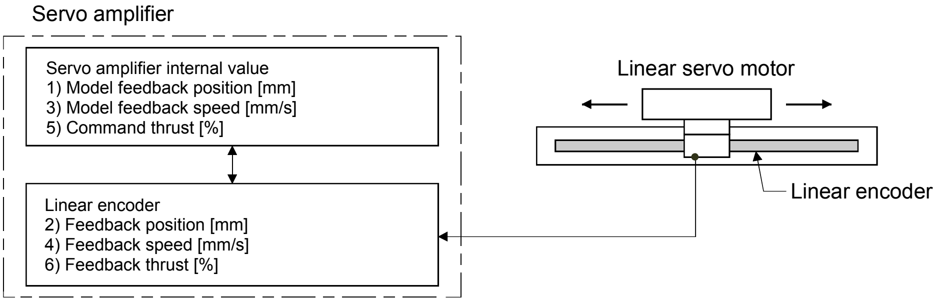
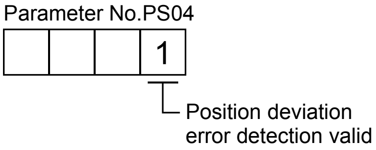


Figure 13.1 Summary of linear servo control error detection function

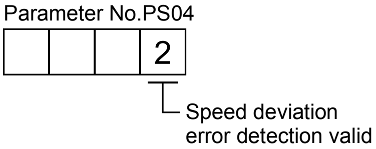
(a) Position deviation error detection
Set the parameter No.PS04 to "□□□1" to make the position deviation error detection enabled.



If there is a deviation larger than the setting value (1 to 200mm) of the parameter No.PS05 (Linear servo control position deviation error detection level) after comparing the model feedback position 1) and the feedback position 2) in Figure 13.1, the alarm (Linear servo control error 42.□) occurs, and the linear servo motor stops. The factory setting of parameter No.PS05 is 50mm. Change the setting value as necessary.

(b) Speed deviation error detection

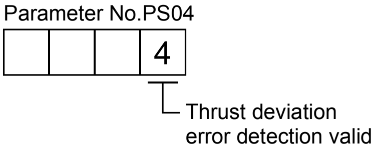
Set the parameter No.PS04 to "□□□2" to make the speed deviation error detection enabled.



If there is a deviation larger than the setting value (1 to 5000m/s) of the parameter No.PS06 (Linear servo control speed deviation error detection level) after comparing the model feedback speed 3) and the feedback speed 4) in Figure 13.1, the alarm (Linear servo control error 42.□) occurs, and the linear servo motor stops. The factory setting of parameter No.PS06 is 1,000mm/s. Change the setting value as necessary.

(c) Thrust deviation error detection

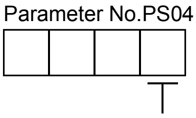
Set the parameter No.PS04 to "□□□4" to make the thrust deviation error detection enabled.



If there is a deviation larger than the setting value (1 to 1,000%) of the parameter No.PS07 (Linear servo control thrust deviation error detection level) after comparing the command thrust 5) and the feedback thrust 6) in Figure 13.1, the alarm (Linear servo control error 42.□) occurs, and the linear servo motor stops. The factory setting of parameter No.PS05 is 100%. Change the setting value as necessary.

(d) Detecting multiple deviation errors

Setting the parameter No.PS04 as shown below allows the linear servo motor to detect multiple deviation errors. For the error detection methods, refer to (1) (a), (b) and (c) in this section.



Setting value	Position deviation error detection	Speed deviation error detection	Thrust deviation error detection
3	○	○	
5	○		○
6		○	○
7	○	○	○

(2) Auto tuning function

The auto tuning function during the linear servo operation is the same as that of normal servo, but the calculation method of load to motor mass ratio (J ratio) is different. The load to motor mass ratio (J ratio) on the linear servo is a mass ratio calculated dividing the load mass by the load mass ratio to the linear servo motor primary side (coil).

Example)	Linear servo motor primary side (coil) mass	＝2kg
	Load mass (excluding the motor primary side (coil) mass)	＝4kg
	Mass ratio	＝4/2＝Twice

Refer to chapter 6, other parameters set with the auto tuning function.

POINT

- If not meeting with the following conditions, the auto tuning mode 1 may not operate properly.
  The acceleration/deceleration time constant which takes less than 5s to reach to 2,000mm/s
  The linear servo motor speed is 150mm/s or faster.
  The load mass ratio to the linear servo motor primary side (coil) is 100 times or smaller.
  The acceleration/deceleration thrust is 10% or less of the rated thrust.

(3) Machine analyzer function

POINT

- Make sure to carry out the machine analyzer function after the magnetic pole detection. If the magnetic pole detection is not executed, the function may not operate properly.
- The stop position at the completion of machine analyzer can be any position.

13.7.7 Absolute position detection system

When using the linear servo motor for the absolute position detection system, the absolute position linear encoder is required. The backup of absolute position data is performed by the linear encoder. For this reason, there is no need to mount a MR-BTCASE battery case and MR-BAT battery for encoder on the servo amplifier. Also, the alarm (25.1) and warnings (92.1, 9F.1 and E3.□) related to the absolute position are not detected.

13.8 Parameters

⚠CAUTION	・Never adjust or change the parameter values extremely as it will make operation instable.

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□□)	When using this servo amplifier in the position control mode.
Gain/filter parameters (No.PB□□)	Use these parameters when making gain adjustment manually.
Extension setting parameters (No.PC□□)	When changing settings such as analog monitor output signal, use these parameters.
I/O setting parameters (No.PD□□)	Use these parameters when changing the I/O signals of the servo amplifier.
Special setting parameters (No.PS□□)	Use these parameters when setting specially for the linear servo motor.
Option setting parameter (No.Po□□)	These parameters are dedicated to MR-J3W.

13.8.1 Parameter write inhibit (Parameter No.PA19)

POINT

- Turn off the power and then on again, or reset the controller after setting the parameter to validate the parameter value.

In the factory setting, this servo amplifier allows changes to the all parameters, settings. With the setting of parameter No.PA19, write can be disabled to prevent accidental changes.
The next 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□□	Special setting parameters No.PS□□	Option setting parameter No.Po□□
0000h	Reference	○					
	Write	○					
000Bh (factory setting)	Reference	○	○	○			
	Write	○	○	○			
000Ch	Reference	○	○	○	○		
	Write	○	○	○	○		
000Dh	Reference	○	○	○	○	○	
	Write	○	○	○	○	○	
000Eh	Reference	○	○	○	○	○	○
	Write	○	○	○	○	○	○
100Bh	Reference	○					
	Write	Parameter No.PA19 only					
100Ch	Reference	○	○	○	○		
	Write	Parameter No.PA19 only					
100Dh	Reference	○	○	○	○	○	
	Write	Parameter No.PA19 only					
100Eh	Reference	○	○	○	○	○	○
	Write	Parameter No.PA19 only					

13.8.2 Basic setting parameters (No.PA□□)

(1) Parameter list

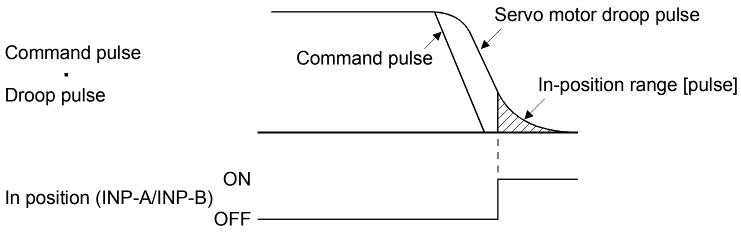
POINT

- The parameter whose symbol preceded by * can be validated with the following conditions.
  - * : Turn off the power and then on again, or reset the controller after setting the parameter.
  - **: Turn off the power and then on again after setting the parameter.
- Never change the parameters for the manufacturer setting.

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PA01	**STY	Control mode	Each axis	0000h		This section (2)
PA02	**REG	Regenerative option	Common	0000h		Section 5.1.4
PA03	*ABS	Absolute position detection system	Each axis	0000h		This section (2)
PA04	*AOP1	Function selection A-1	Common	0000h		Section 5.1.6
PA05		For manufacturer setting		0		
PA06				1		
PA07				1		
PA08	ATU	Auto tuning mode	Each axis	0001h		Section 5.1.7
PA09	RSP	Auto tuning response	Each axis	12		
PA10	INP	In-position range	Each axis	100	pulse	This section (2)
PA11		For manufacturer setting		1000.0		
PA12				1000.0		
PA13				0000h		
PA14	*POL	Moving direction selection	Each axis	0		This section (2)
PA15	*ENR	Encoder output pulses	Each axis	4000		
PA16	*ENR2	Encoder output pulses 2	Each axis	0		
PA17	**MSR	Linear servo motor series setting・Linear servo motor type setting	Each axis	0000h		
PA18	**MTY		Each axis	0000h		
PA19	*BLK	Parameter write inhibit	Each axis	000Bh		

Note 1. Each axis: Set a value for each of the A-axis and the B-axis.
Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.
2. Valid for the A-axis and the B-axis.

(2) List of details

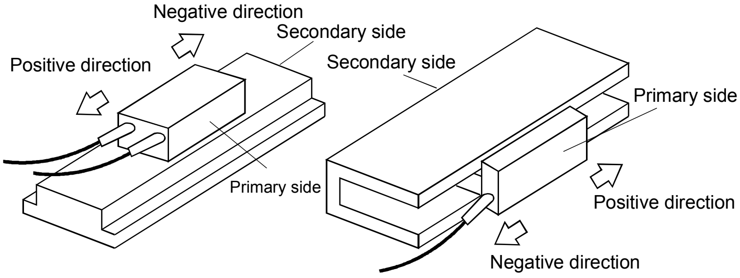
No.	Symbol	Name	Setting	Factory setting	Unit	Setting range
PA01	**STY	Control mode This parameter is set as "□□0□" (rotary servo motor) in the initial setting. To use a linear servo motor, set to "□□4□". Parameter No.PA01 0 0 □ 0 Control mode selection 0: Rotary servo motor 4: Linear servo motor	Each axis	0000h		Refer to name and function column.
PA03	*ABS	Absolute position detection system Set this parameter when using the absolute position detection system in the position control mode. 0 0 0 □ Selection of absolute position detection system (refer to chapter 12) 0: Used in incremental system 1: Used in absolute position detection system If the absolute position detection system is enabled when the linear encoder of the incremental type is being used, parameter error (37.2) occurs. POINT · This parameter cannot be used in the speed control mode.	Each axis	0000h		Refer to name and function column.
PA10	INP	In-position range Set the range, where in position (INP-A/INP-B) is output, in the command pulse unit.  POINT · This parameter cannot be used in the speed control mode.	Each axis	100	pulse	0 to 65535

<table>
<tr><th>No.</th><th>Symbol</th><th>Name</th><th>Setting</th><th>Factory setting</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PA14</td><td>*POL</td><td>

Moving direction selection
Select linear servo motor moving direction relative.

<table>
<tr><th rowspan="2">Setting</th><th colspan="2">Linear servo motor moving direction</th></tr>
<tr><th>When positioning address increases</th><th>When positioning address decreases</th></tr>
<tr><td>0</td><td>Positive direction</td><td>Negative direction</td></tr>
<tr><td>1</td><td>Negative direction</td><td>Positive direction</td></tr>
</table>

The positive/negative directions of the linear servo motor are as shown below.



LM-H2 series LM-U2 series

POINT

- This parameter cannot be used in the speed control mode.

</td><td>Each axis</td><td>0</td><td></td><td>0・1</td></tr>
<tr><td>PA15</td><td>*ENR</td><td>

Encoder output pulses
This parameter is made valid when parameter No.PC03 is set to "□□1□ (initial value)".
Set the encoder pulses (A phase, B phase) output by the servo amplifier.
Set the encoder pulses output by the servo amplifier by division ratio.
Travel distance [pulse] of the linear encoder is divided by the set value.

$$\text{Output pulse} = \frac{\text{Travel distance of linear encoder}}{\text{Set value}} \text{ [pulse]}$$

The number of A/B phase pulses actually output is 1/4 times greater than the preset number of pulses. Also, the maximum output frequency is 4.6Mpps (after multiplication by 4). Use this parameter within the range.

</td><td>Each axis</td><td>4000</td><td></td><td>1
to
65535</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name</th><th>Setting</th><th>Factory setting</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PA16</td><td>*ENR2</td><td>Encoder output pulse 2
This parameter is made valid when parameter No.PC03 is set to "□□3□".
Set the encoder pulses (A phase, B phase) output by the servo amplifier.
Set the encoder pulses output by the servo amplifier by parameter No.PA15 and parameter No.PA16.
Travel distance [pulse] of the linear encoder is multiplied by the set value.
Output pulse ＝ Travel distance of linear encoder ×
$$\frac{\text{Set value of parameter No.PA15}}{\text{Set value of parameter No.PA16}} \text{ [pulse]}$$
The number of A/B phase pulses actually output is 1/4 times greater than the preset number of pulses. Also, the maximum output frequency is 4.6Mpps (after multiplication by 4). Use this parameter within the range.
When the set value is "0 (initial value)", it is internally treated as "1".</td><td>Each axis</td><td>0</td><td></td><td>1
to
65535</td></tr>
<tr><td>PA17</td><td>**MSR</td><td>Linear servo motor series setting・Linear servo motor type setting</td><td>Each axis</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PA18</td><td>**MTY</td><td>Select the linear servo motor to be used. Set both of parameter No.PA17 and PA18. Setting them incorrectly causes the motor combination error (1A.1).
<table>
<tr><th rowspan="2">Linear servo motor series</th><th rowspan="2">Primary side (coil) model name</th><th colspan="2">Parameter setting</th></tr>
<tr><th>No.PA17</th><th>No.PA18</th></tr>
<tr><td rowspan="4">LM-H2</td><td>LM-H2P1A-06M-4SS0</td><td>00B3</td><td>1101</td></tr>
<tr><td>LM-H2P2A-12M-1SS0</td><td>00B3</td><td>2101</td></tr>
<tr><td>LM-H2P2B-24M-1SS0</td><td>00B3</td><td>2201</td></tr>
<tr><td>LM-H2P3A-24M-1SS0</td><td>00B3</td><td>3101</td></tr>
<tr><td rowspan="6">LM-U2</td><td>LM-U2PAB-05M-0SS0</td><td>00B4</td><td>A201</td></tr>
<tr><td>LM-U2PBB-07M-1SS0</td><td>00B4</td><td>B201</td></tr>
<tr><td>LM-U2PAD-10M-0SS0</td><td>00B4</td><td>A401</td></tr>
<tr><td>LM-U2PAF-15M-0SS0</td><td>00B4</td><td>A601</td></tr>
<tr><td>LM-U2PBD-15M-1SS0</td><td>00B4</td><td>B401</td></tr>
<tr><td>LM-U2PBF-22M-1SS0</td><td>00B4</td><td>2601</td></tr>
</table></td><td>Each axis</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PA19</td><td>*BLK</td><td>Parameter write inhibit
<table>
<tr><th rowspan="2">Setting value</th><th rowspan="2">Operation</th><th colspan="6">Parameters that can be controlled</th></tr>
<tr><th>No.PA□□</th><th>No.PB□□</th><th>No.PC□□</th><th>No.PD□□</th><th>No.PS□□</th><th>No.Po□□</th></tr>
<tr><td rowspan="2">0000h</td><td>Reference</td><td>○</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Write</td><td>○</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">000Bh</td><td>Reference</td><td>○</td><td>○</td><td>○</td><td></td><td></td><td></td></tr>
<tr><td>Write</td><td>○</td><td>○</td><td>○</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">000Ch</td><td>Reference</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td></td></tr>
<tr><td>Write</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td></td></tr>
<tr><td rowspan="2">000Dh</td><td>Reference</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr>
<tr><td>Write</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr>
<tr><td rowspan="2">000Eh</td><td>Reference</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>Write</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td rowspan="2">100Bh</td><td>Reference</td><td>○</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Write</td><td>PA19 only</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">100Ch</td><td>Reference</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td></td></tr>
<tr><td>Write</td><td>PA19 only</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">100Dh</td><td>Reference</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr>
<tr><td>Write</td><td>PA19 only</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">100Eh</td><td>Reference</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>Write</td><td>PA19 only</td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td>Each axis</td><td>000Bh</td><td></td><td>Refer to name and function column.</td></tr>
</table>

13.8.3 Gain/Filter parameters (No.PB□□)

(1) Parameter list

POINT

- The parameter whose symbol preceded by * can be validated with the following conditions.
  - : Turn off the power and then on again, or reset the controller after setting the parameter.
  **: Turn off the power and then on again after setting the parameter.
- Never change the parameters for the manufacturer setting.

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PB01	FILT	Adaptive tuning mode (Adaptive filter Ⅱ)	Each axis	0000h		Section 5.2.2
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control)	Each axis	0000h		
PB03		For manufacturer setting		0		
PB04	FFC	Feed forward gain	Each axis	0	%	Section 5.2.2
PB05		For manufacturer setting		500		
PB06	GD2	Load mass ratio to the linear servo motor primary side (coil)	Each axis	7.0	Multiplier (×1)	This section (2)
PB07	PG1	Model loop gain	Each axis	24	rad/s	Section 5.2.2
PB08	PG2	Position loop gain	Each axis	37	rad/s	
PB09	VG2	Speed loop gain	Each axis	823	rad/s	
PB10	VIC	Speed integral compensation	Each axis	33.7	ms	
PB11	VDC	Speed differential compensation	Each axis	980		
PB12		For manufacturer setting		0		
PB13	NH1	Machine resonance suppression filter 1	Each axis	4500	Hz	Section 5.2.2
PB14	NHQ1	Notch shape selection 1	Each axis	0000h		
PB15	NH2	Machine resonance suppression filter 2	Each axis	4500	Hz	
PB16	NHQ2	Notch shape selection 2	Each axis	0000h		
PB17		Automatic setting parameter				
PB18	LPF	Low-pass filter	Each axis	3141	rad/s	
PB19	VRF1	Vibration suppression control vibration frequency setting	Each axis	100.0	Hz	
PB20	VRF2	Vibration suppression control resonance frequency setting	Each axis	100.0	Hz	

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PB21		For manufacturer setting		0.00		
PB22				0.00		
PB23	VFBF	Low-pass filter selection	Each axis	0000h		Section 5.2.2
PB24	*MVS	Slight vibration suppression control selection	Each axis	0000h		
PB25		For manufacturer setting		0000h		
PB26	*CDP	Gain changing selection	Each axis	0000h		Section 5.2.2
PB27	CDL	Gain changing condition	Each axis	10		
PB28	CDT	Gain changing time constant	Each axis	1	ms	
PB29	GD2B	Gain changing - load mass ratio to the linear servo motor primary side (coil)	Each axis	7.0	Multiplier (×1)	This section (2)
PB30	PG2B	Gain changing position loop gain	Each axis	37	rad/s	Section 5.2.2
PB31	VG2B	Gain changing speed loop gain	Each axis	823	rad/s	
PB32	VICB	Gain changing speed integral compensation	Each axis	33.7	ms	
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	Each axis	100.0	Hz	
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	Each axis	100.0	Hz	
PB35		For manufacturer setting		0.00		
PB36				0.00		
PB37				100		
PB38				0.0		
PB39				0.0		
PB40				0.0		
PB41				1125		
PB42				1125		
PB43				0004h		
PB44				0.0		
PB45				0000h		

Note 1. Each axis: Set a value for each of the A-axis and the B-axis.
Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.
2. Valid for the A-axis and the B-axis.

(2) List of details

No.	Symbol	Name and function	Setting	Factory setting	Unit	Setting range
PB06	GD2	Load mass ratio to the linear servo motor primary side (coil) Used to set the load mass ratio to the mass of the linear servo motor primary side (coil). When auto tuning mode 1 and interpolation mode are selected, the result of auto tuning is automatically used. In this case, it varies between 0 and 100.0. When parameter No.PA08 is set to "□□□2" or "□□□3", this parameter can be set manually.	Each axis	7.0	Multi-plier (×1)	0 to 300.0
PB29	GD2B	Gain changing - load mass ratio to the linear servo motor primary side (coil) Used to set the load mass ratio to the linear servo motor primary side (coil) when gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No.PA08: □□□3).	Each axis	7.0	Multi-plier (×1)	0 to 300.0

13.8.4 Extension setting parameters (No.PC□□)

(1) Parameter list

POINT

- The parameter whose symbol preceded by * can be validated with the following conditions.
  * : Turn off the power and then on again, or reset the controller after setting the parameter.
  **: Turn off the power and then on again after setting the parameter.
- Never change the parameters for the manufacturer setting.

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PC01	ERZ	Error excessive alarm level	Each axis	0	mm	This section (2)
PC02	MBR	Electromagnetic brake sequence output	Each axis	0	ms	Section 5.3.2
PC03	*ENRS	Encoder output pulses selection	Each axis	0010h		This section (2)
PC04	**COP1	Function selection C-1	Each axis	0000h		
PC05	**COP2	Function selection C-2	Each axis	0000h		
PC06	*COP3	Function selection C-3	Each axis	0000h		Section 5.3.2
PC07	ZSP	Zero speed	Each axis	50	mm/s	
PC08		For manufacturer setting		0		
PC09	MOD1	Analog monitor 1 output	Common	0000h		This section (2), (3)
PC10	MOD2	Analog monitor 2 output	Common	0001h		
PC11	MO1	Analog monitor 1 offset	Common	0	mV	
PC12	MO2	Analog monitor 2 offset	Common	0	mV	
PC13		Do not use it in a linear servo.		0		
PC14				0		
PC15	SNO	Station number selection	Common	0		Section 5.3.2
PC16		For manufacturer setting		0000h		
PC17	**COP4	Function selection C-4	Each axis	0000h		Section 5.3.2
PC18		For manufacturer setting		0000h		
PC19				0000h		
PC20				0000h		
PC21	*BPS	Alarm history clear	Each axis	0000h		Section 5.3.2
PC22		For manufacturer setting		0000h		
PC23				0000h		
PC24				0000h		
PC25				0000h		
PC26				0000h		

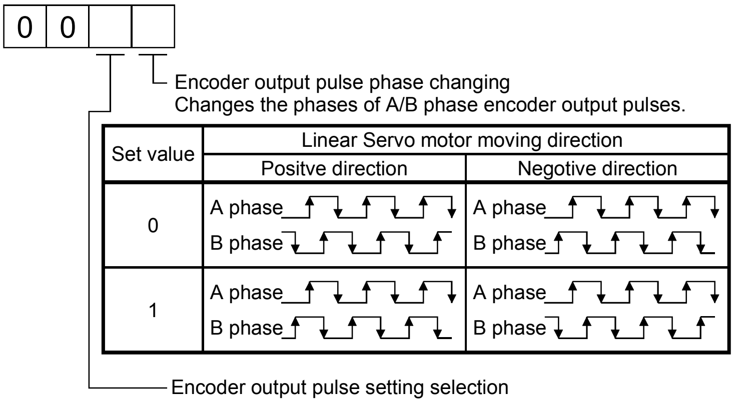
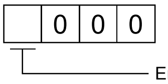
No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PC27	**COP9	Function selection C-9	Each axis	0000h		This section (2)
PC28		For manufacturer setting		0000h		
PC29				0000h		
PC30				0000h		
PC31				0000h		
PC32				0000h		

Note 1. Each axis: Set a value for each of the A-axis and the B-axis.

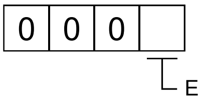
Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.

2. Valid for the A-axis and the B-axis.

(2) List of details

No.	Symbol	Name	Setting	Factory setting	Unit	Setting range
PC01	ERZ	Error excessive alarm level This parameter cannot be used in the speed control mode. Used to set the error excessive alarm level in mm unit. When "0" is set in this parameter, the alarm level is 3mm. When a value other than "0" is set, the alarm level is the amount of the set value. However, the alarm level stays at 200mm even if a value exceeding "200" is set. Note. Setting can be changed in parameter No.PC06.	Each axis	0	mm (Note)	Refer to name and function column.
PC03	*ENRS	Encoder output pulse selection Use to select the, encoder output pulse direction and encoder pulse output setting.  Encoder output pulse phase changing Changes the phases of A/B phase encoder output pulses. Encoder output pulse setting selection 1: Division ratio setting 2: Cannot be set (If this value is set, alarm 37.1 will occur.) 3: A/B phase pulse electronic gear setting (Set with the electronic gear parameter No.PA15 and PA16.)	Each axis	0010h		Refer to name and function column.
PC04	**COP1	Function selection C-1 Select the encoder cable communication system selection.  Encoder cable communication system selection 0: Two-wire type 1: Four-wire type Incorrect setting will result in an encoder alarm 1 (16.3).	Each axis	0000h		Refer to name and function column.

<table>
<tr><th>No.</th><th>Symbol</th><th>Name</th><th>Setting</th><th>Factory setting</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PC06</td><td>*COP3</td><td>Function selection C-3
Select the error excessive alarm level setting for parameter No.PC01.
□ 0 0 0
Error excessive alarm level setting selection
0: 1 [mm]unit
1: 0.1 [mm]unit
2: 0.01 [mm]unit
3: 0.001[mm]unit</td><td>Each axis</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PC07</td><td>ZSP</td><td>Zero speed
Used to set the output range of the zero speed (ZSP-A/ZSP-B).
Zero speed (ZSP-A/ZSP-B) has hysteresis width of 20mm/s.</td><td>Each axis</td><td>50</td><td>mm/s</td><td>0
to
10000</td></tr>
<tr><td>PC09</td><td>MOD1</td><td>Analog monitor 1 output
Used to selection the signal provided to the analog monitor 1 (MO1) output.
□ 0 0 □
Analog monitor 1 (MO1) output selection
<table>
<tr><th>Setting</th><th>Item</th></tr>
<tr><td>0</td><td>Linear servo motor speed (±8V/max. speed)</td></tr>
<tr><td>1</td><td>Thrust (±8V/max. thrust)</td></tr>
<tr><td>2</td><td>Linear servo motor speed (+8V/max. speed)</td></tr>
<tr><td>3</td><td>Thrust (±8V/max. thrust)</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)</td></tr>
<tr><td>7</td><td>Droop pulses (±10V/1000 pulses) (Note)</td></tr>
<tr><td>8</td><td>Droop pulses (±10V/10000 pulses) (Note)</td></tr>
<tr><td>9</td><td>Droop pulses (±10V/100000 pulses) (Note)</td></tr>
<tr><td>D</td><td>Bus voltage (±8V/400V)</td></tr>
</table>
Note. Encoder pulse unit.
Analog monitor 1 (MO1) output axis selection
0: A-axis
1: B-axis</td><td>Common</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PC10</td><td>MOD2</td><td>Analog monitor 2 output
Used to selection the signal provided to the analog monitor 2 (MO2) output.
□ 0 0 □
Analog monitor 2 (MO2) output selection
The setting details are the same as analog monitor 1 output.
For the setting details, refer to parameter No.PC09.
Analog monitor 2 (MO2) output axis selection
The setting details are the same as analog monitor 1 output.
For the setting details, refer to parameter No.PC09.</td><td>Common</td><td>0001h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PC26</td><td></td><td>For manufacturer setting
Do not change these values by any means.
Set the communication method of the encoder cable (two-wire type/four-wire type) with parameter No.PC04.</td><td></td><td>0000h</td><td></td><td></td></tr>
</table>

No.	Symbol	Name	Setting	Factory setting	Unit	Setting range
PC27	**COP9	Function selection C-9 The polarity setting of the encoder connected to the CN2A and CN2B connector and the Z phase connection judgement of the A/B/Z phase input interface encoder.  Encoder pulse count polarity selection 0: Linear servo motor positive direction and linear encoder pulse increase direction 1: Linear servo motor positive direction and linear encoder pulse decrease direction	Each axis	0000h		Refer to name and function column.

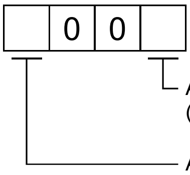
(3) Analog monitor

The servo status can be output to two channels in terms of voltage.

(a) Setting

Change the following digits of parameter No.PC09, PC10.

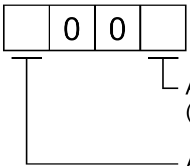
Parameter No.PC09



Analog monitor (MO1) output selection
(Signal output to across MO1-LG)

Analog monitor 1 (MO1) output axis selection
0: A-axis
1: B-axis

Parameter No.PC10



Analog monitor (MO2) output selection
(Signal output to across MO2-LG)

Analog monitor 2 (MO2) output axis selection
0: A-axis
1: B-axis

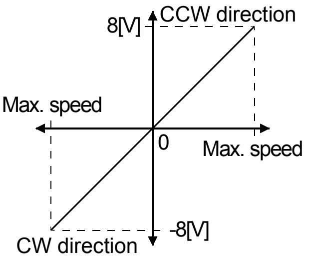
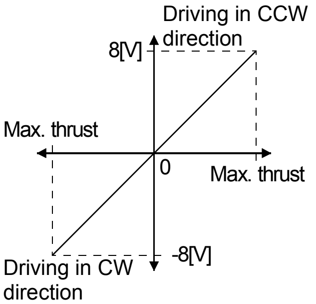
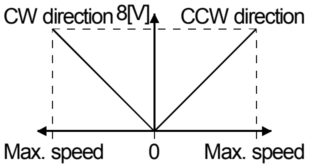
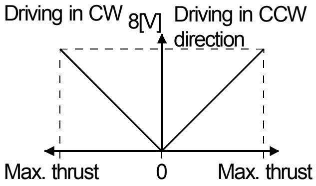
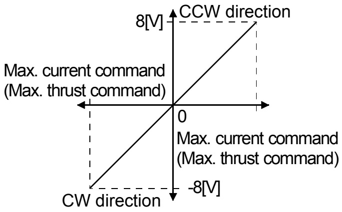
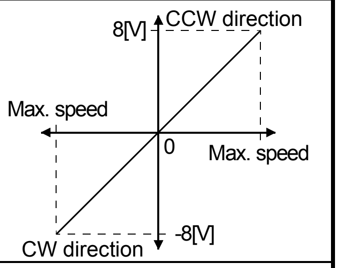
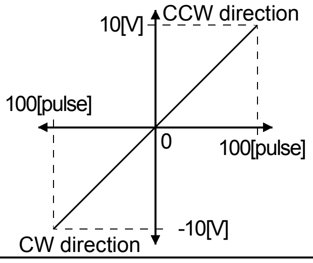
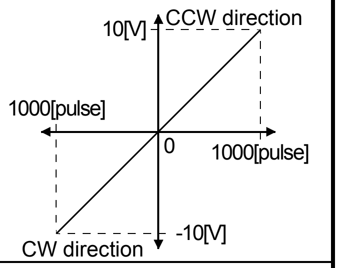
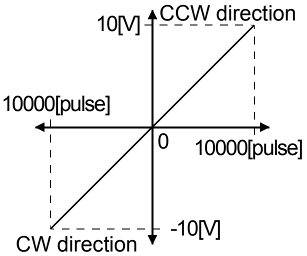
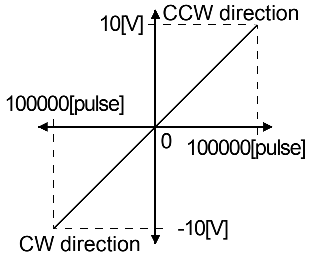
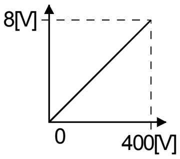
Parameters No.PC11 and PC12 can be used to set the offset voltages to the analog output voltages. The setting range is between －999 and 999mV.

Parameter No.	Description	Setting range [mV]
PC11	Used to set the offset voltage for the analog monitor 1 (MO1).	－999 to 999
PC12	Used to set the offset voltage for the analog monitor 2 (MO2).	

(b) Set content

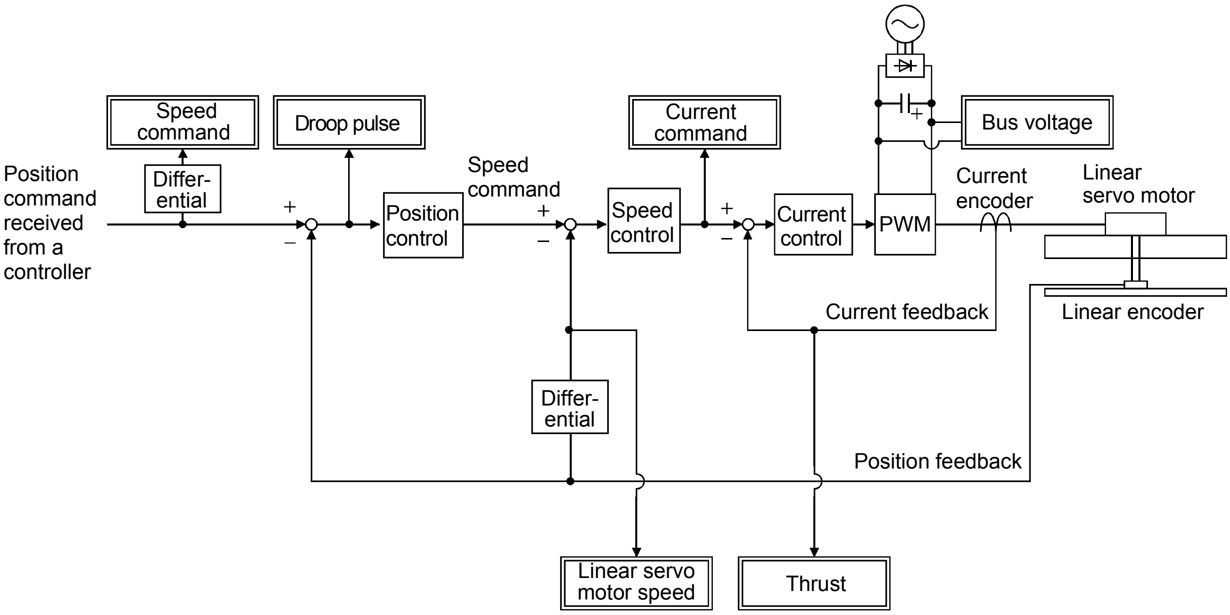
The servo amplifier is factory-set to output the linear servo motor speed to analog monitor 1 (MO1) and the torque to analog monitor (MO2). The setting can be changed as listed below by changing the parameter No.PC09 and PC10 value.

Refer to (3)(c) for the measurement point.

Setting	Output item	Description	Setting	Output item	Description
0	Linear servo motor speed		1	Thrust	
2	Linear servo motor speed		3	Thrust	
4	Current command		5	Speed command	
6	Droop pulses (Note) (±10V/100 pulses)		7	Droop pulses (Note) (±10V/1000 pulses)	
8	Droop pulses (Note) (±10V/10000 pulses)		9	Droop pulses (Note) (±10V/100000 pulses)	
D	Bus voltage				

Note. Encoder pulse unit.

(c) Analog monitor block diagram



13.8.5 I/O setting parameters (No.PD□□)

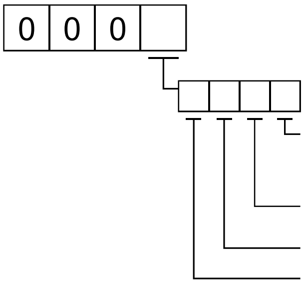
(1) Parameter list

> POINT
> - The parameter whose symbol preceded by * can be validated with the following conditions.
>   * : Turn off the power and then on again, or reset the controller after setting the parameter.
> - Never change the parameters for the manufacturer setting.

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PD01		For manufacturer setting		0000h		
PD02	*DIA2	Input signal automatic ON selection	Each axis	0000h		This section (2)
PD03		For manufacturer setting		0020h		
PD04				0021h		
PD05				0022h		
PD06				0000h		
PD07	*D01	Output signal device selection 1 (CN3-12 for A-axis and CN3-25 for B-axis)	Each axis	0005h		Section 5.4.2
PD08		For manufacturer setting		0004h		
PD09	*D03	Output signal device selection 3 (CN3-11 for A-axis and CN3-24 for B-axis)	Each axis	0003h		Section 5.4.2
PD10		For manufacturer setting		0000h		
PD11				0004h		
PD12				0000h		
PD13				0000h		
PD14	*DOP3	Function selection D-3	Each axis	0000h		Section 5.4.2
PD15		For manufacturer setting		0000h		
PD16				0000h		
PD17				0000h		
PD18				0000h		
PD19				0000h		
PD20				0000h		
PD21				0000h		
PD22				0000h		
PD23				0000h		
PD24				0000h		
PD25				0000h		
PD26				0000h		
PD27				0000h		
PD28				0000h		
PD29				0000h		
PD30				0000h		
PD31				0000h		
PD32				0000h		

Note 1. Each axis: Set a value for each of the A-axis and the B-axis.
Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.
2. Valid for the A-axis and the B-axis.

(2) List of details

<table>
<tr><th>No.</th><th>Symbol</th><th>Name</th><th>Setting</th><th>Factory setting</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD02</td><td>*DIA2</td><td>Input signal automatic ON selection
Select the input devices to be automatically turned ON.
0 0 0

<table>
<tr><th rowspan="2">Signal name</th><th colspan="2">Factory setting</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td>Upper stroke limit (FLS)</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td>Lower stroke limit (RLS)</td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
BIN 0: Used as external input signal
BIN 1: Automatic ON

For example, to turn ON RLS, the setting is "□□□2".
When the upper stroke limit (FLS) or the lower stroke limit (RLS) is used on the controller side, do not set to automatically ON since the magnetic pole detection signal is shared with the input signal.</td><td>Each axis</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
</table>

13.8.6 Special setting parameters (No.PS□□)

(1) Parameter list

POINT

- The parameter whose symbol preceded by * can be validated with the following conditions.
  - *: Turn off the power and then on again, or reset the controller after setting the parameter.
  - **: Turn off the power and then on again after setting the parameter.
- Never change the parameters for the manufacturer setting.

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PS01	**LIT1	Linear function selection 1	Each axis	0301h		This section (2)
PS02	**LIM	Linear encoder resolution setting Numerator	Each axis	1000		
PS03	**LID	Linear encoder resolution setting Denominator	Each axis	1000		
PS04	*LIT2	Linear function selection 2	Each axis	0003h		
PS05	LB1	Linear servo motor control position deviation error detection level	Each axis	0	mm	
PS06	LB2	Linear servo motor control speed deviation error detection level	Each axis	0	mm/s	
PS07	LB3	Linear servo motor control thrust deviation error detection level	Each axis	100	%	

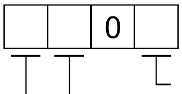
No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PS08	*LIT3	Linear function selection 3	Each axis	0010h		This section (2)
PS09	LPWM	Magnetic pole detection voltage level	Each axis	30	%	
PS10		For manufacturer setting		5		
PS11				100		
PS12				500		
PS13				0000h		
PS14				0		
PS15				0000h		
PS16				0000h		
PS17	LTSTS	Minute position detection method function selection	Each axis	0000h		This section (2)
PS18	IDLV	Minute position detection method identification signal amplitude	Each axis	0000h	%	
PS19		For manufacturer setting		0000h		
PS20				0000h		
PS21				0000h		
PS22				0000h		
PS23				0000h		
PS24				0000h		
PS25				0000h		
PS26				0000h		
PS27				0000h		
PS28				0000h		
PS29				0000h		
PS30				0000h		
PS31				0000h		
PS32				0000h		

Note 1. Each axis: Set a value for each of the A-axis and the B-axis.

Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.

2. Valid for the A-axis and the B-axis.

(2) List of details

<table>
<tr><th>No.</th><th>Symbol</th><th>Name</th><th>Setting</th><th>Factory setting</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PS01</td><td>**LIT1</td><td>Linear function selection 1
The magnetic pole detection setting, the stop interval setting at home position return, the valid/invalid setting of the linear servo motor thermistor can be selected. (Refer to section 13.7.2.)

Linear servo motor magnetic pole detection setting
0: Magnetic pole detection invalid (This setting is valid only with absolute position linear encoder.)
1: Magnetic pole always valid
Stop interval setting at home position return
The stop interval for the dog method home position return is set.
<table>
<tr><th>Setting value</th><th>Stop interval [pulse]</th></tr>
<tr><td>0</td><td>8192</td></tr>
<tr><td>1</td><td>131072</td></tr>
<tr><td>2</td><td>262144</td></tr>
<tr><td>3</td><td>1048576</td></tr>
<tr><td>4</td><td>4194304</td></tr>
<tr><td>5</td><td>16777216</td></tr>
<tr><td>6</td><td>67108864</td></tr>
</table>
Linear servo motor thermistor valid/invalid setting
0: Valid
1: Invalid
When the linear servo motor without thermistor is used, this setting is invalid.</td><td>Each axis</td><td>0301h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PS02</td><td>**LIM</td><td>Linear encoder resolution setting Numerator
Set the linear encoder resolution in 1μm unit. (Refer to section 13.7.1 (3).)
Set the numerator for parameter No.PS02.
Linear encoder resolution (μm)＝LIM/LID
When "0" is set in this parameter, the factory setting is applied in the servo amplifier.</td><td>Each axis</td><td>1000</td><td></td><td>0 to 65535</td></tr>
<tr><td>PS03</td><td>**LID</td><td>Linear encoder resolution setting Denominator
Set the denominator for parameter No.PS03.
When "0" is set in this parameter, the factory setting is applied in the servo amplifier.</td><td>Each axis</td><td>1000</td><td></td><td>0 to 65535</td></tr>
</table>

No.	Symbol	Name	Setting	Factory setting	Unit	Setting range
PS04	*LIT2	Linear function selection 2 Linear servo motor control error detection function and linear servo motor control error reset can be selected. □ 0 0 □ Linear servo motor control error detection function selection (Refer to section 13.7.6 (1).) 0: Invalid 1: Position deviation error detection valid 2: Speed deviation error detection valid 3: Position/speed detection deviation error detection valid 4: Thrust deviation error detection valid 5: Position/thrust deviation error detection valid 6: Speed/thrust deviation error detection valid 7: Position/speed/thrust deviation error detection valid Linear servo motor control error detection reset selection Set the controller reset condition of the linear servo motor control error (42.□). 0: Reset impossible (Reset by switching OFF is possible.) 1: Reset possible	Each axis	0003h		Refer to name and function column.
PS05	LB1	Linear servo motor control position deviation error detection level Used to set the position deviation error detection level of the linear servo motor control error detection. When the difference between the model feedback position and the feedback position is bigger than this setting value, the linear servo motor control error (42.1). (Refer to section 13.7.6 (1).) When "0" is set in this parameter, 50mm is set for detection level.	Each axis	0	mm	0 to 1000
PS06	LB2	Linear servo motor control speed deviation error detection level Used to set the speed deviation error detection level of the linear servo motor control error detection. When the difference between the model feedback speed and the feedback speed is bigger than this setting value, the linear servo motor control error is detected (42.2). (Refer to section 13.7.6 (1).) When "0" is set in this parameter, 1000mm/s is set for detection level.	Each axis	0	mm/s	0 to 5000
PS07	LB3	Linear servo motor control thrust deviation error detection level Used to set the thrust deviation error detection level of the linear servo motor control error detection. When the difference between the command thrust and the feedback thrust is bigger than this setting value, the linear servo motor control error is detected (42.3). (Refer to section 13.7.6 (1).) When “0” is set in this parameter, the factory setting is applied in the servo amplifier.	Each axis	100	%	0 to 1000
PS08	*LIT3	Linear function selection 3 The magnetic pole detection method can be selected. (Refer to section 13.7.2 (6).) 0 0 1 □ Selection of magnetic pole 0: Detection method 4: Minute position detection method	Each axis	0010h		Refer to name and function column.
PS09	LPWM	Magnetic pole detection voltage level Used to set the direct current exciting voltage level during the magnetic pole detection. When the overload alarm (50.□ and 51.□) or overcurrent alarm (32.□) occurs, set the smaller value. When the initial magnetic pole detection error occurs during the magnetic pole detection, set the bigger value. (Refer to section 13.7.2 (3).)	Each axis	30	%	0 to 100

<table>
<tr><th>No.</th><th>Symbol</th><th>Name</th><th>Setting</th><th>Factory setting</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PS10</td><td></td><td>For manufacturer setting
Do not change these values by any means.</td><td></td><td>5</td><td></td><td></td></tr>
<tr><td>PS11</td><td></td><td></td><td></td><td>100</td><td></td><td></td></tr>
<tr><td>PS12</td><td></td><td></td><td></td><td>500</td><td></td><td></td></tr>
<tr><td>PS13</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS14</td><td></td><td></td><td></td><td>0</td><td></td><td></td></tr>
<tr><td>PS15</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS16</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS17</td><td>LTSTS</td><td>Minute position detection method function selection
Used to set the response and the load to motor mass ratio of the minute position detection method.
To make the parameter valid, set parameter No.PS08 (Linear function selection 3) to "□□□4" (minute position detection method). (Refer to (4)(b) in section 13.7.2.)

0 0 □ □

Response of the minute position detection method
<table>
<tr><th>Setting</th><th>Response</th><th>Setting</th><th>Response</th></tr>
<tr><td>0</td><td>Low response</td><td>8</td><td>Medium response</td></tr>
<tr><td>1</td><td>↕</td><td>9</td><td>↕</td></tr>
<tr><td>2</td><td></td><td>A</td><td></td></tr>
<tr><td>3</td><td></td><td>B</td><td></td></tr>
<tr><td>4</td><td></td><td>C</td><td></td></tr>
<tr><td>5</td><td></td><td>D</td><td></td></tr>
<tr><td>6</td><td></td><td>E</td><td></td></tr>
<tr><td>7</td><td>Medium response</td><td>F</td><td>High response</td></tr>
</table>
Selecting the load mass ratio to the linear servo motor primary side (coil), which decides the response of the minute position detection method
<table>
<tr><th>Setting</th><th>Load to motor mass ratio</th><th>Setting</th><th>Load to motor mass ratio</th></tr>
<tr><td>0</td><td>Less than 10 times</td><td>8</td><td>80 times</td></tr>
<tr><td>1</td><td>10 times</td><td>9</td><td>90 times</td></tr>
<tr><td>2</td><td>20 times</td><td>A</td><td>100 times</td></tr>
<tr><td>3</td><td>30 times</td><td>B</td><td>110 times</td></tr>
<tr><td>4</td><td>40 times</td><td>C</td><td>120 times</td></tr>
<tr><td>5</td><td>50 times</td><td>D</td><td>130 times</td></tr>
<tr><td>6</td><td>60 times</td><td>E</td><td>140 times</td></tr>
<tr><td>7</td><td>70 times</td><td>F</td><td>150 times or more</td></tr>
</table>
</td><td>Each axis</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PS18</td><td>IDLV</td><td>Minute position detection method identification signal amplitude
Used to set the identification signal amplitude for the minute position detection method. To make the parameter valid, set parameter No.PS08 (Linear function selection 3) to "□□□4". Identification signal is "100%" when "0" is set. (Refer to (4)(b) in section 13.7.2.)</td><td>Each axis</td><td>0000h</td><td>%</td><td>0000h to 006Fh</td></tr>
<tr><td>PS19</td><td></td><td>For manufacturer setting
Do not change these values by any means.</td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS20</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS21</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS22</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS23</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS24</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS25</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS26</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
</table>

No.	Symbol	Name	Setting	Factory setting	Unit	Setting range
PS27		For manufacturer setting		0000h		
PS28		Do not change these values by any means.		0000h		
PS29				0000h		
PS30				0000h		
PS31				0000h		
PS32				0000h		

13.8.7 Option setting parameter

POINT

- The parameter whose symbol preceded by * can be validated with the following conditions.
  - * : Turn off the power and then on again, or reset the controller after setting the parameter.
  - **: Turn off the power and then on again after setting the parameter.
- Never change the parameters for the manufacturer setting.

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
Po01	*OOP1	Function selection O-1	Common	0000h		Section 5.5.2
Po02	SGRA	Axis selection for graphing analog deta (MR Configurator)	Common	0000h		
Po03	SGRD	Axis selection for graphing digtal deta (MR Configurator)	Common	0000h		
Po04	**OOP2	Function selection O-2	Common	0000h		
Po05		For manufacturer setting		0000h		
Po06				0000h		
Po07				0000h		
Po08				0000h		
Po09				0000h		
Po10				0000h		
Po11				0000h		
Po12				0000h		
Po13				0000h		
Po14				0000h		
Po15				0000h		
Po16				0000h		

Note 1. Each axis: Set a value for each of the A-axis and the B-axis.
Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.
2. Valid for the A-axis and the B-axis.

13.9 Troubleshooting

POINT

- When an each axis stop alarm occurs, the servo motor in the non-alarm-occurring axis can continue running.

If an alarm/warning has occurred, refer to this chapter and remove its cause.

13.9.1 Alarms and warning list

When an fault occurs during operation, the corresponding alarm or warning is displayed.
If any alarm has occurred, refer to section 13.9.2 and section 8.3; if any warning has occurred, refer to section 13.9.3 and section 8.4, and take the appropriate action. When an alarm occurs, ALM-A/ALM-B 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	Name	Alarm deactivation			Detection method (Note 3)	Stop method (Note 4)
			Power OFF→ON	Error reset	CPU reset		
Alarms	10	Undervoltage	○	○	○	Common	All axis
	11	Switch setting error	○			Common	All axis
	12	Memory error 1 (RAM)	○			Common	All axis
	13	Clock error	○			Common	All axis
	15	Memory error 2 (EEP-ROM)	○			Common	All axis
	16	Encoder initial communication error 1	○			Each axis	Each axis
	17	Board error	○			Common	All axis
	19	Memory error 3 (Flash-ROM)	○			Common	All axis
	1A	Motor combination error	○			Each axis	Each axis
	1E	Encoder initial communication error 2	○			Each axis	Each axis
	1F	Encoder initial communication error 3	○			Each axis	Each axis
	20	Encoder normal communication error 1	○			Each axis	Each axis
	21	Encoder normal communication error 2	○			Each axis	Each axis
	24	Main circuit error	○	○	○	Each axis	All axis
	27	Initial magnetic pole detection error	○	○	○	Each axis	Each axis
	28	Linear encoder error 2	○			Each axis	Each axis
	2A	Linear encoder error 1	○			Each axis	Each axis
	30	Regenerative error	(Note 1) ○	(Note 1) ○	(Note 1) ○	Common	All axis
	31	Overspeed	○	○	○	Each axis	Each axis
	32	Overcurrent	○			Each axis	All axis
	33	Overvoltage	○	○	○	Common	All axis
	34	SSCNET receive error 1	○	(Note 2) ○	○	Each axis	Each axis
	35	Command frequency error	○	○	○	Each axis	Each axis
	36	SSCNET receive error 2	○	○	○	Each axis	Each axis
	37	Parameter error	○			Each axis	Each axis
	42	Linear servo control error	○	(Note 5) ○	(Note 5) ○	Each axis	Each axis
	45	Main circuit device overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○	Common	All axis
	46	Linear servo motor overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each axis	Each axis
	47	Cooling fan error	○			Common	All axis
	50	Overload 1	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each axis	Each axis
	51	Overload 2	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each axis	Each axis
	52	Error excessive	○	○	○	Each axis	Each axis
	8A	USB communication time-out error	○	○	○	Common	All axis
	8E	USB communication error	○	○	○	Common	All axis
	888	Watchdog	○			Common	All axis

	Display	Name	Alarm deactivation			Detection method (Note 3)	Stop method (Note 4)
			Power OFF→ON	Error reset	CPU reset		
Warnings	91	Main circuit device overheat warning				Common	
	96	Home position setting warning				Each axis	
	E0	Excessive regeneration warning				Common	
	E1	Overload warning 1				Each axis	
	E2	Linear servo motor overheat warning				Each axis	
	E4	Parameter warning				Each axis	
	E6	Servo forced stop warning				Common	All axis
	E7	Controller forced stop warning				Common	All axis
	E8	Cooling fan speed reduction warning				Common	
	E9	Main circuit off warning				Common	All axis
	EB	The other axis fault warning				Each axis	All axis
	EC	Overload warning 2				Each axis	
	ED	Output watt excess warning				Each axis	

Note 1. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.
2. In some controller communication status, the alarm factor may not be removed.
3. Alarms and warnings are detected in the following axes.
Each axis: Alarms and warnings are detected in the A-axis and the B-axis separately.
Common: Alarms and warnings are detected in the A-axis and the B-axis together.
4. When an alarm or a warning occurs, the axes stop as below.
Each axis: Only the axis that detected the alarm or warning stops.
All axis: All axes stop.
5. The alarm can be deactivated by setting parameter No.PS04 to "1□□□."

13.9.2 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.
- Shut off the main circuit power supply when alarms are occurring in both of the A-axis and the B-axis. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

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. To protect the main circuit elements, any of these servo alarms cannot be deactivated from the servo system controller until the specified time elapses after its occurrence. Judging the load changing condition until the alarm occurs, the servo amplifier calculates this specified time automatically.
  - Regenerative error (30.☐)
  - Main circuit device overheat (45.☐)
  - Linear servo motor overheat (46.1)
  - Overload 1 (50.☐)
  - Overload 2 (51.☐)
- The alarm can be deactivated by switching power off, then on or by the error reset command・CPU reset from the servo system controller. For details, refer to section 13.9.1.

When an alarm occurs, the trouble (ALM-A/ALM-B) 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.

Alarm No.10		Name: Undervoltage		Stop method: All axes stop	
Alarm description		・Voltage of the control power has dropped. ・Voltage of the main circuit power has dropped.			
Display	Name	Cause	Checkpoint	Finding	Action
10.1	Voltage drop in the control power	Same as for the rotary servo motor. Refer to section 8.3.			
10.2	Voltage drop in the main circuit power				

Alarm No.11		Name: Switch setting error			Stop method: All axis stop	
Alarm description		・Rotary axis setting switch is incorrectly set. ・DIP switch is incorrectly set. ・Servo motor selection switch is incorrect set.				
Display	Name	Cause		Checkpoint	Finding	Action
11.1	Rotary switch setting error	Same as for the rotary servo motor. Refer to section 8.3.				
11.2	DIP switch setting error					
11.3	Servo motor selection switch setting error	(1)	Setting of servo motor selection switch is incorrect.	Check the DIP switch (SW3) setting. Rotary servo motor: off Linear servo motor: on	DIP switch is incorrectly set.	Correct the setting.
					Setting is correct.	Check (2).
		(2)	Control mode is incorrectly set by the parameter.	Check the parameter No. PA01 setting. Rotary servo motor: "□□0□" Linear servo motor: "□□4□"	Parameter setting is incorrect.	Correct the setting.
11.4	Servo motor selection switch setting error 2	(1)	Wrong encoder is connected.	Check the linear encoder. Rotary servo motor: servo motor Linear servo motor: linear encoder	Wrong linear encoder is connected.	Correct the setting.
					Right linear encoder is connected.	Check (2).
		(2)	Setting of servo motor selection switch is incorrect.	Check the DIP switch (SW3) setting. Rotary servo motor: off Linear servo motor: on	Set value is incorrect.	Correct the setting.

Alarm No.12		Name: Memory error (RAM)		Stop method: All axes stop	
Alarm description		・Interior part of the servo amplifier (CPU) is faulty. ・Interior part of the servo amplifier (custom IC) is faulty.			
Display	Name	Cause	Checkpoint	Finding	Action
12.1	CPU built-in RAM error	Same as for the rotary servo motor. Refer to section 8.3.			
12.2	CPU data RAM error				
12.3	Custom IC RAM error				

Alarm No.13		Name: Clock error		Stop method: All axes stop	
Alarm description		・Fault is found in the printed board. ・There is a clock error transmitted from the controller.			
Display	Name	Cause	Checkpoint	Finding	Action
13.1	Clock error	Same as for the rotary servo motor. Refer to section 8.3.			

Alarm No.15		Name: Memory error 2 (EEP-ROM)		Stop method: All axes stop	
Alarm description		・Interior part of the servo amplifier (EEP-ROM) is faulty.			
Display	Name	Cause	Checkpoint	Finding	Action
15.1	EEP-ROM error at power on	Same as for the rotary servo motor. Refer to section 8.3.			
15.2	EEP-ROM error during operation				

Alarm No.16		Name: Encoder initial communication error 1			Stop method: Corresponding axis stops	
Alarm description		・Error occurs in the communication between the linear encoder and the servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
16.1	Encoder receive data error 1	(1)	Encoder cable is faulty.	Check the shield.	Problem found.	Repair the cable.
					No problem found.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise, surrounding air temperature, and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Servo amplifier is faulty.	Check the reproducibility of the error.	Reproduced.	Replace the servo amplifier.
					Not reproduced.	Examine checkpoints described in the alarm display "16.3".
16.2	Encoder receive data error 2	(1)	Encoder cable is faulty.	Examine checkpoints described in the alarm display "16.1".		
		(2)	Fault is generated from the surrounding environment of the unit.			
		(3)	Replace the servo amplifier.			
16.3	Encoder receive data error 3	(1)	The encoder cable is unplugged.	Check if the encoder cable is connected properly.	Not connected properly.	Connect properly.
					Connected properly.	Check (2).
		(2)	Encoder cable is faulty.	Check for breakage and short of the encoder cable. Check the shield.	Problem found.	Repair or replace the cable.
					No problem found.	Check (3).
		(3)	Two-wire/four-wire type parameter setting is incorrect.	Check the parameter No. PC04 setting. Two-wire type: "00□□" Four-wire type: "10□□"	Setting is incorrect.	Correct the setting.
					Normal.	Check (4).
		(4)	Signal from the linear encoder cannot be received.	Connect to a properly operating linear encoder.	Alarm does not occur.	Replace the linear encoder.
					Alarm occurs.	Check (5).
		(5)	Servo amplifier is faulty.	Replace the servo amplifier and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
					Reproduced.	Check (6).
		(6)	Fault is generated from the surrounding environment of the unit.	Check for noise, and other factors.	Problem found.	Take countermeasure according to the cause.

Alarm No.16		Name: Encoder initial communication error 1			Stop method: Corresponding axis stops	
Alarm description		・Error occurs in the communication between the linear encoder and the servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
16.5	Encoder transmission data error 1	(1)	Encoder cable is faulty.	Check the shield.	Problem found.	Repair the cable.
					No problem found.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise, and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Encoder is faulty.	Replace to a properly operating servo motor.	Error is not reproduced.	Replace the servo motor.
16.6	Encoder transmission data error 2	(1)	Encoder cable is faulty.	Examine checkpoints described in the alarm display "16.5".		
		(2)	Fault is generated from the surrounding environment of the unit.			
		(3)	Encoder is faulty.			
16.7	Encoder transmission data error 3	(1)	Encoder cable is faulty.	Examine checkpoints described in the alarm display "16.5".		
		(2)	Fault is generated from the surrounding environment of the unit.			
		(3)	Encoder is faulty.			

Alarm No.17		Name: Board error		Stop method: All axes stop	
Alarm description		・Interior part of the servo amplifier is faulty.			
Display	Name	Cause	Checkpoint	Finding	Action
17.1	AD converter error	Same as for the rotary servo motor. Refer to section 8.3.			
17.2	Current feedback data error				
17.3	Custom IC error				
17.4	Amplifier detection signal error				
17.5	Rotary switch error				
17.6	DIP switch error				

Alarm No.19		Name: Memory error 3 (Flash-ROM)		Stop method: All axes stop	
Alarm description		・Interior part of the servo amplifier (FLASH-ROM) is faulty.			
Display	Name	Cause	Checkpoint	Finding	Action
19.1	Flash-ROM error 1	Same as for the rotary servo motor. Refer to section 8.3.			
19.2	Flash-ROM error 2				

Alarm No.1A		Name: Motor combination error			Stop method: Corresponding axis stops	
Alarm description		・Combination of servo amplifier and servo motor is incorrect.				
Display	Name	Cause		Checkpoint	Finding	Action
1A.1	Motor combination error	(1)	Servo amplifier is connected to an incorrect linear servo motor or vice versa.	Check the model name of the linear servo motor and its combination with the servo amplifier.	Combination is incorrect.	Use in the right combination.
					Combination is correct.	Check (2).
		(2)	Linear servo setting is selected in the parameter.	Check the parameter No. PA01 setting. Rotary servo motor: "□□0□" Linear servo motor: "□□4□"	Linear servo motor is selected.	Check the combination, then check (3).
					Rotary servo motor is selected.	Select the linear servo motor.
		(3)	The linear servo motor, which requires the parameter No.Po04 setting, is being used.	Check the parameter No. Po04 setting.	Set value is incorrect.	Correct the setting.

Alarm No.1E		Name: Encoder initial communication error 2			Stop method: Corresponding axis stops	
Alarm description		・Encoder is faulty.				
Display	Name	Cause		Checkpoint	Finding	Action
1E.1	Encoder failure	Same as for the rotary servo motor. Refer to section 8.3.				

Alarm No.1F		Name: Encoder initial communication error 3			Stop method: Corresponding axis stops	
Alarm description		・Connected linear encoder is not compatible.				
Display	Name	Cause		Checkpoint	Finding	Action
1F.1	Incompatible encoder	(1)	Incompatible linear encoder is connected to the servo amplifier.	Check the model name of the linear encoder.	Incompatible linear encoder.	Replace the linear encoder.
					Compatible linear encoder.	Check (2).
		(2)	Information in the linear encoder is incorrect.	Check the linear encoder ID from the system information display of MR Configurator.	ID is incorrect.	Replace the linear encoder.

Alarm No.20		Name: Encoder normal communication error 1			Stop method: Corresponding axis stops	
Alarm description		・Error is found in the communication between the linear encoder and the servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
20.1	Encoder receive data error 1	(1)	Encoder cable is faulty.	Check the shield.	Problem found.	Repair the cable.
					No problem found.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise, surrounding air temperature, and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Servo amplifier is faulty.	Replace the servo amplifier and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
					Reproduced.	Examine checkpoints described in the alarm display “20.3”.

Alarm No.20		Name: Encoder normal communication error 1			Stop method: Corresponding axis stops	
Alarm description		・Error is found in the communication between the linear encoder and the servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
20.2	Encoder receive data error 2	(1)	Encoder cable is faulty.	Examine checkpoints described in the alarm display "20.1".		
		(2)	Fault is generated from the surrounding environment of the unit.			
		(3)	Servo amplifier is faulty.			
20.3	Encoder receive data error 3	(1)	The encoder cable is unplugged.	Check if the encoder cable is connected properly.	Not connected properly.	Connect properly.
					Connected properly.	Check (2).
		(2)	Encoder cable is faulty.	Check for breakage and short of the encoder cable.	Problem found.	Repair or replace the cable.
					No problem found.	Check (3).
		(3)	Improper shield treatment of encoder cable.	Check the shield treatment.	Problem found.	Take measures against noise.
					No problem found.	Check (4).
		(4)	Servo amplifier is faulty.	Replace the servo amplifier and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
					Reproduced.	Check (5).
		(5)	Fault is generated from the surrounding environment of the unit.	Check for external noise, surrounding air temperature, and other factors.	Problem found.	Take countermeasure according to the cause.
20.5	Encoder transmission data error 1	(1)	Improper shield treatment of encoder cable.	Check the shield treatment.	Problem found.	Repair the cable.
					No problem found.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise, and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Linear encoder is faulty.	Replace to a properly operating linear encoder.	Error is not reproduced.	Replace the linear encoder.
20.6	Encoder transmission data error 2	(1)	Improper shield treatment of encoder cable.	Examine checkpoints described in the alarm display "20.5".		
		(2)	Fault is generated from the surrounding environment of the unit.			
		(3)	Linear encoder is faulty.			
20.7	Encoder transmission data error 3	(1)	Improper shield treatment of encoder cable.	Examine checkpoints described in the alarm display "20.5".		
		(2)	Fault is generated from the surrounding environment of the unit.			
		(3)	Linear encoder is faulty.			

Alarm No.21		Name: Encoder normal communication error 2			Stop method: Corresponding axis stops	
Alarm description		・Error is found in the linear encoder data.				
Display	Name	Cause		Checkpoint	Finding	Action
21.1	Encoder data error	(1)	Linear encoder is faulty.	Replace to a properly operating linear encoder.	Error is not reproduced.	Replace the linear encoder.
					Reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.

Alarm No.24		Name: Main circuit error			Stop method: All axes stop	
Alarm description		・Ground fault occurs at servo motor power cable of the servo amplifier. ・Ground fault occurs at servo motor.				
Display	Name	Cause		Checkpoint	Finding	Action
24.1	Ground fault detected at hardware detection circuit	Same as for the rotary servo motor. Refer to section 8.3.				
24.2	Ground fault detected at software detection function					

Alarm No.27		Name: Initial magnetic pole detection error			Stop method: Corresponding axis stops	
Alarm description		・Initial magnetic pole detection cannot be performed properly.				
Display	Name	Cause		Checkpoint	Finding	Action
27.1	magnetic pole detection abnormal termination	(1)	Machine struck something.	Check if the machine struck something.	Machine struck something.	Move the start position of the magnetic pole detection.
					Machine did not strike.	Check (2).
		(2)	Wiring fault of the power cable.	Check the power cable.	Problem found.	Modify the wiring.
					Normal.	Check (3).
		(3)	Resolution of the linear encoder and the resolution setting of the parameter are different.	Review the parameter No.PS02 and PS03 settings.	Setting is incorrect.	Correct the setting.
					Setting is correct.	Check (4).
		(4)	Polarity of the linear encoder is incorrect. (Installation direction is incorrect.)	Check polarities of the linear encoder and the linear servo motor.	The polarity is incorrect.	Correct the setting.
					Normal.	Check (5).
		(5)	Accuracy of the initial magnetic pole detection is not satisfactory.	Travel distance during the magnetic pole detection is short.	Travel distance is short.	Review the parameter No.PS09 setting.
27.2	magnetic pole detection time out error	(1)	Only one of the magnetic pole detection limit switches is ON.	Check the status of the limit switch.	Problem found.	Remove the cause. Change the location of the magnetic pole detection.
					Normal.	Check (2).
		(2)	Excitation level during the initial magnetic pole detection is small.	Travel distance during the magnetic pole detection is short.	Travel distance is short.	Review the parameter No.PS09 setting.

Alarm No.27		Name: Initial magnetic pole detection error			Stop method: Corresponding axis stops	
Alarm description		・Initial magnetic pole detection cannot be performed properly.				
Display	Name	Cause		Checkpoint	Finding	Action
27.3	magnetic pole detection limit switch error	(1)	Both of the magnetic pole detection limit switches are OFF.	Check that the limit switches are ON.	Limit switches are OFF.	Turn the limit switches ON.
27.4	magnetic pole detection estimated error	(1)	The estimated value obtained from the magnetic pole detection is faulty.	Examine checkpoints described in the alarm display "27.1".		
27.5	magnetic pole detection position deviation error	(1)	Position deviation increases during the magnetic pole detection.	Examine checkpoints described in the alarm display "27.1".		
27.6	magnetic pole detection speed deviation error	(1)	Speed deviation increases during the magnetic pole detection.	Examine checkpoints described in the alarm display "27.1".		
27.7	magnetic pole detection current error	(1)	The current reaches the alarm level during the magnetic pole detection.	Examine checkpoints described in the alarm display "27.1".		

Alarm No.28		Name: Linear encoder error 2			Stop method: Corresponding axis stops	
Alarm description		・Fault is found in the surrounding environment of the linear encoder.				
Display	Name	Cause		Checkpoint	Finding	Action
28.1	Linear encoder environment error	(1)	Temperature of the linear encoder is high.	Check the temperature of the linear encoder.	Temperature is high.	Consult the linear encoder manufacturer.
					Temperature is low.	Check (2).
		(2)	Signal level from the linear encoder drops.	Check the installation of the linear encoder.	Problem found.	Modify the installation of the linear encoder.

Alarm No.2A		Name: Linear encoder error 1			Stop method: Corresponding axis stops	
Alarm description		・Error signal from the linear encoder is received.				
Display	Name	Cause		Checkpoint	Finding	Action
2A.1	Linear encoder side error 1	(1)	Installation positions of the linear encoder and the head are faulty.	Adjust the positions of the linear encoder and the head, and check the reproducibility of the error.	Not reproduced.	Use in the adjusted positions.
					Reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Alarm of the linear encoder.	Check the details of section 13.9.4.	Improve the detail information No.1 of the linear encoder manufacturer.	Consult the linear encoder manufacturer.

Alarm No.2A		Name: Linear encoder error 1			Stop method: Corresponding axis stops	
Alarm description		・Error signal from the linear encoder is received.				
Display	Name	Cause		Checkpoint	Finding	Action
2A.2	Linear encoder side error 2	(1)	Installation positions of the linear encoder and the head are faulty.	Adjust the positions of the linear encoder and the head, and check the reproducibility of the error.	Not reproduced.	Use in the adjusted positions.
					Reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Alarm of the linear encoder.	Check the details of section 13.9.4.	Improve the detail information No.2 of the linear encoder manufacturer.	Consult the linear encoder manufacturer.
2A.3	Linear encoder side error 3	(1)	Installation positions of the linear encoder and the head are faulty.	Adjust the positions of the linear encoder and the head, and check the reproducibility of the error.	Not reproduced.	Use in the adjusted positions.
					Reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Alarm of the linear encoder.	Check the details of section 13.9.4.	Improve the detail information No.3 of the linear encoder manufacturer.	Consult the linear encoder manufacturer.
2A.4	Linear encoder side error 4	(1)	Installation positions of the linear encoder and the head are faulty.	Adjust the positions of the linear encoder and the head, and check the reproducibility of the error.	Not reproduced.	Use in the adjusted positions.
					Reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Alarm of the linear encoder.	Check the details of section 13.9.4.	Improve the detail information No.4 of the linear encoder manufacturer.	Consult the linear encoder manufacturer.
2A.5	Linear encoder side error 5	(1)	Installation positions of the linear encoder and the head are faulty.	Adjust the positions of the linear encoder and the head, and check the reproducibility of the error.	Not reproduced.	Use in the adjusted positions.
					Reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Alarm of the linear encoder.	Check the details of section 13.9.4.	Improve the detail information No.5 of the linear encoder manufacturer.	Consult the linear encoder manufacturer.

Alarm No.2A		Name: Linear encoder error 1			Stop method: Corresponding axis stops	
Alarm description		・Error signal from the linear encoder is received.				
Display	Name	Cause		Checkpoint	Finding	Action
2A.6	Linear encoder side error 6	(1)	Installation positions of the linear encoder and the head are faulty.	Adjust the positions of the linear encoder and the head, and check the reproducibility of the error.	Not reproduced.	Use in the adjusted positions.
					Reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Alarm of the linear encoder.	Check the details of section 13.9.4.	Improve the detail information No.6 of the linear encoder manufacturer.	Consult the linear encoder manufacturer.
2A.7	Linear encoder side error 7	(1)	Installation positions of the linear encoder and the head are faulty.	Adjust the positions of the linear encoder and the head, and check the reproducibility of the error.	Not reproduced.	Use in the adjusted positions.
					Reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Alarm of the linear encoder.	Check the details of section 13.9.4.	Improve the detail information No.7 of the linear encoder manufacturer.	Consult the linear encoder manufacturer.
2A.8	Linear encoder side error 8	(1)	Installation positions of the linear encoder and the head are faulty.	Adjust the positions of the linear encoder and the head, and check the reproducibility of the error.	Not reproduced.	Use in the adjusted positions.
					Reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment of the unit.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Alarm of the linear encoder.	Check the details of section 13.9.4.	Improve the detail information No.8 of the linear encoder manufacturer.	Consult the linear encoder manufacturer.

Alarm No.30		Name: Regenerative error		Stop method: All axes stop	
Alarm description		・Permissible regenerative power of the built-in regenerative resistor or regenerative option is exceeded. ・Regenerative transistor in the servo amplifier is faulty.			
Display	Name	Cause	Checkpoint	Finding	Action
30.1	Regeneration heat error	Same as for the rotary servo motor. Refer to section 8.3.			
30.2	Regenerative transistor error				
30.3	Regenerative transistor feedback data error				

Alarm No.31		Name: Overspeed		Stop method: Corresponding axis stops	
Alarm description		・Linear servo motor speed exceeds the instantaneous permissible speed.			
Display	Name	Cause	Checkpoint	Finding	Action
31.1	Abnormal motor speed	Same as for the rotary servo motor. Refer to section 8.3.			

Alarm No.32		Name: Overcurrent		Stop method: All axes stop	
Alarm description		・Current that flew is the permissible current of the servo amplifier or higher.			
Display	Name	Cause	Checkpoint	Finding	Action
32.1	Overcurrent detected at hardware detection circuit (during operation).	Same as for the rotary servo motor. Refer to section 8.3.			
32.2	Overcurrent detected at software detection function (during operation).				
32.3	Overcurrent detected at hardware detection circuit (during a stop).				
32.4	Overcurrent detected at software detection function (during a stop).				

Alarm No.33		Name: Overvoltage		Stop method: All axes stop	
Alarm description		・Bus voltage exceeds 400VDC.			
Display	Name	Cause	Checkpoint	Finding	Action
33.1	Main circuit voltage error	Same as for the rotary servo motor. Refer to section 8.3.			

Alarm No.34		Name: SSCNET receive error 1		Stop method: Corresponding axis stops	
Alarm description		・SSCNETⅢ communication error (Continuous communication error for 3.5ms)			
Display	Name	Cause	Checkpoint	Finding	Action
34.1	SSCNET receive data error	Same as for the rotary servo motor. Refer to section 8.3.			
34.2	SSCNET communication connector connection error				
34.3	Communication data error				
34.4	Hardware error signal detection				

Alarm No.35		Name: Command frequency error		Stop method: Corresponding axis stops	
Alarm description		・Input pulse frequency of command pulse is too high.			
Display	Name	Cause	Checkpoint	Finding	Action
35.1	Command frequency error	Same as for the rotary servo motor. Refer to section 8.3.			

Alarm No.36		Name: SSCNET receive error 2		Stop method: Corresponding axis stops	
Alarm description		・SSCNETⅢ communication error (Continuous communication error for about 70ms.)			
Display	Name	Cause	Checkpoint	Finding	Action
36.1	Continuous communication data error	Same as for the rotary servo motor. Refer to section 8.3.			

Alarm No.37		Name: Parameter error		Stop method: Corresponding axis stops	
Alarm description		・Settings in the servo amplifier are incorrect.			
Display	Name	Cause	Checkpoint	Finding	Action
37.1	Parameter setting range error	Same as for the rotary servo motor. Refer to section 8.3.			
37.2	Parameter combination error				

Alarm No.42		Name: Linear servo control error			Stop method: Corresponding axis stops	
Alarm description		・Linear servo control error occurs.				
Display	Name	Cause		Checkpoint	Finding	Action
42.1	Linear servo control error on the positioning detection	(1)	Resolution of the linear encoder and the resolution setting of the parameter are different.	Review the parameter No.PS02 and PS03 settings.	Setting is incorrect.	Correct the setting.
					Setting is correct.	Check (2).
		(2)	Polarity of the linear encoder is incorrect. (Installation direction is incorrect.)	Check polarities of the linear encoder and the linear servo motor.	The polarity is incorrect.	Correct the setting.
					Normal.	Check (3).
		(3)	Connection of the linear servo motor is incorrect.	Check the wiring.	Problem found.	Perform wiring correctly.
					Normal.	Check (4).
		(4)	Initial magnetic pole detection is not performed.	Perform the magnetic pole detection again, and check the reproducibility of the error.	Not reproduced.	Perform the magnetic pole detection.
					Reproduced.	Check (5).
		(5)	Position deviation reaches the detection level.	Check the operation status. (Check the number of droop pulses.)	Deviation is large.	Review the operation status. Review the parameter No.PS05 (Linear servo motor control position deviation error detection level) setting as required.
42.2	Linear servo control error on the speed detection	(1)	Resolution of the linear encoder and the resolution setting of the parameter are different.	Review the parameter No.PS02 and PS03 settings.	Setting is incorrect.	Correct the setting.
					Setting is correct.	Check (2).
		(2)	Polarity of the linear encoder is incorrect. (Installation direction is incorrect.)	Check polarities of the linear encoder and the linear servo motor.	The polarity is incorrect.	Correct the setting.
					Normal.	Check (3).
		(3)	Connection of the linear servo motor is incorrect.	Check the wiring.	Problem found.	Perform wiring correctly.
					Normal.	Check (4).
		(4)	Initial magnetic pole detection is not performed.	Perform the magnetic pole detection again, and check the reproducibility of the error.	Not reproduced.	Perform the magnetic pole detection.
					Reproduced.	Check (5).
		(5)	Speed deviation reaches the detection level.	Check the operation status. (Calculate the deviation between the speed command and the linear servo motor speed.)	Deviation is large.	Review the operation status. Review the parameter No.PS06 (Linear servo motor control speed deviation error detection level) setting as required.

Alarm No.42		Name: Linear servo control error		Stop method: Corresponding axis stops	
Alarm description		・Linear servo control error occurs.			
Display	Name	Cause	Checkpoint	Finding	Action
42.3	Linear servo control error on the thrust detection	(1) Resolution of the linear encoder and the resolution setting of the parameter are different.	Review the parameter No.PS02 and PS03 settings.	Setting is incorrect.	Correct the setting.
				Setting is correct.	Check (2).
		(2) Polarity of the linear encoder is incorrect. (Installation direction is incorrect.)	Check polarities of the linear encoder and the linear servo motor.	The polarity is incorrect.	Correct the setting.
				Normal.	Check (3).
		(3) Connection of the linear servo motor is incorrect.	Check the wiring.	Problem found.	Perform wiring correctly.
				Normal.	Check (4).
		(4) Initial magnetic pole detection is not performed.	Perform the magnetic pole detection again, and check the reproducibility of the error.	Not reproduced.	Perform the magnetic pole detection.
				Reproduced.	Check (5).
		(5) Thrust deviation reaches the detection level.	Check the operation status. (Calculate the deviation between the current command and the torque.)	Deviation is large.	Review the operation status. Review the parameter No.PS07 (Linear servo motor control thrust deviation error detection level) setting as required.

Alarm No.45		Name: Main circuit device overheat		Stop method: All axes stop	
Alarm description		・Inside of the servo amplifier overheats.			
Display	Name	Cause	Checkpoint	Finding	Action
45.1	Main circuit abnormal temperature	Same as for the rotary servo motor. Refer to section 8.3.			
45.2	Board temperature error				

Alarm No.46		Name: Servo motor overheat		Stop method: Corresponding axis stops	
Alarm description		・Linear servo motor overheats abnormally.			
Display	Name	Cause	Checkpoint	Finding	Action
46.1	Abnormal temperature of linear servo motor	(1) Thermistor cable is not connected.	Check if the lead from the linear servo motor is connected.	Not connected.	Connect the lead.
				Connected.	Check (2).
		(2) The lead of the linear servo motor has breakage.	Check the lead of the linear servo motor.	Has breakage.	Repair the lead.
				Does not have breakage.	Check (3).
		(3) Surrounding air temperature of the linear servo motor is over 40℃.	Check the surrounding air temperature of the linear servo motor.	Surrounding air temperature is over 40℃.	Lower the surrounding air temperature of the linear servo motor.
				Surrounding air temperature is 40℃ or less.	Check (4).
		(4) Linear servo motor is overloaded.	Check the effective load ratio.	Effective load ratio is large.	Reduce the load or review the operation method.
				Effective load ratio is small.	Check (5).
		(5) Thermistor in linear servo motor is faulty.	Replace the linear servo motor, and check the reproducibility of the error.	Not reproduced.	Replace the servo motor.

Alarm No.47		Name: Cooling fan error		Stop method: All axes stop	
Alarm description		・Cooling fan speed of the servo amplifier is decreased. ・Cooling fan speed drops to the alarm level or lower.			
Display	Name	Cause	Checkpoint	Finding	Action
47.1	Cooling fan stop error	Same as for the rotary servo motor. Refer to section 8.3.			
47.2	Decreased cooling fan speed error				

Alarm No.50		Name: Overload 1			Stop method: Corresponding axis stops	
Alarm description		・Load exceeds overload protection characteristic of servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
50.1	Thermal overload error 1 during operation	(1)	Servo amplifier is used in excess of its continuous output current.	Check the effective load ratio.	Effective load ratio is large.	Reduce load. Check operation pattern. Use servo motor that provides larger output.
					Effective load ratio is small.	Check (2).
		(2)	Servo system is instable and causing oscillation.	Check for oscillation in motor.	Oscillation is occurring.	Adjust the gain.
					Oscillation is not occurring.	Check (3).
		(3)	After the overload alarm has been output, the operation is restarted without having cool-off time.	Check if the alarm is reset after waiting 15 minutes or longer subsequent to the output of the alarm.	Not reset.	Reset the alarm after sufficient cool-off time.
					Reset.	Check (4).
		(4)	Servo amplifier is faulty.	Replace the servo amplifier, and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.
50.2	Thermal overload error 2 during operation	(1)	Machine struck something.	Check if the machine struck something.	Machine struck.	Review the operation pattern.
					Machine did not strike.	Check (2).
		(2)	Power cable is cut.	Check the power cable.	Problem found.	Modify the wiring.
					No problem found.	Check (3).
		(3)	Incorrect connections to/from the linear servo motor.	Check the wiring of U, V and W phase.	Problem found.	Perform wiring correctly.
					No problem found.	Check (4).
		(4)	Resolution of the linear encoder and the resolution setting of the parameter are different.	Review the parameter No.PS02 and PS03 settings.	Setting is incorrect.	Correct the setting.
					Setting is correct.	Check (5).
		(5)	Polarity of the linear encoder is incorrect. (Installation direction is incorrect.)	Check polarities of the linear encoder and the linear servo motor.	The polarity is incorrect.	Correct the setting.
					Normal.	Check (6).
		(6)	Initial magnetic pole detection is not performed.	Perform the magnetic pole detection again, and check the reproducibility of the error.	Not reproduced.	Perform the magnetic pole detection.
					Reproduced.	Check (7).
		(7)	Linear encoder is faulty.	Replace the servo motor, and check the reproducibility of the error.	Not reproduced.	Replace the servo motor.
					Reproduced.	Check (8).
		(8)	Servo amplifier is used in excess of its continuous output current.	Examine checkpoints described in the alarm display "50.1".		
		(9)	Servo system is instable and causing oscillation.			
		(10)	Servo amplifier is faulty.			

Alarm No.50		Name: Overload 1			Stop method: Corresponding axis stops	
Alarm description		・Load exceeds overload protection characteristic of servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
50.3	Thermal overload error 4 during operation	(1)	Machine struck something.	Examine checkpoints described in the alarm display "50.2".		
		(2)	Power cable is cut.			
		(3)	Incorrect connections to/from the linear servo motor.			
		(4)	Resolution of the linear encoder and the resolution setting of the parameter are different.			
		(5)	Polarity of the linear encoder is incorrect. (Installation direction is incorrect.)			
		(6)	Initial magnetic pole detection is not performed.			
		(7)	Linear encoder is faulty.			
		(8)	Servo amplifier is used in excess of its continuous output current.			
		(9)	Servo system is instable and causing oscillation.			
		(10)	Servo amplifier is faulty.			
50.4	Thermal overload error 1 during a stop	(1)	Servo amplifier is used in excess of its continuous output current.	Check the effective load ratio.	Effective load ratio is large.	Reduce load. Check operation pattern. Use servo motor that provides larger output.
					Effective load ratio is small.	Check (2).
		(2)	Hunting occurs during servo lock.	Check for hunting.	Hunting occurs.	Adjust the gain.
					Hunting does not occur.	Check (3).
		(3)	After the overload alarm has been output, the operation is restarted without having cool-off time.	Check if the alarm is reset after waiting 15 minutes or longer subsequent to the output of the alarm.	Not reset.	Reset the alarm after sufficient cool-off time.
					Reset.	Check (4).
		(4)	Servo amplifier is faulty.	Replace the servo amplifier, and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.

Alarm No.50		Name: Overload 1			Stop method: Corresponding axis stops	
Alarm description		・Load exceeds overload protection characteristic of servo amplifier.				
Display	Name	Cause		Checkpoint	Finding	Action
50.5	Thermal overload error 2 during a stop	(1)	Machine struck something.	Check if the machine struck something.	Machine struck.	Review the operation pattern.
					Machine did not strike.	Check (2).
		(2)	Power cable is cut.	Check the power cable.	Problem found.	Modify the wiring.
					No problem found.	Check (3).
		(3)	Incorrect connections to/from the linear servo motor.	Check the wiring of U, V and W phase.	Problem found.	Perform wiring correctly.
					No problem found.	Check (4).
		(4)	Resolution of the linear encoder and the resolution setting of the parameter are different.	Review the parameter No.PS02 and PS03 settings.	Setting is incorrect.	Correct the setting.
					Setting is correct.	Check (5).
		(5)	Polarity of the linear encoder is incorrect. (Installation direction is incorrect.)	Check polarities of the linear encoder and the linear servo motor.	The polarity is incorrect.	Correct the setting.
					Normal.	Check (6).
		(6)	Initial magnetic pole detection is not performed.	Perform the magnetic pole detection again, and check the reproducibility of the error.	Not reproduced.	Perform the magnetic pole detection.
					Reproduced.	Check (7).
		(7)	Linear encoder is faulty.	Replace the servo motor, and check the reproducibility of the error.	Not reproduced.	Replace the servo motor.
					Reproduced.	Check (8).
		(8)	Servo amplifier is used in excess of its continuous output current.	Examine checkpoints described in the alarm display "50.4".		
		(9)	Servo system is instable and causing oscillation.			
		(10)	Servo amplifier is faulty.			
50.6	Thermal overload error 4 during operation	(1)	Machine struck something.	Examine checkpoints described in the alarm display "50.5".		
		(2)	Power cable is cut.			
		(3)	Incorrect connections to/from the servo motor.			
		(4)	Resolution of the linear encoder and the resolution setting of the parameter are different.			
		(5)	Polarity of the linear encoder is incorrect. (Installation direction is incorrect.)			
		(6)	Initial magnetic pole detection is not performed.			
		(7)	Linear encoder is faulty.			
		(8)	Servo amplifier is used in excess of its continuous output current.			
		(9)	Servo system is instable and causing oscillation.			
		(10)	Servo amplifier is faulty.			

Alarm No.51		Name: Overload 2			Stop method: Corresponding axis stops	
Alarm description		・Machine collision or the like caused maximum output current to flow for several seconds continuously.				
Display	Name	Cause		Checkpoint	Finding	Action
51.1	Thermal overload error 3 during operation	(1)	Power cable is cut.	Check the power cable.	Problem found.	Modify the wiring.
					No problem found.	Check (2).
		(2)	Incorrect connections to/from the linear servo motor.	Check the wiring of U, V and W phase.	Misconnection found.	Modify the wiring.
					Normal.	Check (3).
		(3)	Misconnection of encoder cable.	Check the encoder cable connection.	Problem found.	Check the cable connection.
					No problem found.	Check (4).
		(4)	Resolution of the linear encoder and the resolution setting of the parameter are different.	Review the parameter No.PS02 and PS03 settings.	Setting is incorrect.	Correct the setting.
					Setting is correct.	Check (5).
		(5)	Polarity of the linear encoder is incorrect. (Installation direction is incorrect.)	Check polarities of the linear encoder and the linear servo motor.	The polarity is incorrect.	Correct the setting.
					Normal.	Check (6).
		(6)	Initial magnetic pole detection is not performed.	Perform the magnetic pole detection again, and check the reproducibility of the error.	Not reproduced.	Perform the magnetic pole detection.
					Reproduced.	Check (7).
		(7)	Linear encoder is faulty.	Replace the servo motor, and check the reproducibility of the error.	Not reproduced.	Replace the servo motor.
					Reproduced.	Check (8).
		(8)	Machine struck something.	Check if the machine struck something.	Machine struck.	Review the operation pattern.
					Machine did not strike.	Check (9).
		(9)	Torque is saturated.	Check the torque during the operation.	Torque is saturated.	Review the operation pattern.
					Torque is not saturated.	Check (10).
		(10)	Servo amplifier is faulty.	Replace the servo amplifier, and check the reproducibility of the error.	Not reproduced.	Replace the servo amplifier.

Alarm No.51		Name: Overload 2			Stop method: Corresponding axis stops	
Alarm description		・Machine collision or the like caused maximum output current to flow for several seconds continuously.				
Display	Name	Cause		Checkpoint	Finding	Action
51.2	Thermal overload error 3 during a stop	(1)	Power cable is cut.	Examine checkpoints described in the alarm display "51.1".		
		(2)	Incorrect connections to/from the linear servo motor.			
		(3)	Misconnection of encoder cable.			
		(4)	Resolution of the linear encoder and the resolution setting of the parameter are different.			
		(5)	Polarity of the linear encoder is incorrect. (Installation direction is incorrect.)			
		(6)	Initial magnetic pole detection is not performed.			
		(7)	Linear encoder is faulty.			
		(8)	Machine struck something.			
		(9)	Torque is saturated.			
		(10)	Servo amplifier is faulty.			

Alarm No.52		Name: Error excessive		Stop method: Corresponding axis stops	
Alarm description		・The droop pulse existing between the model position and the actual servo motor position exceeds the alarm level.			
Display	Name	Cause	Checkpoint	Finding	Action
52.3	Excess droop pulse existing between the model position and the actual servo motor position	Same as for the rotary servo motor. Refer to section 8.3.			
52.4	Maximum deviation at 0 torque limit				

Alarm No.8A		Name: USB communication time-out error		Stop method: All axes stop	
Alarm description		・Communication between the servo amplifier and a communication device (PC, etc.) stops for the specified time or longer.			
Display	Name	Cause	Checkpoint	Finding	Action
8A.1	USB communication time-out for the specified time or longer	Same as for the rotary servo motor. Refer to section 8.3.			

Alarm No.8E		Name: USB communication error		Stop method: All axes stop	
Alarm description		・USB communication error occurs between the servo amplifier and a communication device (PC, etc.)			
Display	Name	Cause	Checkpoint	Finding	Action
8E.1	USB communication receive error	Same as for the rotary servo motor. Refer to section 8.3.			
8E.2	USB communication checksum error				
8E.3	USB communication character error				
8E.4	USB communication command error				
8E.5	USB communication data No. error				

13.9.3 Remedies for warnings

> **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.
>
> ・Main circuit device overheat warning (91.☐)
> ・Excessive regenerative warning (E0.☐)
> ・Overload warning 1 (E1.☐)

When a warning whose stop method is all axis stop in the following table occurs, the servo amplifier goes into the servo-off status and the servo motor stops at the warning occurrence. 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 MR Configurator to refer to a factor of warning occurrence.

Alarm No.91		Name: Main circuit device overheat warning		Stop method: Axes can operate (warning detected at both axes).	
Alarm description		・The temperature inside of the servo amplifier exceeds the warning level.			
Display	Name	Cause	Checkpoint	Finding	Action
91.1	Main circuit device overheat warning	Same as for the rotary servo motor. Refer to section 8.4.			
91.2	Board temperature warning				

<table>
<tr><td colspan="2">Alarm No.96</td><td colspan="2">Name: Home position setting warning</td><td colspan="2">Stop method: Axes can operate (detected by the corresponding axis).</td></tr>
<tr><td colspan="2">Alarm description</td><td colspan="4">・Home positioning cannot be made.</td></tr>
<tr><td>Display</td><td>Name</td><td>Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td>96.1</td><td>INP error at home positioning</td><td colspan="4" rowspan="2">Same as for the rotary servo motor.
Refer to section 8.4.</td></tr>
<tr><td>96.2</td><td>Command input error at home positioning</td></tr>
</table>

<table>
<tr><td colspan="2">Alarm No.E0</td><td colspan="2">Name: Excessive regeneration warning</td><td colspan="2">Stop method: Axes can operate (warning detected at both axes)</td></tr>
<tr><td colspan="2">Warning description</td><td colspan="4">・There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative resistor or regenerative option.</td></tr>
<tr><td>Display</td><td>Name</td><td>Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td>E0.1</td><td>Excessive regeneration warning</td><td colspan="4">Same as for the rotary servo motor.
Refer to section 8.4.</td></tr>
</table>

<table>
<tr><td colspan="2">Alarm No.E1</td><td colspan="2">Name: Overload warning 1</td><td colspan="2">Stop method: Axes can operate (detected at the corresponding axis)</td></tr>
<tr><td colspan="2">Alarm description</td><td colspan="4">・There is a possibility that overload alarm (50.□, 51.□) may occur.</td></tr>
<tr><td>Display</td><td>Name</td><td>Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td>E1.1</td><td>Thermal overload warning 1 during operation</td><td colspan="4" rowspan="8">Same as for the rotary servo motor.
Refer to section 8.4.</td></tr>
<tr><td>E1.2</td><td>Thermal overload warning 2 during operation</td></tr>
<tr><td>E1.3</td><td>Thermal overload warning 3 during operation</td></tr>
<tr><td>E1.4</td><td>Thermal overload warning 4 during operation</td></tr>
<tr><td>E1.5</td><td>Thermal overload warning 1 during a stop</td></tr>
<tr><td>E1.6</td><td>Thermal overload warning 2 during a stop</td></tr>
<tr><td>E1.7</td><td>Thermal overload warning 3 during a stop</td></tr>
<tr><td>E1.8</td><td>Thermal overload warning 4 during a stop</td></tr>
</table>

Alarm No.E2		Name: Linear servo motor overheat warning		Stop method: Axes can operate (detected at the corresponding axis)	
Alarm description		・The linear servo motor overheat (46) may occur.			
Display	Name	Cause	Checkpoint	Finding	Action
E2.1	Linear servo motor overheat warning	(1) The linear servo motor temperature reaches 85% of the overheat alarm level of the linear servo motor.	Examine checkpoints described in the alarm display "46.1".		

Alarm No.E4		Name: Parameter warning		Stop method: Axes can operate (detected at the corresponding axis)	
Alarm description		・At parameter write, write to parameter outside of the setting range is attempted.			
Display	Name	Cause	Checkpoint	Finding	Action
E4.1	Parameter setting range error warning	Same as for the rotary servo motor. Refer to section 8.4.			

Alarm No.E6		Name: Servo forced stop warning		Stop method: All axes stop	
Alarm description		・Forced stop signal is turned off.			
Display	Name	Cause	Checkpoint	Finding	Action
E6.1	Forced stop warning	Same as for the rotary servo motor. Refer to section 8.4.			

Alarm No.E7		Name: Controller forced stop warning		Stop method: All axes stop	
Alarm description		・Forced stop signal is input from the servo system controller.			
Display	Name	Cause	Checkpoint	Finding	Action
E7.1	Controller forced stop warning	Same as for the rotary servo motor. Refer to section 8.4.			

Alarm No.E8		Name: Cooling fan speed reduction warning		Stop method: Axes can operate (warning detected at both axes)	
Alarm description		・The speed of cooling fan drops to or below the warning level.			
Display	Name	Cause	Checkpoint	Finding	Action
E8.1	Decreased cooling fan speed warning	Same as for the rotary servo motor. Refer to section 8.4.			

Alarm No.E9		Name: Main circuit off warning		Stop method: All axes stop (warning detected at both axes)	
Alarm description		・Servo-on command is input when the main circuit power is off. ・Bus voltage drops when linear servo motor is running below 50m/s.			
Display	Name	Cause	Checkpoint	Finding	Action
E9.1	Servo-on signal on at main circuit off	Same as for the rotary servo motor. Refer to section 8.4.			
E9.2	Bus voltage drop during low speed operation				

<table>
<tr><td colspan="2">Alarm No.EB</td><td colspan="2">Name: The other axis fault warning</td><td colspan="2">Stop method: All axes stop (warning detected at both axes)</td></tr>
<tr><td colspan="2">Alarm description</td><td colspan="4">・In the other axis, alarm demanding all axes stop (11.☐, 15.☐, 17.☐, 24.☐ and 32.☐) is output.</td></tr>
<tr><td>Display</td><td>Name</td><td>Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td>EB.1</td><td>The other axis fault warning</td><td colspan="4">Same as for the rotary servo motor.
Refer to section 8.4.</td></tr>
</table>

<table>
<tr><td colspan="2">Alarm No.EC</td><td colspan="2">Name: Overload warning 2</td><td colspan="2">Stop method: Axes can operate (detected at the corresponding axis)</td></tr>
<tr><td colspan="2">Alarm description</td><td colspan="4">・The operation, in which current exceeding the rating flows intensively in any of U, V and W phases of the servo motor, is repeated.</td></tr>
<tr><td>Display</td><td>Name</td><td>Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td>EC.1</td><td>Overload warning 2</td><td colspan="4">Same as for the rotary servo motor.
Refer to section 8.4.</td></tr>
</table>

<table>
<tr><td colspan="2">Alarm No.ED</td><td colspan="2">Name: Output watt excess warning</td><td colspan="2">Stop method: Axes can operate (detected at the corresponding axis)</td></tr>
<tr><td colspan="2">Alarm description</td><td colspan="4">・The status, in which the output wattage (speed x torque) of the servo motor exceed the rated output, continues steadily.</td></tr>
<tr><td>Display</td><td>Name</td><td>Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td>ED.1</td><td>Output watt excess</td><td colspan="4">Same as for the rotary servo motor.
Refer to section 8.4.</td></tr>
</table>

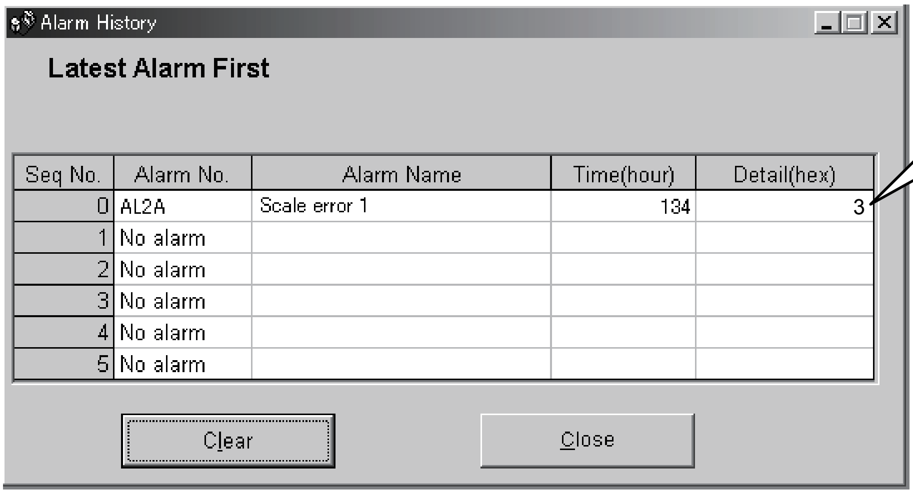
13.9.4 Detailed explanation of linear encoder error 1 (2A.□)

If the cause of Linear encoder error 1 (2A.□) occurrence is not identified, confirm the details shown on the following table according to the alarm detailed information for the alarm history display of MR Configurator, and then contact with the linear encoder manufacturer.

Table 13.1 Detailed explanation of linear encoder error 1 (2A.□) for each manufacturer

Display	Detail information No.	Linear encoder error 1 (2A.□) details				
		Mitutoyo Corporation		Magnescale Co., Ltd.	Heidenhain Corporation	Renishaw Inc.
		AT343A/AT543A	ST741/ST743			
2A.8	7	Optical overspeed	Servo alarm		Overspeed error	
2A.7	6	ROM・RAM error	Signal strength alarm			Overspeed
2A.6	5	EEPROM error	Signal strength error	Encoder alarm	EEPROM error	
2A.5	4	CPU error	Transducer error		CPU error	
2A.4	3	Capacitive error	ABS detection error		ABS data error	
2A.3	2	Photoelectric error	Hardware error		INC data error	
2A.2	1	Photoelectric・capacitive data mismatch	Initialization error	Encoder warning	Scale level error INC/ABS data mismatch error	Level error
2A.1	0	Initialization error	Overspeed error		Initialization error	

As an example, the following describes the detailed information when Linear encoder error 1(2A.□) occurs in the linear encoder AT343A manufactured by Mitutoyo Corporation.



Seq No.	Alarm No.	Alarm Name	Time(hour)	Detail(hex)
0	AL2A	Scale error 1	134	3
1	No alarm			
2	No alarm			
3	No alarm			
4	No alarm			
5	No alarm			

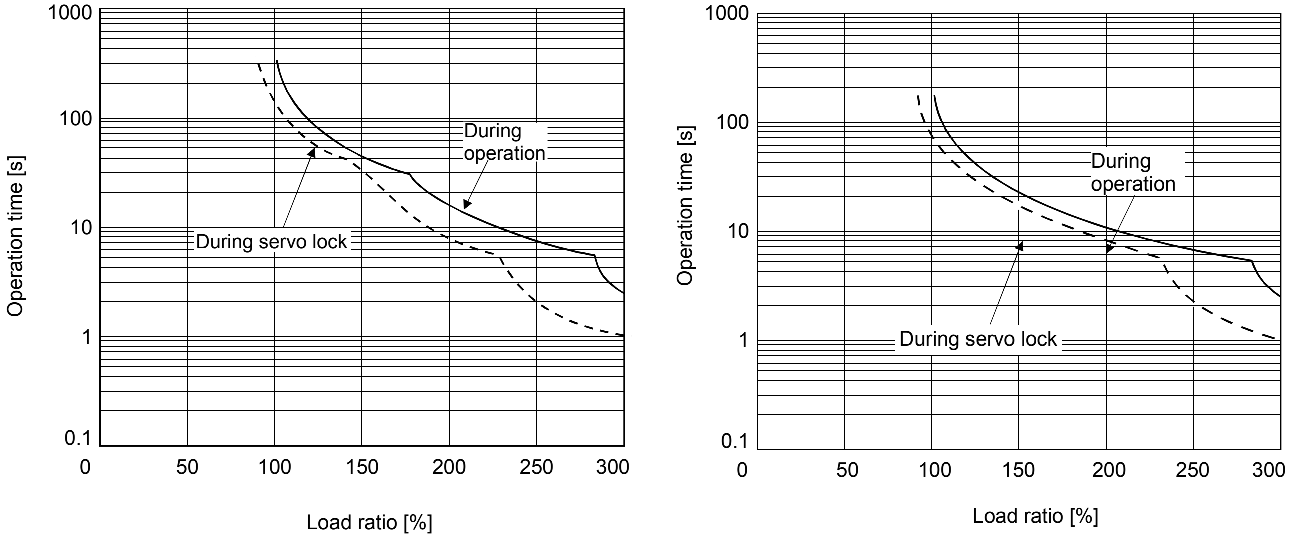
The value is displayed in hexadecimal. Convert it to decimal to read.

In this case, the alarm detail of the linear encoder error (2A.□) is "3".
An alarm detail is displayed in hexadecimal (h) in MR Configurator, but it is displayed in decimal in MR-J3W-B.
In this example, confirm items with number "3" in the Detail column. The occurrence of the Photoelectric error is identified.

13.10 Characteristics

13.10.1 Overload protection characteristics

An electronic thermal relay is built in the servo amplifier to protect the linear servo motor and servo amplifier from overloads. Overload 1 alarm (50.□) occurs if overload operation performed is above the electronic thermal relay protection curve shown in any of Figs 13.2. Overload 2 alarm (51.□) 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.
Servo amplifier MR-J3W series has solid-state servo motor overload protection. (The motor full load current is 115% rated current.)



a. LM-H2 series

b. LM-U2 series

Fig 13.2 Electronic thermal relay protection characteristics

13.10.2 Dynamic brake characteristics

Use the next equation to calculate an approximate coasting distance to a stop when the dynamic brake is operated.

$$\mathrm{Lmax} = V_0 \cdot \{0.03 + M \cdot (A + B \cdot V_0^2)\}$$

Lmax : Machine coasting distance [m]
V_0 : Brake time speed [m/s]
M : Movable part total mass [kg]
A : Coefficient (according to the table below)
B : Coefficient (according to the table below)

Linear servo motor	Coefficient A	Coefficient B
LM-H2P1A-06M	2.91×10^{-2}	8.44×10^{-3}
LM-H2P2A-12M	1.01×10^{-2}	5.71×10^{-3}
LM-H2P2B-24M	3.14×10^{-2}	7.26×10^{-4}
LM-H2P3A-24M	3.28×10^{-2}	7.59×10^{-4}

Linear servo motor	Coefficient A	Coefficient B
LM-U2PAB-05M-0SS0	5.72×10^{-2}	1.72×10^{-4}
LM-U2PAD-10M-0SS0	2.82×10^{-2}	8.60×10^{-5}
LM-U2PAF-15M-0SS0	1.87×10^{-2}	5.93×10^{-5}
LM-U2PBB-07M-1SS0	3.13×10^{-2}	1.04×10^{-4}
LM-U2PBD-15M-1SS0	1.56×10^{-2}	5.18×10^{-5}
LM-U2PBF-22M-1SS0	4.58×10^{-2}	1.33×10^{-5}

⚠ CAUTION

- The coasting distance is a theoretically calculated value which ignores the running load such as friction. The calculated value is considered to be longer than it really is. However, if a sufficient braking distance is not obtained when some margin is allowed, it may result in crashing into the stroke edge, which is highly dangerous. Install the anti-crash mechanism such as an air brake or an electric/mechanical stopper such as a shock absorber to reduce the shock of movable parts. No linear servo motor with an electromagnetic brake is available.

MEMO

App. 1 Difference between MR-J3-B and MR-J3W-B

App. 1.1 Parameter change list

Parameter No.	Name	Setting	Difference from MR-J3-B	Comment
PA01	Control mode	Each axis	None	
PA02	Regenerative option	Common	Specification added	The parameter only supports the regenerative resistor connected to MR-J3W-B.
PA03	Absolute position detection system	Each axis	None	
PA04	Function selection A-1	Common		
PA05 to PA07	For manufacturer setting			
PA08	Auto tuning mode	Each axis		
PA09	Auto tuning response	Each axis		
PA10	In-position range	Each axis		
PA11 to PA13	For manufacturer setting			
PA14	Rotation direction selection (Moving direction selection)	Each axis		
PA15	Encoder output pulses	Each axis	Function added	A/B phase pulse electronic gear setting is added.
PA16	Encoder output pulses 2	Each axis	Function added	A/B phase pulse electronic gear setting is added.
PA17	Linear servo motor series setting	Each axis	New	Used to set a motor ID during the linear servo motor drive.
PA18	Linear servo motor type setting	Each axis	New	Used to set a motor ID during the linear servo motor drive.
PA19	Parameter write inhibit	Each axis	None	

Parameter No.	Name	Setting	Difference from MR-J3-B	Comment
PB01	Adaptive tuning mode (Adaptive filterⅡ)	Each axis	Specification change	Tuning mode is deleted.
PB02	Vibration suppression control filter tuning mode (advanced vibration suppression control)	Each axis	Specification change	Tuning mode is deleted.
PB03	For manufacturer setting		None	
PB04	Feed forward gain	Each axis		
PB05	For manufacturer setting			
PB06	Load to motor inertia moment ratio	Each axis		
PB07	Model loop gain	Each axis		
PB08	Position loop gain	Each axis		
PB09	Speed loop gain	Each axis		
PB10	Speed integral compensation	Each axis		
PB11	Speed differential compensation	Each axis		
PB12	For manufacturer setting			
PB13	Machine resonance suppression filter 1	Each axis		
PB14	Notch form selection 1	Each axis		
PB15	Machine resonance suppression filter 2	Each axis		
PB16	Notch form selection 2	Each axis		
PB17	Automatic setting parameter			
PB18	Low-pass filter setting	Each axis		
PB19	Vibration suppression control vibration frequency setting	Each axis		

Parameter No.	Name	Setting	Difference from MR-J3-B	Comment
PB20	Vibration suppression control resonance frequency setting	Each axis	None	
PB21 ・ PB22	For manufacturer setting			
PB23	Low-pass filter selection	Each axis		
PB24	Slight vibration suppression control selection	Each axis		
PB25	For manufacturer setting			
PB26	Gain changing selection	Each axis		
PB27	Gain changing condition	Each axis		
PB28	Gain changing time constant	Each axis		
PB29	Gain changing load to motor inertia moment ratio	Each axis		
PB30	Gain changing position loop gain	Each axis		
PB31	Gain changing speed loop gain	Each axis		
PB32	Gain changing speed integral compensation	Each axis		
PB33	Gain changing vibration suppression control vibration frequency setting	Each axis		
PB34	Gain changing vibration suppression control resonance frequency setting	Each axis		
PB35 to PB45	For manufacturer setting			

Parameter No.	Name	Setting	Difference from MR-J3-B	Comment
PC01	Error excessive alarm level	Each axis	None	
PC02	Electromagnetic brake sequence output	Each axis		
PC03	Encoder output pulses selection	Each axis	Function added	A/B phase pulse electronic gear setting is added.
PC04	Function selection C-1	Each axis	None	
PC05	Function selection C-2	Each axis		
PC06	Function selection C-3	Each axis		
PC07	Zero speed	Each axis		
PC08	For manufacturer setting			
PC09	Analog monitor 1 output	Common	Specification change	The setting to select an output axis of the analog monitor is added.
PC10	Analog monitor 2 output	Common	Specification change	The setting to select an output axis of the analog monitor is added.
PC11	Analog monitor 1 offset	Common	None	
PC12	Analog monitor 2 offset	Common		
PC13	For manufacturer setting			
PC14				
PC15	Station number selection	Common	Specification added	The setting to select a communicating axis of MR Configurator is added.
PC16	For manufacturer setting		None	
PC17	Function selection C-4	Each axis		
PC18 to PC20	For manufacturer setting			
PC21	Alarm history clear	Each axis		

Parameter No.	Name	Setting	Difference from MR-J3-B	Comment
PC22 to PC26	For manufacturer setting		None	
PC27	Function selection C-9	Each axis		
PC28 to PC32	For manufacturer setting			

Parameter No.	Name	Setting	Difference from MR-J3-B	Comment
PD01	For manufacturer setting		None	
PD02	Input signal automatic ON selection	Each axis	Function added	Automatically ON function for FLS and RLS is added.
PD03 to PD06	For manufacturer setting		None	
PD07	Output signal device selection 1 (A-axis: CN3-12 B-axis: CN3-25)	Each axis	Specification change	Connector pin numbers are changed for MR-J3W.
PD08	For manufacturer setting		Specification change	Cannot be assigned to MR-J3W-B.
PD09	Output signal device selection 3 (A-axis: CN3-11 B-axis: CN3-24)	Each axis	Specification change	Connector pin numbers are changed for MR-J3W.
PD10 to PD13	For manufacturer setting		None	
PD14	Function selection D-3	Each axis		
PD15 to PD32	For manufacturer setting			

Parameter No.	Name	Setting	Difference from MR-J3-B	Comment
PS01	Linear function selection 1	Each axis	Function added	Not used for rotary servo motors. Used for linear servo motors. (Factory setting does not need to be changed.)
PS02	Linear encoder resolution setting Numerator	Each axis	Function added	
PS03	Linear encoder resolution setting Denominator	Each axis	Function added	
PS04	Linear function selection 2	Each axis	Function added	
PS05	Linear servo motor control position deviation error detection level	Each axis	Function added	
PS06	Linear servo motor control speed deviation error detection level	Each axis	Function added	
PS07	Linear servo motor control thrust deviation error detection level	Each axis	Function added	
PS08	Linear function selection 3	Each axis	Function added	
PS09	Magnetic pole detection voltage level	Each axis	Function added	
PS10 to PS16	For manufacturer setting		None	
PS17	Minute position detection method function selection	Each axis	Function added	Not used for rotary servo motors. Used for linear servo motors.
PS18	Minute position detection method identification signal amplitude	Each axis	Function added	
PS19 to PS32	For manufacturer setting		None	

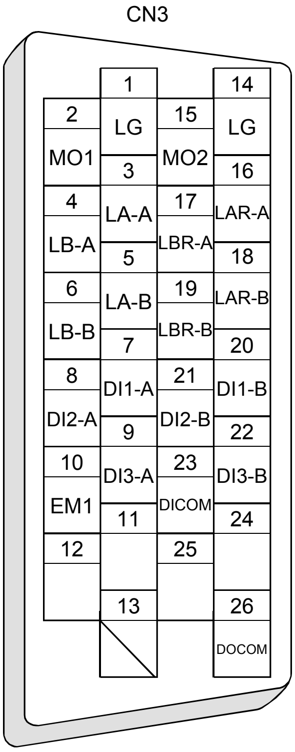
Parameter No.	Name	Setting	Difference from MR-J3-B	Comment
Po01	Function selection O-1	Common	New addition	All-alarm all axis stop function is added.
Po02	Axis selection for graphing analog deta (MR Configurator)	Common	New addition	Axis selection for analog data channels in MR Configurator is added.
Po03	Axis selection for graphing digtal deta (MR Configurator)	Common	New addition	Axis selection for digital data channels in MR Configurator is added.
Po04 to Po16	For manufacturer setting		None	

App. 1.2 Comparison of alarms and warnings

Warning No.	Name	Detection method	Stop method	Difference from MR-J3-B	Comment・Precautions
10	Undervoltage	Common	All axis	None	
11	Switch setting error	Common	All axis	New alarm	Occurs when the rotary switch or the DIP switch setting is faulty.
12	Memory error 1 (RAM)	Common	All axis	None	
13	Clock error	Common	All axis		
15	Memory error 2 (EEP-ROM)	Common	All axis		
16	Encoder initial communication error 1	Each axis	Each axis		
17	Board error	Common	All axis		
19	Memory error 3 (Flash-ROM)	Common	All axis		
1A	Motor combination error	Each axis	Each axis		
1E	Encoder initial communication error 2	Each axis	Each axis	New alarm	Occurs when the cause of an alarm exists at the encoder side.
1F	Encoder initial communication error 3	Each axis	Each axis	New alarm	Occurs when the encoder is not supported.
20	Encoder normal communication error 1	Each axis	Each axis	None	
21	Encoder normal communication error 2	Each axis	Each axis	New alarm	Occurs when the cause of an alarm exists at the encoder side.
24	Main circuit error	Each axis	All axis	None	
25	Absolute position erase	Each axis	Each axis		
27	Initial magnetic pole detection error	Each axis	Each axis	New alarm	Alarm for the use with a linear servo motor.
28	Linear encoder error2	Each axis	Each axis	New alarm	Alarm for the use with a linear servo motor.
2A	Linear encoder error1	Each axis	Each axis	New alarm	Alarm for the use with a linear servo motor.
30	Regenerative error	Common	All axis	None	
31	Overspeed	Each axis	Each axis		
32	Overcurrent	Each axis	All axis		
33	Overvoltage	Common	All axis		
34	SSCNET receive error 1	Each axis	Each axis		
35	Command frequency error	Each axis	Each axis		
36	SSCNET receive error 2	Each axis	Each axis		
37	Parameter error	Each axis	Each axis		
42	Linear servo control error	Each axis	Each axis	New alarm	Alarm for the use with a linear servo motor.
45	Main circuit device overheat	Common	All axis	None	
46	Servo motor overheat	Each axis	Each axis		
47	Cooling fan error	Common	All axis		
50	Overload 1	Each axis	Each axis		
51	Overload 2	Each axis	Each axis		
52	Error excessive	Each axis	Each axis		
8A	USB communication time-out error	Common	All axis		
8E	USB communication error	Common	All axis		

Warning No.	Name	Detection method	Stop method	Difference from MR-J3-B	Comment・Precautions
91	Main circuit device overheat warning	Common		New warning	Occurs when the temperature inside the servo amplifier reaches the warning level.
92	Battery cable disconnection warning	Each axis		None	
96	Home position setting warning	Each axis			
9F	Battery warning	Each axis			
E0	Excessive regeneration warning	Common			
E1	Overload warning 1	Each axis			
E2	Linear servo motor overheat warning	Each axis		New alarm	Alarm for the use with a linear servo motor.
E3	Absolute position counter warning	Each axis		None	
E4	Parameter warning	Each axis			
E6	Servo forced stop warning	Common	All axis		
E7	Controller forced stop warning	Common	All axis		
E8	Cooling fan speed reduction warning	Common			
E9	Main circuit off warning	Common			
EB	The other axis fault warning	Each axis	All axis		
EC	Overload warning 2	Each axis			
ED	Output watt excess warning	Each axis			

App. 2 Signal layout recording paper



App. 3 COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES

App. 3.1 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 also to machines and equipment into which servos have been installed.

(1) EMC directive
The EMC directive applies to the servo units alone. This servo is designed to comply with the EMC directive. The EMC directive also applies the 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).

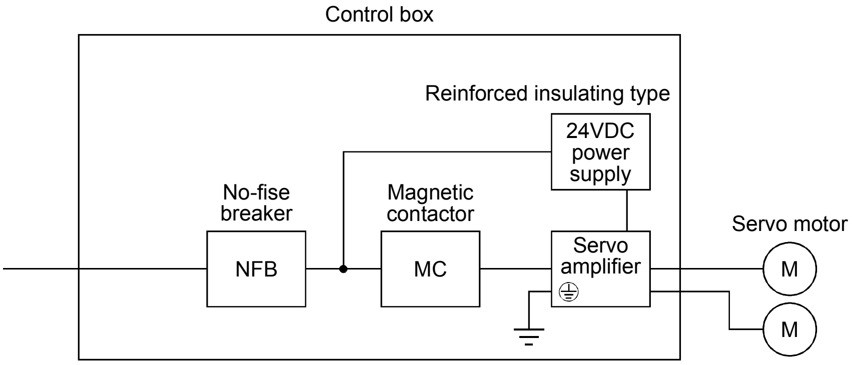
(2) Low voltage directive
The low voltage directive applies also to servo units alone. This servo is designed to comply with the low voltage directive.

(3) Machinery directive
Not being machines, the servo amplifiers need not comply with this directive.

App. 3.2 For compliance

(1) Servo amplifiers and servo motors used
Use the servo amplifiers and servo motors which standard product.
Servo amplifier : MR-J3W-☐B
Servo motor series : HF-MP☐ ・ HF-KP☐ ・ HF-SP☐ ・ HC-UP☐ ・ HC-LP☐

(2) Structure
The control circuit provide safe separation to the main circuit in the servo amplifier.



(3) Environment

(a) Operate the servo amplifier at or above pollution degree 2 set forth in IEC/EN 60664-1. For this purpose, install the servo amplifier in a control box which is protected against water, oil, carbon, dust, dirt, etc. (IP54).

(b) Environment

Environment			Conditions
(Note) Ambient Temperature	In operation	[°C]	0 to 55
		[°F]	32 to 131
	In storage, In transportation	[°C]	−20 to 65
		[°F]	−4 to 149
Ambient Humidity	In operation, In storage, In transportation		90% RH or less
Maximum Altitude	In operation, In storage		1000m or less
	In transportation		10000m or less

Note. Ambient temperature is the internal temperature of the control box.

(4) Power supply

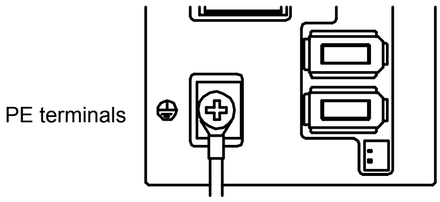
(a) This servo amplifier can be supplied from star-connected supply with earthed neutral point of overvoltage category III set forth in IEC/EN 60664-1. However, when using the neutral point of 400V system for single phase supply, a reinforced insulating transformer is required in the power input section.

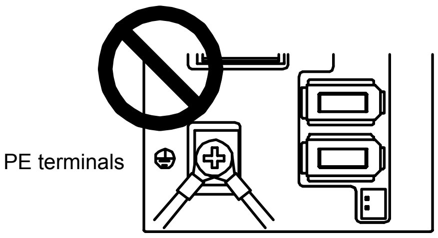
(b) When supplying interface power from external, use a 24VDC power supply which has been insulation-reinforced in I/O.

(5) Grounding

(a) To prevent an electric shock, the protective earth (PE) terminal (marked ⏚) of the servo amplifier must be connected to the protective earth (PE) of the control box.

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

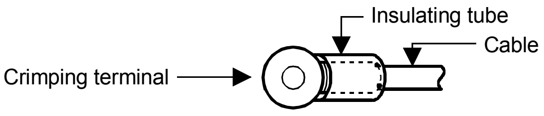




(c) If an earth leakage circuit breaker is used, always earth the protective earth (PE) terminal of the servo amplifier to prevent an electric shock.

(6) Wiring and installation

(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 IEC/EN Standard.
The IEC/EN Standard-compliant power connector sets are available from us as options.

(c) The Servo amplifier must install in the metal cabinet (control box).

(7) Peripheral devices, options

(a) Use the circuit breaker and magnetic contactor models which are EN/IEC Standard-compliant products given this Servo Amplifier Instruction Manual.
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 wires given this Servo Amplifier Instruction Manual meet the following conditions. For use in any other conditions, follow Table 5 and Annex C of IEC/EN 60204-1.

・Ambient temperature: 40℃ (104℉)
・Sheath : PVC (polyvinyl chloride)
・Installation 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).

App. 4 COMPLIANCE WITH UL/CSA STANDARD

This servo amplifier complies with UL 508C, and CSA C22.2 No.14 standard.

(1) Servo amplifiers and servo motors used

Use the servo amplifiers and servo motors which standard product.

Servo amplifier	Axis	Servo motor				
		HF-MP	HF-KP	HF-SP	HC-LP	HC-UP
MR-J3W-22B	A	053 13 23	053 13 23			
	B					
MR-J3W-44B	A	053 (Note) 13 (Note) 23 43	053 (Note) 13 (Note) 23 43			
	B					
MR-J3W-77B	A	43 (Note)	43 (Note)	51 (Note)	52 (Note)	72 (Note)
	B	73	73	52 (Note)		

Note. This servo motor can be used by setting "□□1□" to parameter No.Po04.

(2) Installation

The MR-J3W series have been approved as the products which have been installed in the electrical enclosure.

The minimum enclosure size is based on 150% of each MR-J3W combination.

And also, design the enclosure so that the ambient temperature in the enclosure is 55℃ (131℉) or less, refer to the spec manual.

The Servo amplifier must install in the metal cabinet (control box).

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

Suitable For Use In A Circuit Capable Of Delivering Not More Than 100 kA rms Symmetrical Amperes, 500 Volts Maximum.

(4) Flange

Mount the servo motor on a flange which has the following size or produces an equivalent or higher heat dissipation effect.

Flange size [mm]	Servo motor				
	HF-MP	HF-KP	HF-SP	HC-UP	HC-LP
250 × 250 × 6	053 ・ 13 ・ 23	053 ・ 13 ・ 23			
250 × 250 × 12	43	43	51 ・ 52		52
300 × 300 × 12	73	73			
550 × 550 × 30				72	

(5) Capacitor discharge time

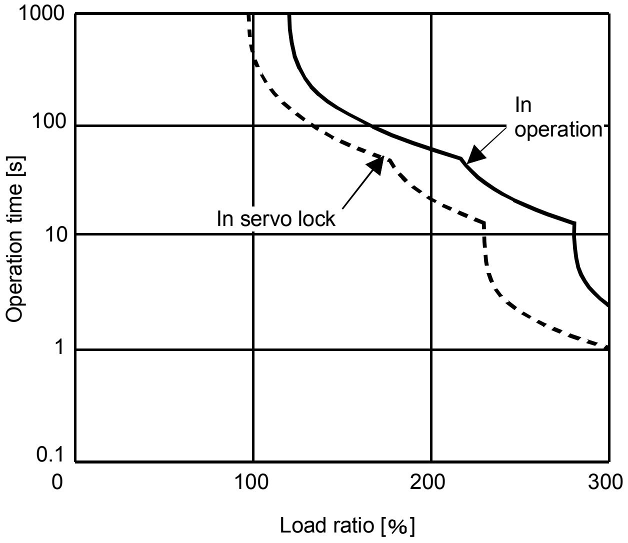
The capacitor discharge time is as follows. To ensure safety, do not touch the charging section for 15 minutes after power-off.

Servo amplifier	Discharge time (min)
MR-J3W-22B	5
MR-J3W-44B	6
MR-J3W-77B	11

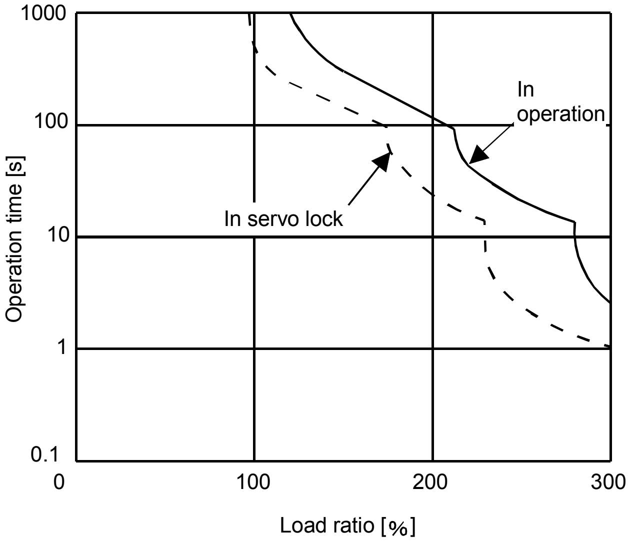
(6) Overload protection characteristics

An electronic thermal relay is built in the servo amplifier to protect the servo motor and servo amplifier from overloads. The operation characteristics of the electronic thermal relay are shown below. It is recommended to use an unbalanced torque-generated machine, such as a vertical motion shaft, so that unbalanced torque is not more than 70% of the rated torque. When closely mounting MR-J3W-44B, operate the servo amplifier at 90% or smaller effective load ratio. When closely mounting MR-J3W-22B and MR-J3W-77B, operate the servo amplifier at 100% load ratio.

Servo amplifier MR-J3W series have each solid-state servo motor overload protection. (The motor full load current is 115% rated current.)



HF-MP053 · 13
HF-KP053 · 13



HF-MP23 · 43 · 73
HF-KP23 · 43 · 73
HF-SP51 · 52
HC-UP72
HC-LP52

(7) Selection example of wires

To comply with the UL/CSA Standard, use UL-approved copper wires rated at 60/75℃ (140/167℉) for wiring.

Servo amplifier	Wires [mm²] (Note 1)						
	(Note 3) L_1 · L_2 · L_3 · ⏚	L_{11} · L_{21}	(Note 2, 3) U · V · W · ⏚	P+ · C	P+ · D	(Note 2) B1 · B2	THM1 · THM2
MR-J3W-22B	2 (AWG14)					1.25 (AWG16)	0.2 (AWG24)
MR-J3W-44B							

Note 1. Wires are selected based on the highest rated current among combining servo motors.
2. This wire size indicates the size of cable extension which is used when the wiring length exceeds 10m.
3. Use the crimping terminal specified as below for the PE terminal of the servo amplifier.

Crimping terminal : FVD2-4
Tool (body) : YNT-1614
Manufacturer : JST
Tightening torque : 1.2 N·m

(8) 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 and per the table below.

For installation in Canada, branch circuit protection must be provided, in accordance with the Canada Electrical Code and any applicable provincial codes and per the table below.

Use the no-fuse breaker or a Class T fuse indicated in the table below.

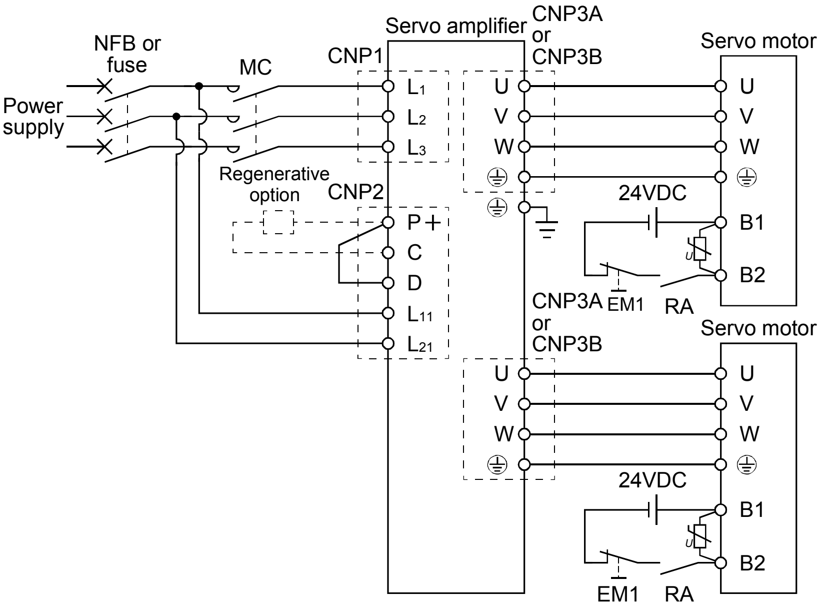
Servo motor total output	No-fuse breaker (Note)		Fuse	
	Current	Voltage AC [V]	Current [A]	Voltage AC [V]
300W or less	30A frame 5A	240	15	300
From over 300W to 600W	30A frame 10A		20	
From over 600W to 1kW	30A frame 15A		20	
From over 1kW to 1.5kW	30A frame 20A		30	

Note. Listed no-fuse breakers are for when the power factor improving reactor is not used.

(9) Options, peripheral devices

Use the UL/CSA Standard-compliant products.

(10) Connection example



(11) Approval mark of UL/CSA standards

This servo amplifier complies with UL and CSA standards and is labeled with the corresponding approval mark.

Approval mark: NRTL Listing to UL 508C
Testing by TÜV Rheinland according to UL and CSA standards

App. 5 Handling of AC servo amplifier batteries for the United Nations Recommendations on the Transport of Dangerous Goods

United Nations Recommendations on the Transport of Dangerous Goods Rev. 15 (hereinafter Recommendations of the United Nations) has been issued. To reflect this, transport regulations for lithium metal batteries are partially revised in the Technical Instruction (ICAO-TI) by the International Civil Aviation Organization (ICAO) and the International Maritime Dangerous Goods Code (IMDG Code) by the International Maritime Organization (IMO).
To comply the instruction and code, we have modified the indication on the package for general-purpose AC servo batteries.

(1) Target model
Battery (Cell): MR-J3BAT, MR-BAT, A6BAT
Battery unit (Battery): MR-J2M-BT

(2) Purpose
Safer transportation of lithium metal batteries.

(3) Change in regulations
The following points are changed for lithium metal batteries transportation by sea or air due to Recommendations of the United Nations Rev. 15 and ICAO-TI 2009-2010 edition. For lithium metal batteries, cells are classified as UN3090, and batteries contained in or packed with equipment are classified as UN3091.

(a) A package containing 24 cells or 12 batteries or less that are not contained in equipment are no longer exempt from the following: attachment of a handling label, submission of the Shipper's Declaration for Dangerous Goods, and a 1.2m drop test.

(b) A battery handling label (size: 120 × 110mm) is required. Emergency telephone number must be filled out in the additional handling information of the Shipper's Declaration for Dangerous Goods.

(c) New handling label design containing battery illustration (Figure) must be used.

Figure. Example of Mitsubishi Label with Battery Illustration (size: 120 × 110mm)

(4) Action taken by Mitsubishi
The following caution will be added to the packages of the target batteries.
"Containing lithium metal battery. Regulations apply for transportation."

(5) Transportation precaution for customers
For sea or air transportation, the handling label (Figure) is required for the package of a Mitsubishi cell or battery and the outer package containing several packages of Mitsubishi cells or batteries. Documentations like the handling label in the specified design and the Shipper's Declaration for Dangerous Goods are required. Please attach the documentations to the packages. The above change will not affect the function and performance of the product.

App. 6 Symbol for the new EU Battery Directive

Symbol for the new EU Battery Directive (2006/66/EC) that is plastered to general-purpose AC servo battery is explained here.

Note. This symbol mark is for EU countries only.

This symbol mark is according to the directive 2006/66/EC Article 20 Information for end-users and Annex II.

Your MITSUBISHI ELECTRIC product is designed and manufactured with high quality materials and components which can be recycled and/or reused.

This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from your household waste.

If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration. This will be indicated as follows.
Hg: mercury (0.0005%), Cd: cadmium (0.002%), Pb: lead (0.004%)

In the European Union there are separate collection systems for used batteries and accumulators.

Please, dispose of batteries and accumulators correctly at your local community waste collection/recycling centre.

Please, help us to conserve the environment we live in!

App. 7 Recommended cable for servo amplifier power supply

The following information is as of March 2010. For the latest information, contact the manufacturer.
Manufacturer: Mitsubishi Electric System & Service Co., Ltd.
<Sales office> FA PRODUCT DIVISION mail: oss-ip@melsc.jp

(1) Specifications

Primary side power supply cable

Product		Model	Wire size	Insulator material	Minimum bend radius	Insulation outer diameter	Applicable standard (wire part)
1)	Main circuit power supply	SC-EMP01CBL□ M-L	AWG14 × 3pcs.	PVC (red, white, blue)	30mm	Approximately 3.6mm	UL 1063/ MTW
2)	Control circuit power supply	SC-ECP01CBL□ M-L	AWG16 × 2pcs.	PVC (red, white)	30mm	Approximately 3.2mm	
3)	Regenerative option	SC-ERG01CBL□ M-L	AWG14 × 2pcs.	PVC (black)	30mm	Approximately 3.6mm	
4)	Built-in regenerative resistor short circuit connector	SC-ERG02CBL01 M-L	AWG14 × 1pcs.		—		

A symbol "□" in the model name indicates a cable length.

Motor side power supply cable

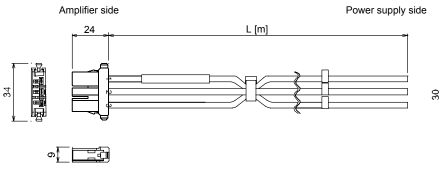
Product			Model	Wire size	Material		Minimum bend radius	Finished outer diameter	Applicable standard (wire part)
					Insulator	Outer sheath			
5)	Direct connection to rotary servo (up to 10m)	Standard	SC-EPWS1CBL□ M-■-L	AWG18 × 4C	ETFE	PVBC (black)	50mm	Approximately 6.2mm	UL 13/CL3
6)		Long flex life	SC-EPWS1CBL□ M-■-H	AWG16 × 4C			40mm	Approximately 5.7mm	UL AWM 2103
7)	Linear servo (up to 10m)	Standard	SC-EPWS2CBL□ M-L	AWG18 × 4C			50mm	Approximately 6.2mm	UL 13/CL3
8)	Linear servo (more than 10m)/junction connection to rotary servo (more than 10m)			AWG16 × 4C	PVC		90mm	Approximately 11.1mm	UL AWM 2501
9)	Linear servo (up to 10m)	Long flex life	SC-EPWS2CBL□ M-H	AWG19 × 4C	ETFE		40mm	Approximately 5.7mm	UL AWM 2103
10)	Linear servo (more than 10m)/junction connection to rotary servo (more than 10m)			AWG14 × 4C			75mm	Approximately 10.5mm	UL AWM 2501

A symbol "□" in the model name indicates a cable length.
A symbol "■" in the model name is "A1" or "A2". A1: Load side lead, A2: Opposite-to- load side lead.
The characters "-H" or "-L" at the end of a model name indicate a flex life. A model name with the characters "-H" has a long flex life. A model name with the characters “-L” has a standard flex life.

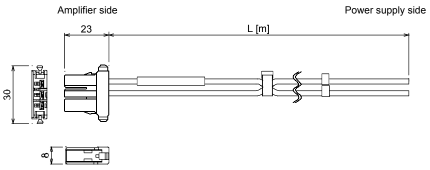
(2) Outline drawing

[Unit: mm]

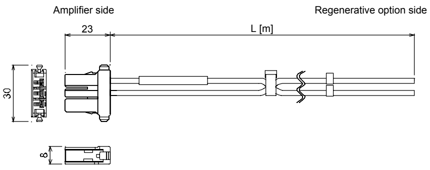
1) [SC-EMP01CBL□M-L]



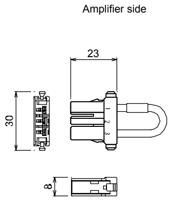
2) [SC-ECP01CBL□M-L]



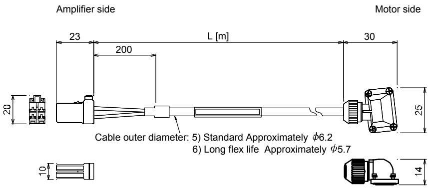
3) [SC-ERG01CBL□M-L]



4) [SC-ERG02CBL01M-L]

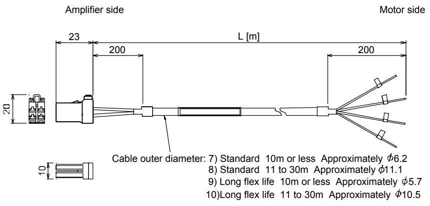


5)/6) [SC-EPWS1CBL□M-■-L/
SC-EPWS1CBL□M-■-H]



Cable outer diameter: 5) Standard Approximately ϕ6.2
6) Long flex life Approximately ϕ5.7

7) 8)/9) 10) [SC-EPWS2CBL□M-L/
SC-EPWS2CBL□M-H]



Cable outer diameter: 7) Standard 10m or less Approximately ϕ6.2
8) Standard 11 to 30m Approximately ϕ11.1
9) Long flex life 10m or less Approximately ϕ5.7
10)Long flex life 11 to 30m Approximately ϕ10.5

A symbol "□" in the model name indicates a cable length.

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Data	*Manual Number	Revision
Mar. 2010	SH(NA)030073-A	First edition

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Italy	Mitsubishi Electric Europe B.V. Italian Branch Viale Colleoni 7 1-20041 Agrate Brianza (Milano), Italy	Tel : ＋39-39-60531 Fax : ＋39-39-6053312
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Singapore	Mitsubishi Electric Asia Pte, Ltd. 307 Alexandra Road #05-01/02, Mitsubishi Electric Building Singapore 159943	Tel : ＋65-6470-2460 Fax : ＋65-6476-7439

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.

MODEL	
MODEL CODE	

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BLDG MARUNOUCHI TOKYO 100-8310

This Instruction Manual uses recycled paper.
Specifications subject to change without notice.

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