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MITSUBISHI ELECTRIC

General-Purpose AC Servo

MELSERVO-J3W Series

SSCNET Ⅲ interface 2-axis AC Servo Amplifier

MODEL

MR-J3W-0303BN6
MR-J3W-□B

SERVO AMPLIFIER
INSTRUCTION MANUAL

D

● 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 Instruction Manual, 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.
- 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.
- When using an earth-leakage current breaker (RCD), select the type B.
- To avoid an electric shock, insulate the connections of the power supply terminals.

2. To prevent fire, note the following

⚠ CAUTION

- Install the servo amplifier, servo motor and regenerative resistor on incombustible material. Installing them directly or close to combustibles will lead to a fire.
- Always connect a magnetic contactor between the power supply and the main circuit power supply (L1, L2, and L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.
- Always connect a circuit protector between the power supply and power supply voltage input terminals (24, 0, and M) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a circuit protector 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 molded-case circuit breaker to the power supply of the servo amplifier.

3. To prevent injury, note the following

⚠ CAUTION
・Only the voltage specified in the Instruction Manual should be applied to each terminal, Otherwise, a burst, damage, etc. may occur. ・Connect 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 geared servo motor 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 treating the servo amplifier be careful about the edged parts such as the corners of the servo amplifier. ・The servo amplifier must be installed in the metal cabinet.

⚠ CAUTION

・When you keep or use it, please fulfill the following environmental conditions.

Item			Environment		
			Servo amplifier	Servo motor	
Ambient temperature	Operation	[℃]	0 to 55 (non-freezing)	0 to 40 (non-freezing)	
		[°F]	32 to 131 (non-freezing)	32 to 104 (non-freezing)	
	Storage	[℃]	−20 to 65 (non-freezing)	−15 to 70 (non-freezing)	
		[°F]	−4 to 149 (non-freezing)	5 to 158 (non-freezing)	
Ambient humidity	Operation		90%RH or less (non-condensing)	80%RH or less (non-condensing)	
	Storage		90%RH or less (non-condensing)		
Ambience			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt		
Altitude			Max. 1000m above sea level		
(Note) Vibration resistance			5.9 m/s^2 at 10 to 55Hz (directions of X, Y and Z axes)	HF-MP series HF-KP series	X, Y: 49 m/s^2
				HF-SP51・52 HC-UP72 HF-JP53・73・103	X, Y: 24.5 m/s^2
				HC-LP52	X: 9.8 m/s^2 Y: 24.5 m/s^2
				HG-AK series	X, Y: 49 m/s^2

Note. Except the servo motor with a reduction gear.

・When you disinfect or protect wooden packing from insects, take measures except by fumigation. Fumigating the servo amplifier or packing the servo amplifier with fumigated wooden packing can cause a malfunction of the servo amplifier due to halogen materials (such as fluorine, chlorine, bromine, and iodine) which are contained in fumigant.

・The servo amplifier must not be used with parts which contain halogen-series flame retardant materials (such as bromine) under coexisting conditions.

(2) Wiring

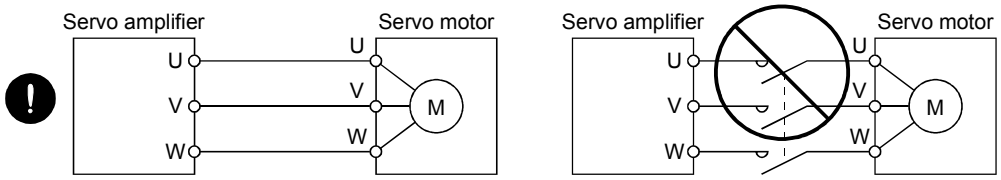
⚠ CAUTION

・Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly.

・Do not install a power capacitor, surge killer or radio noise filter (FR-BIF option) between the servo motor and servo amplifier.

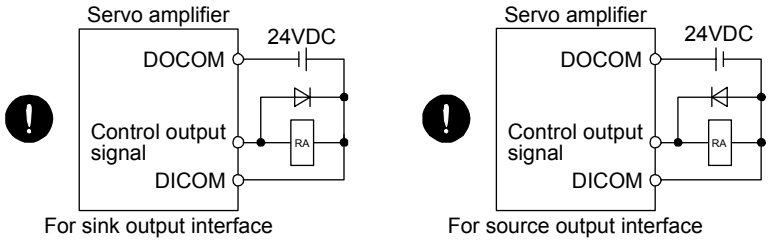
・Connect the wires to the correct phase terminals (U, V, W) of the servo amplifier and servo motor. Not doing so may cause unexpected operation.

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



⚠ CAUTION

- 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.



- 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.
- Connecting an encoder for different axis to the CN2A or CN2B connector may cause a malfunction.
- Connecting a servo motor for different axis to the CNP3A or CNP3B connector may cause a malfunction.

(3) Test run adjustment

⚠ CAUTION

- Before operation, check the parameter settings. Improper settings may cause some machines to perform unexpected operation.
- Never adjust or change the parameter values extremely as it will make operation instable.

(4) Usage

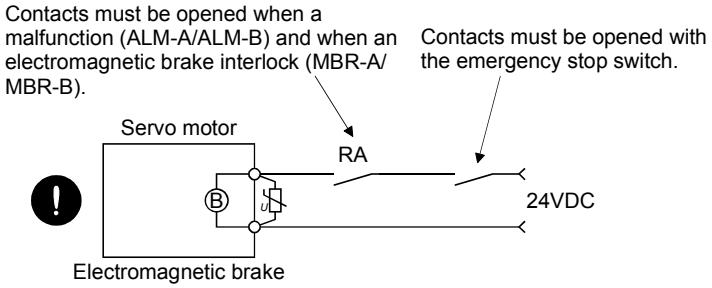
⚠ CAUTION

- 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.
- Provide an adequate protection to prevent unexpected restart after an instantaneous power failure.

(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 CE MARKING

Refer to Appendix 3 for the compliance with CE marking.

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.
Refer to chapter 15 for using MR-J3W-0303BN6.

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)(Note 1)	SH(NA)030041
EMC Installation Guidelines	IB(NA)67310
SSCNET III Interface Linear Servo MR-J3-□B-RJ004 INSTRUCTION MANUAL (Note 2)	SH(NA)030054
SSCNET III Interface Direct drive servo MR-J3-□B-RJ004 INSTRUCTION MANUAL (Note 3)	In production

Note 1. Required to use the rotary servo motor.
2. Required to use the linear servo motor.
3. Required to use the direct drive motor.

<<Wiring>>

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

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MEMO

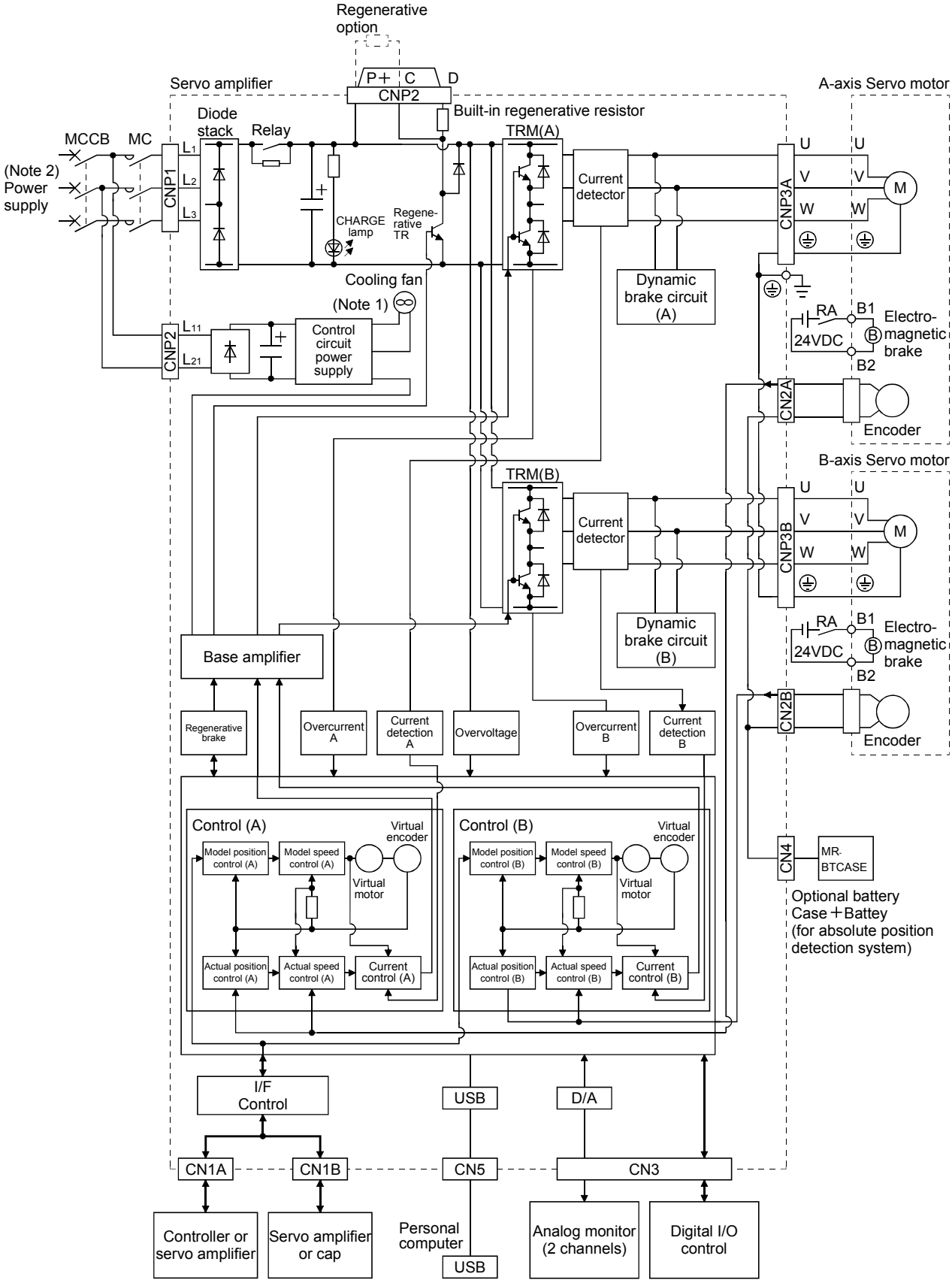
1. FUNCTIONS AND CONFIGURATION

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, a linear servo motor or a direct drive motor can be used for each axis for the MR-J3W servo amplifier. A rotary servo motor, a linear servo motor and a direct drive 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 and the direct drive 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

Item \ Servo amplifier MR-J3W-□			22B		44B		77B		1010B	
Rated output capacity			A-axis 200W	B-axis 200W	A-axis 400W	B-axis 400W	A-axis 750W	B-axis 750W	A-axis 1kW	B-axis 1kW
Output	Rated voltage		3-phase 170VAC							
	Rated current	[A]	1.5	1.5	2.8	2.8	5.8	5.8	6.0	6.0
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		13.9	
	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	1010B
Capacitor regenerative	Reusable regenerative energy (Note 3) [J]			17	22	46	
	Rotary servo motor's inertia moment equivalent to permissible charging amount (Note 4) [$\times 10^{-4}$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, magnetic pole detection protection, Linear servo control error detection protection			
Structure				Natural-cooling, open (IP rating: IP00)	Force-cooling, open (IP rating: IP00)		
Side-by-side installation				○	○(Note 2)	○	
Environmental conditions	Ambient temperature	Operation	[°C]	0 to 55 (non-freezing)			
			[°F]	32 to 131 (non-freezing)			
		Storage	[°C]	−20 to 65 (non-freezing)			
			[°F]	−4 to 149 (non-freezing)			
	Ambient humidity	Operation		90%RH or less (non-condensing)			
		Storage					
	Ambient			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt			
	Altitude			Max. 1000m above sea level			
	Vibration resistance			5.9 m/s^2 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. The regenerative energy is generated under the following conditions.
   Rotary servo motor: The energy is generated when a machine with the inertia moment equivalent to permissible charging amount decelerates from the rated speed to stop.
   Linear servo motor: The energy is generated when a machine with the mass equivalent to permissible charging amount decelerates from the maximum speed to stop.
   Direct drive motor: The energy is generated when a machine with the inertia moment equivalent to permissible charging amount decelerates from the rated speed to 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. This note also applies to the direct drive motor.

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.

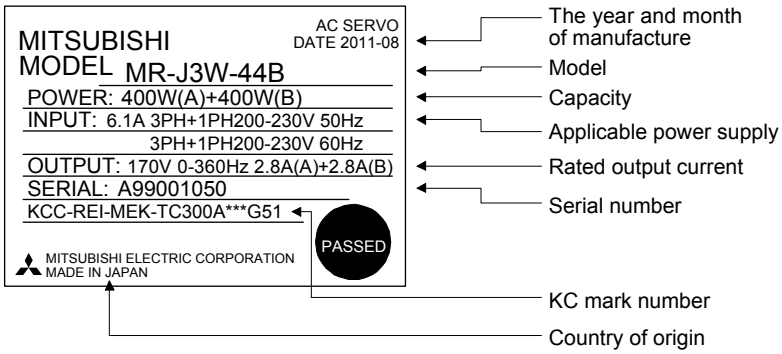
1.4 Function list

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

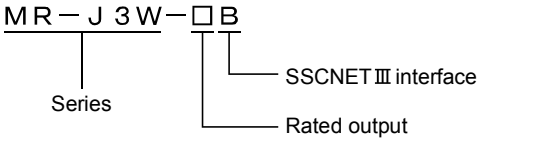
Function	Description	Reference
High-resolution encoder	High-resolution encoder of 262144 pulses/rev is used as a rotary servo motor encoder.	
Absolute position detection system	Merely setting a home position once makes home position return unnecessary at every power-on.	Chapter 12
Gain changing function	Switches gains by using input devices or gain switching conditions (including the servo motor speed).	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 an 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 with MR Configurator 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

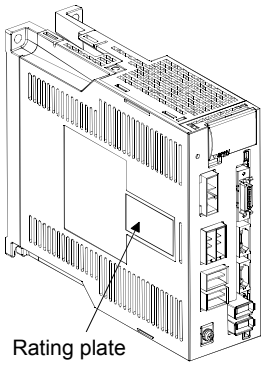
(1) Rating plate



(2) Model



Symbol	Rated outpur[W]	
	A-axis	B-axis
22	200	200
44	400	400
77	750	750
1010	1k	1k



1.6 Combination with servo motor

POINT

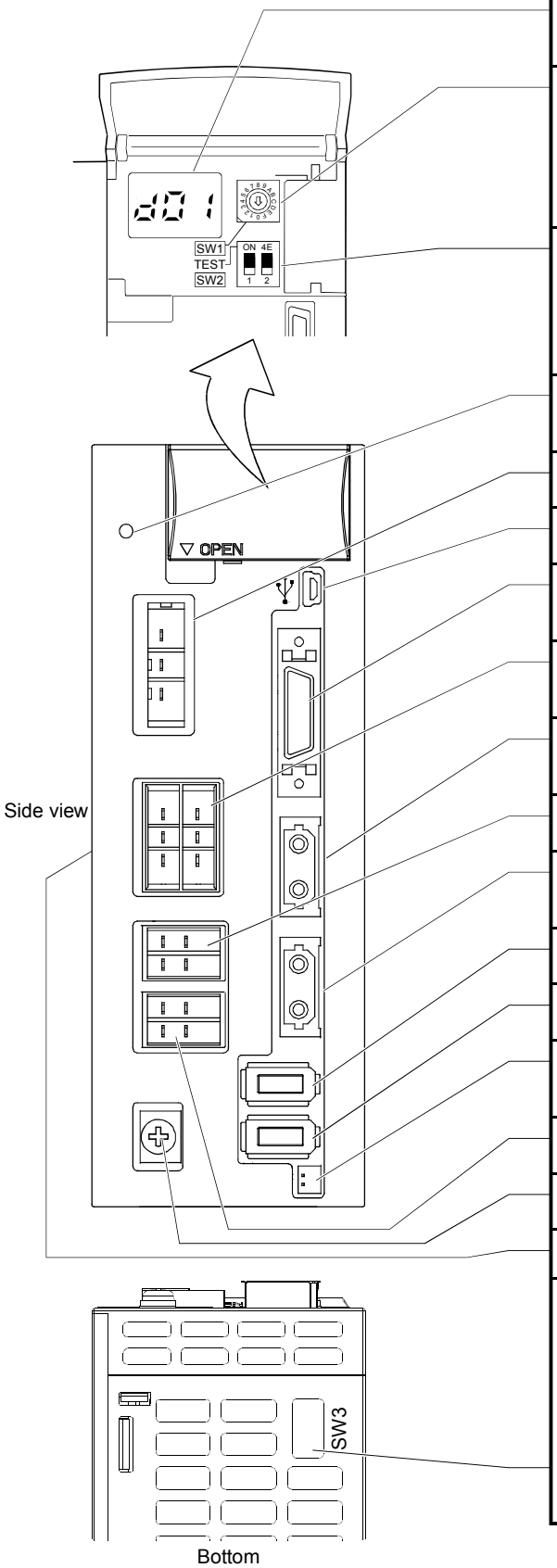
- Refer to section 13.1.2 for the combinations with linear servo motors.
- Refer to section 14.1.2 for the combinations with direct drive motors.

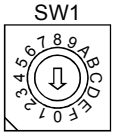
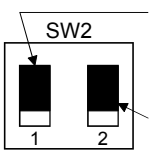
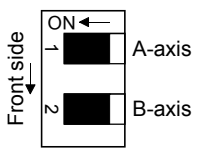
The following table lists combinations of servo amplifiers and servo motors. The same combinations apply to the models with an electromagnetic brake and the models with a reduction gear.
With the servo amplifier whose software version is B3 or later, the following servo motors can be used without parameter change.

Servo motor	Servo amplifier							
	MR-J3W-22B		MR-J3W-44B		MR-J3W-77B		MR-J3W-1010B	
	A-axis	B-axis	A-axis	B-axis	A-axis	B-axis	A-axis	B-axis
HF-MP053	○		○ (Note 1)					
HF-MP13	○		○ (Note 1)					
HF-MP23	○		○					
HF-MP43			○		○ (Note 1)		○ (Note 1)	
HF-MP73					○		○	
HF-KP053	○		○ (Note 1)					
HF-KP13	○		○ (Note 1)					
HF-KP23	○		○					
HF-KP43			○		○ (Note 1)		○ (Note 1)	
HF-KP73							○	
HF-SP51					○ (Note 1)		○	
HF-SP81							○	
HF-SP52					○ (Note 1)		○	
HF-SP102							○	
HC-LP52					○ (Note 1)		○	
HC-LP102							○	
HC-UP72					○ (Note 1)		○	
HF-JP53					○ (Note 2)		○ (Note 2, 3)	
HF-JP73					○ (Note 2)		○ (Note 2)	
HF-JP103							○ (Note 2)	

Note 1. With the servo amplifier whose software version is B2 or earlier, this servo motor can be used by setting parameter No.Po04 to "□□1□". With the servo amplifier whose software version is B3 or later, no parameter setting is required.
2. This servo motor can be used with the servo amplifier whose software version is B3 or later.
3. With this combination, the maximum torque of the HF-JP53 servo motor increases to 400% of the rated torque.

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) 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 3.9
A-axis servo motor power output 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 3.9
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 output 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 and direct drive motor	Section 3.14

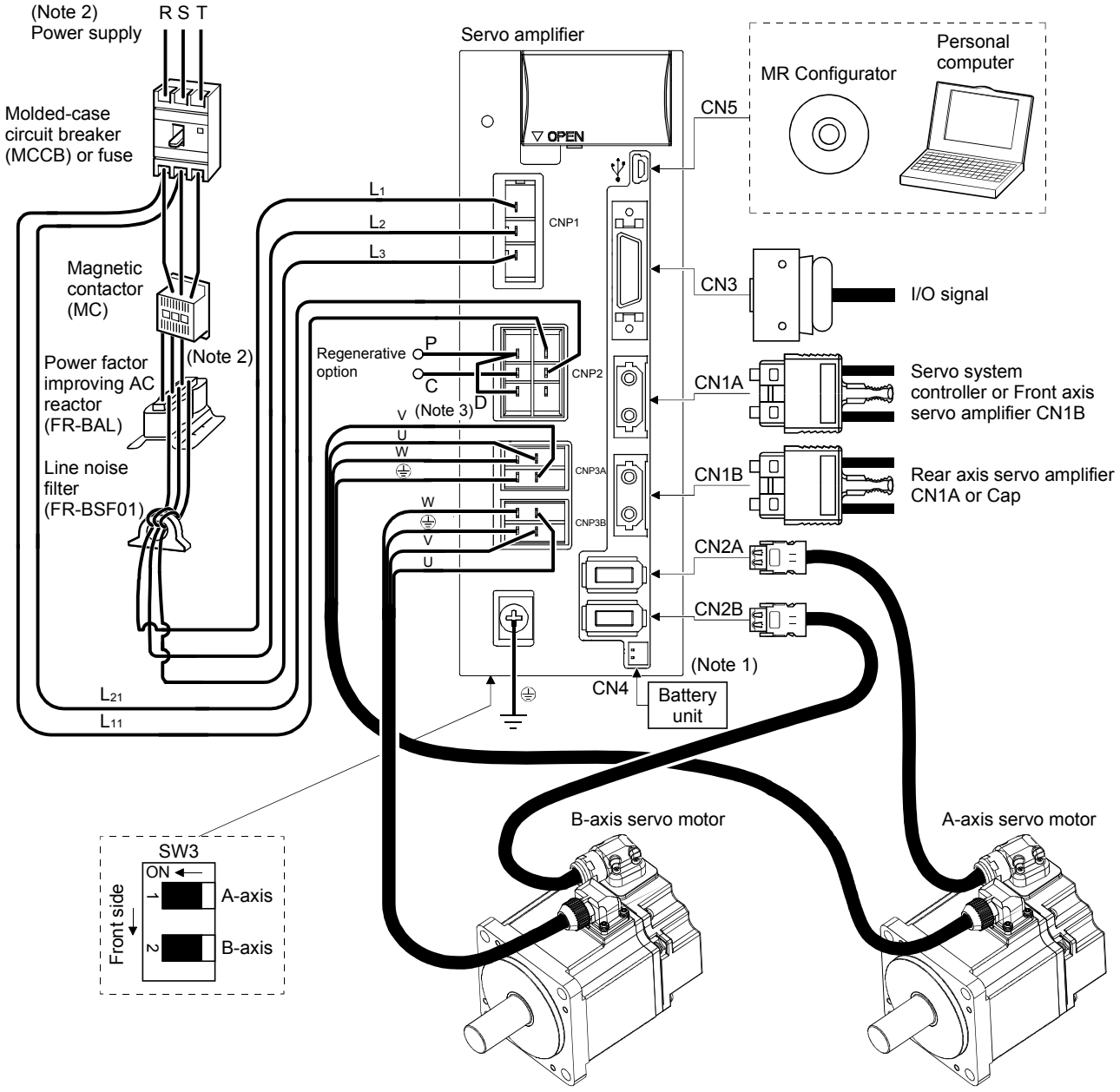
1.8 Configuration including auxiliary equipment

CAUTION

- Connecting a servo motor for different axis to the CNP3A or CNP3B connector may cause a malfunction.

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.

3. Make sure to connect the P+ terminal to the D terminal. When using the regenerative option, refer to section 11.2.

MEMO

2. INSTALLATION

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

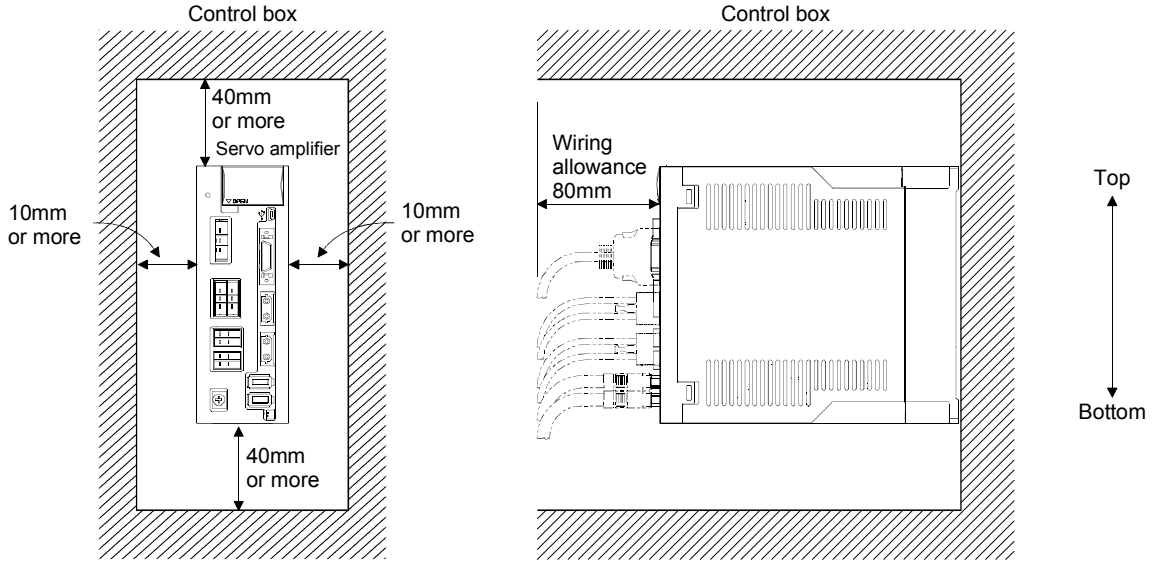
⚠ CAUTION	・Stacking in excess of the limited number of products is not allowed. ・Install the equipment on incombustible material. Installing it directly or close to combustibles will lead to a fire. ・Install the equipment in a load-bearing place in accordance with this Instruction Manual. ・Do not get 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 be installed in the metal cabinet. ・When you disinfect or protect wooden packing from insects, take measures except by fumigation. Fumigating the servo amplifier or packing the servo amplifier with fumigated wooden packing can cause a malfunction of the servo amplifier due to halogen materials (such as fluorine, chlorine, bromine, and iodine) which are contained in fumigant. ・The servo amplifier must not be used with parts which contain halogen-series flame retardant materials (such as bromine) under coexisting conditions.

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. Doing so may cause faults.

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.

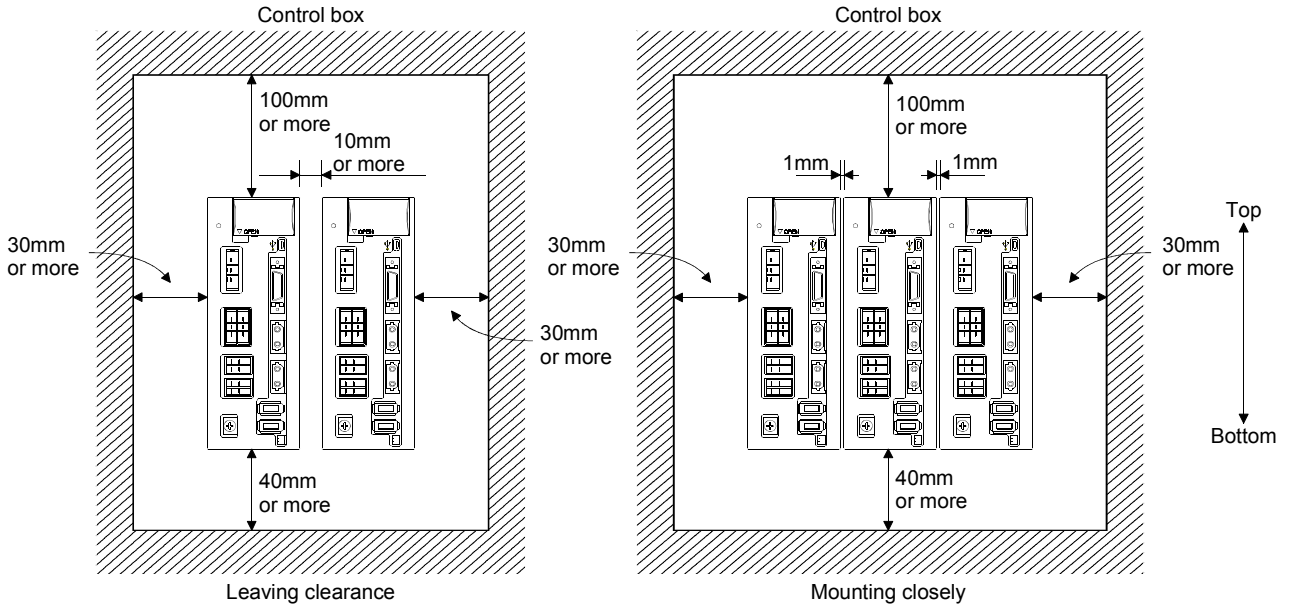
(1) Installation of one servo amplifier



(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.



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 bending stress and cable's own weight stress are not applied to the cable connection.

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

(3) Avoid any probability that the cable 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 bending radius should be made as large as possible. Refer to section 10.4 for the bending life.

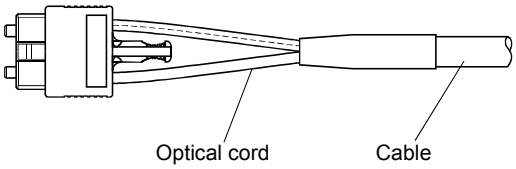
2.4 SSCNETⅢ cable laying

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.

○: Normally, cable is not affected by plasticizer.

(3) Precautions for migrating plasticizer added materials

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

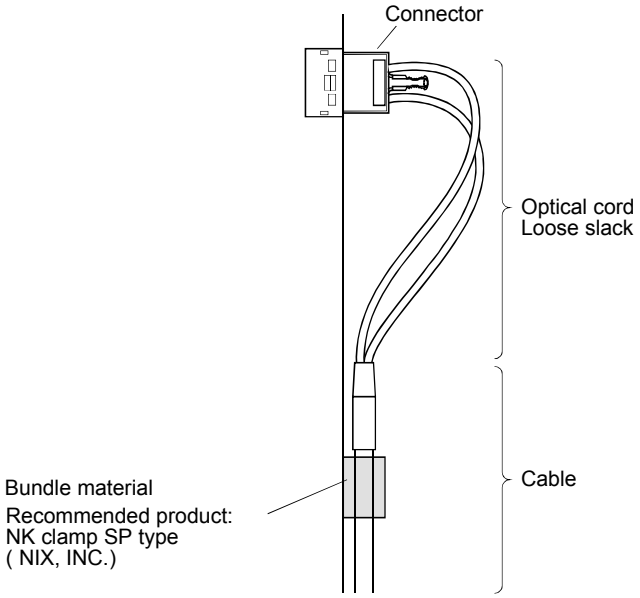
However, some wire sheaths and cable ties, which contain migrating plasticizer (phthalate ester), may affect MR-J3BUS□M and MR-J3BUS□M-A cables (made of plastic).

In addition, MR-J3BUS□M-B cable (made of quartz glass) 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. ・To avoid an electric shock, only qualified personnel should attempt inspections. Otherwise, you may get an electric shock. For repair and parts replacement, contact your safes representative.

⚠ CAUTION	・Do not perform insulation resistance test on the servo amplifier as damage may result. ・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 if the cables and the wires have no damage or crack. 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

Service lives of the following parts are listed below. However, the service lives vary depending on operating methods and environmental conditions. If any fault is found in the parts, they must be replaced immediately regardless of their service lives. For parts replacement, please contact your sales representative.

Part name	Life guideline
Smoothing capacitor	10 years
Relay	Number of power-on, forced stop, and controller forced stop times: 100000 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 lives when the power is turned on and forced stop/controller forced stop occurs 100,000 times in total.

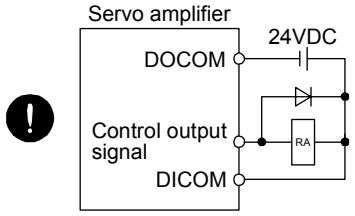
(3) Servo amplifier cooling fan
The cooling fan bearings reach the end of their life in 50,000 to 70,000 hours. Normally, therefore, the fan must be changed in seven or eight years of continuous operation as a guideline.
It must also be changed if unusual noise or vibration is found during inspection.
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

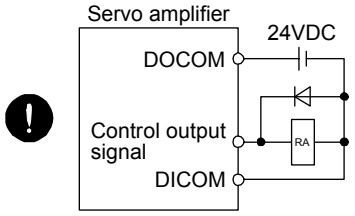
WARNING

- 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.
- To avoid an electric shock, insulate the connections of the power supply terminals.

- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly, resulting in injury.
- Connect cables to 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.



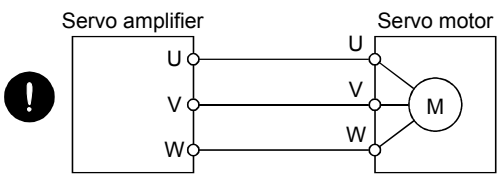
For sink output interface

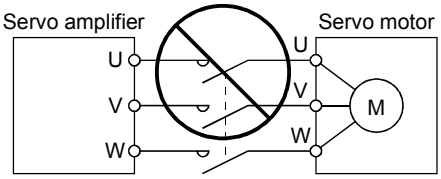


For source output interface

CAUTION

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





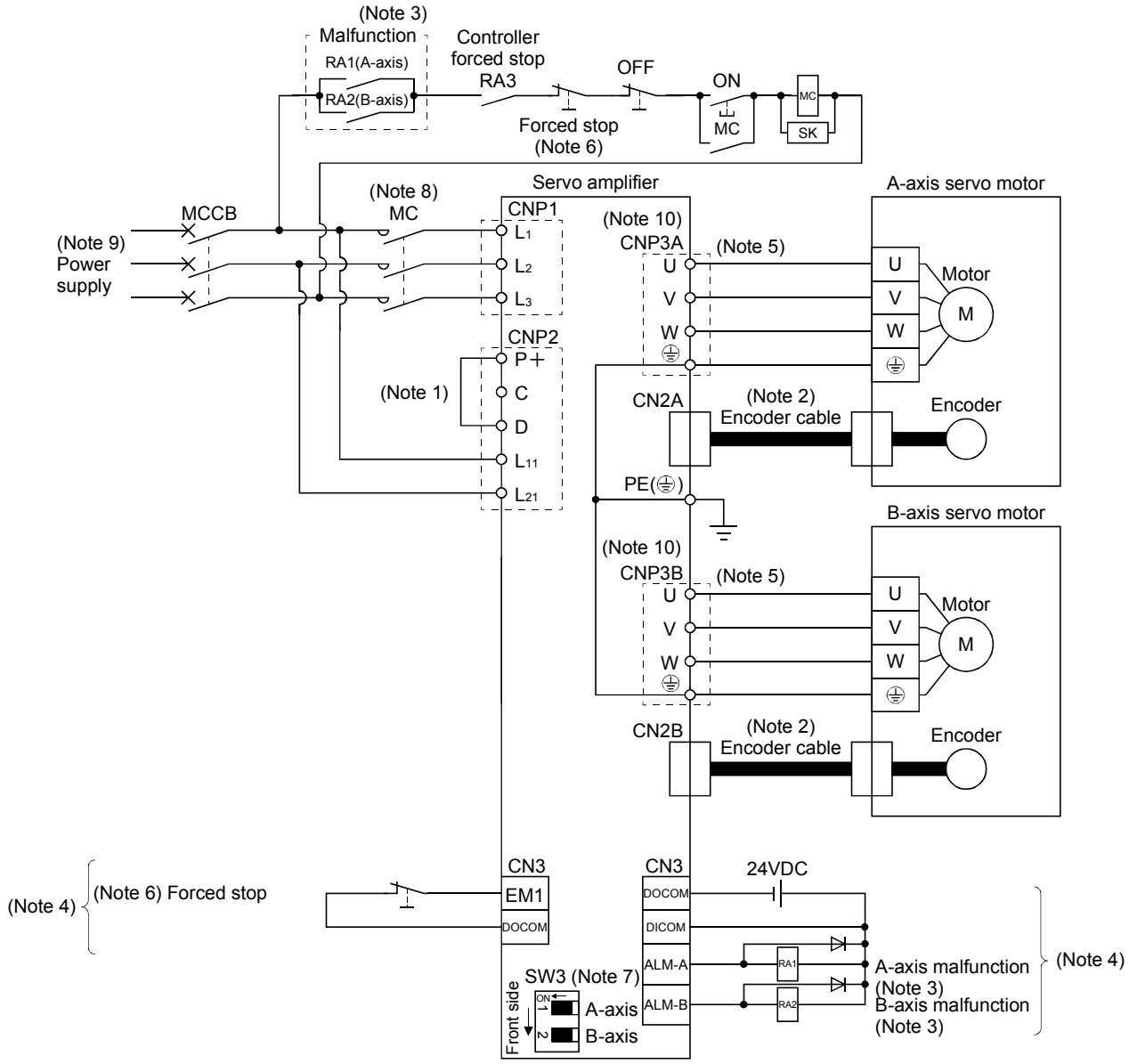
3.1 Input power supply circuit

⚠ CAUTION	・Always connect a magnetic contactor between the power supply and the main circuit power supply (L1, L2, and L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions. ・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. ・Check the servo amplifier model, and then input proper voltage to the servo amplifier power supply. If input voltage exceeds the upper limit, the servo amplifier will break down.

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.

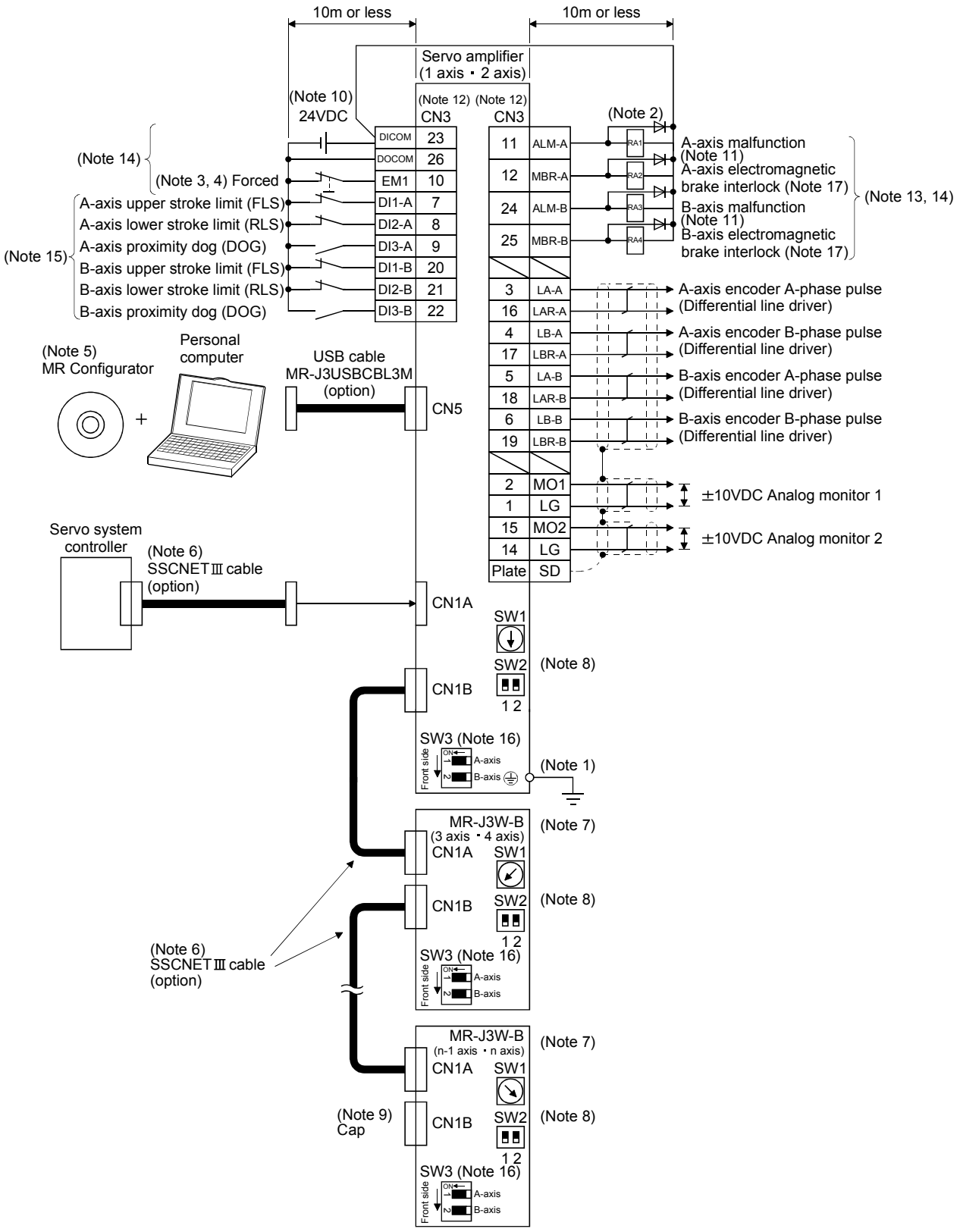
Wire the power supply/main circuit as shown below so that power is shut off and the servo-on command turned off as soon as an alarm occurs, a servo forced stop is made valid, or a controller forced stop is made valid. A molded-case circuit breaker (MCCB) must be used with the input cables of the main 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 malfunction (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. For the power line connection, 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 L_1 ・ L_2 and leave L_3 open. Refer to section 1.3 for the power supply specification.
10. Connecting a servo motor for different axis to the CNP3A or CNP3B connector may cause a malfunction.

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	0.15 to 3m
Standard cable outside panel	MR-J3BUS□M-A	5 to 20m
Long-distance cable	MR-J3BUS□M-B	30 to 50m

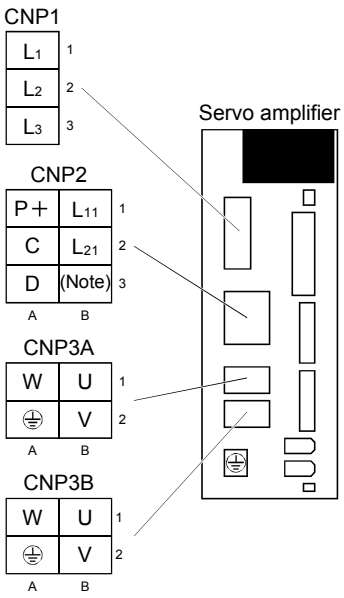
7. The wiring of the third and subsequent axes is omitted.
8. Up to sixteen axes may be connected. Refer to section 3.13 for setting of axis selection.
9. Make sure to put a cap on the unused CN1A・CN1B.
10. Supply 24VDC±10% 250mA current for interfaces from the outside. 250mA is the value applicable 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. Malfunction (ALM-A/ALM-B) turns on in normal alarm-free condition. (Normally closed contact)
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□, QD75MH and LD77MH□.
16. Select the servo motor to be used as below. (Refer to section 3.14.)
    OFF: Rotary servo motor, ON: Linear servo motor
17. When you use a linear servo motor or direct drive motor, use MBR (Electromagnetic brake interlock) for an external brake mechanism.

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
MR-J3W-1010B</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-1010B</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). Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.</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

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

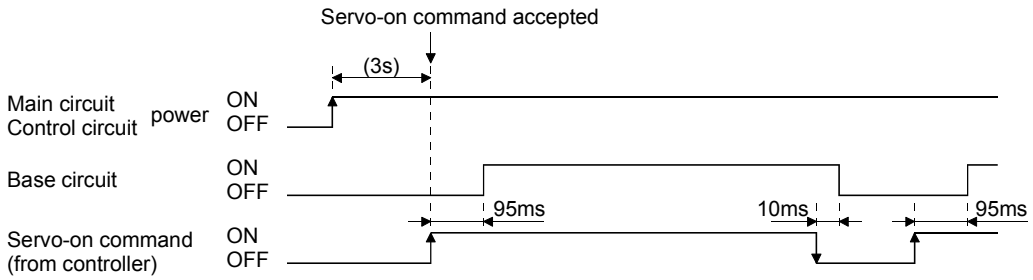
(1) Power-on procedure

1) Always wire the power supply as shown in above section 3.1 using the magnetic contactor with the 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.)

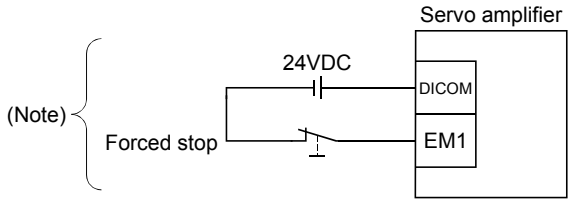
(2) Timing chart



(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.

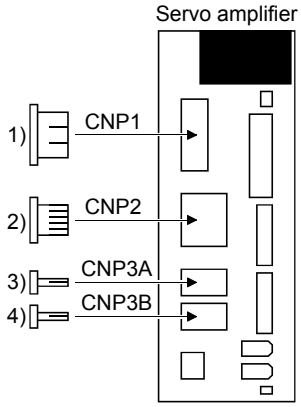
3.3.3 CNP1, CNP2, CNP3A, CNP3B wiring method

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. Refer to section 11.1, and purchase the connector set.

This section shows the recommended products.

(1) Crimping type



No.	Connector for	Receptacle housing	Receptacle contact		Crimping tool	Manufacturer
			Model	Description		
1)	CNP1	J43FSS-03V-KX	BJ4F-71GF-M3.0	Cable size: 1.25 to 2.0mm^2 (AWG16 to AWG14) Insulator OD: ϕ2.0 to 3.8mm	YRF-1130	Japan Solderless Terminals
2)	CNP2	F32FMS-06V-KXY	BF3F-71GF-P2.0	Cable size: 1.25 to 2.0mm^2 (AWG16 to AWG14) Insulator OD: ϕ2.4 to 3.4mm	YRF-1070	Japan Solderless Terminals
			LF3F-41GF-P2.0	Cable size: 0.75 to 1.25mm^2 (AWG19 to AWG16) Insulator OD: ϕ1.8 to 2.8mm	YRF-880	
		3-178129-6	917511-2	Cable size: 1.25 to 2.0mm^2 (AWG16 to AWG14) Insulator OD: ϕ2.2 to 2.8mm	91560-1	TE Connectivity
			353717-2	Cable size: 1.25 to 2.0mm^2 (AWG16 to AWG14) Insulator OD: ϕ3.3 to 3.8mm	91561-1	
3) 4)	CNP3A/ CNP3B	F35FDC-04V-K	BF3F-71GF-P2.0	Cable size: 1.25 to 2.0mm^2 (AWG16 to AWG14) Insulator OD: ϕ2.4 to 3.4mm	YRF-1070	Japan Solderless Terminals
			LF3F-41GF-P2.0	Outer diameter of finished cable: ϕ2.4 to 3.3mm Insulator OD: ϕ1.8 to 2.8mm Option cable: MR-PWS□CBL	YRF-880	
		175363-1	917511-2	Cable size: 1.25 to 2.0mm^2 (AWG16 to AWG14) Insulator OD: ϕ2.2 to 2.8mm	91560-1	TE Connectivity
			353717-2	Cable size: 1.25 to 2.0mm^2 (AWG16 to AWG14) Insulator OD: ϕ3.3 to 3.8mm	91561-1	
			175218-2	Option cable: MR-PWS□CBL	PEW12 + 1762957-1 (Dice)	

(2) Terminal block type (Spring type)

(a) Connector

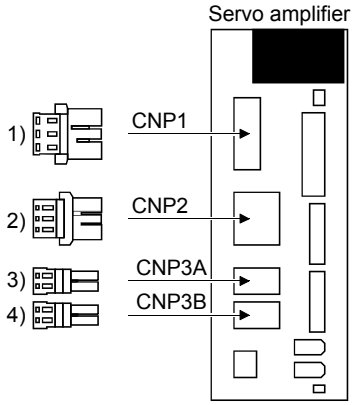


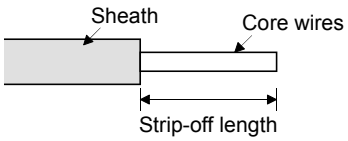
Table 3.1 Connectors and applicable wires

No.	Connector for	Receptacle assembly	Applicable wire size	Strip-off length [mm]	Open tool	Manufacturer
1)	CNP1	03JFAT-SAXGFK-43	AWG16 to AWG14	11.5	J-FAT-OT-EXL(Large size)	Japan Solderless Terminals
2)	CNP2	06JFAT-SAXYGG-F-KK	AWG16 to AWG14	9	J-FAT-OT-EXL(Small size)	
3) 4)	CNP3A/ CNP3B	04JFAT-SAGG-G-KK	AWG19 to AWG14	9	J-FAT-OT-EXL(Small size)	

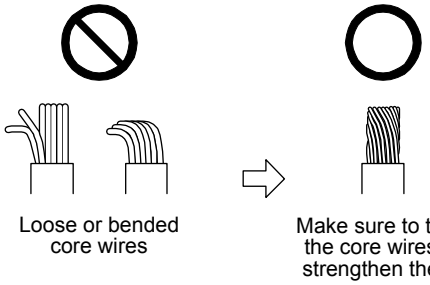
(b) Connection method

1) Stripping off the wire sheath

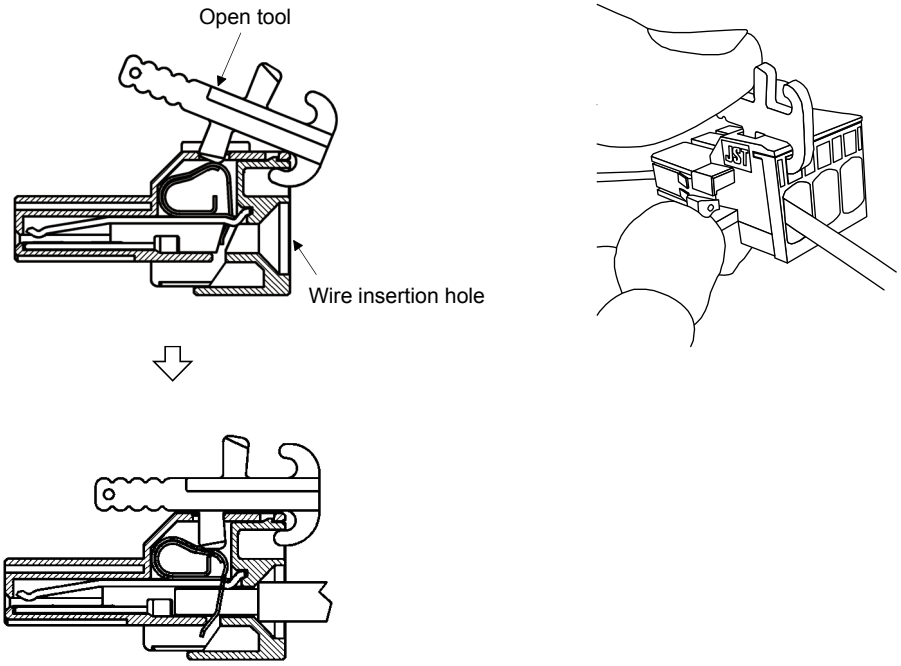
For the strip-off length of the wire sheath, refer to table 3.1.



Twist the core wires lightly to straighten them as shown in the following figure.



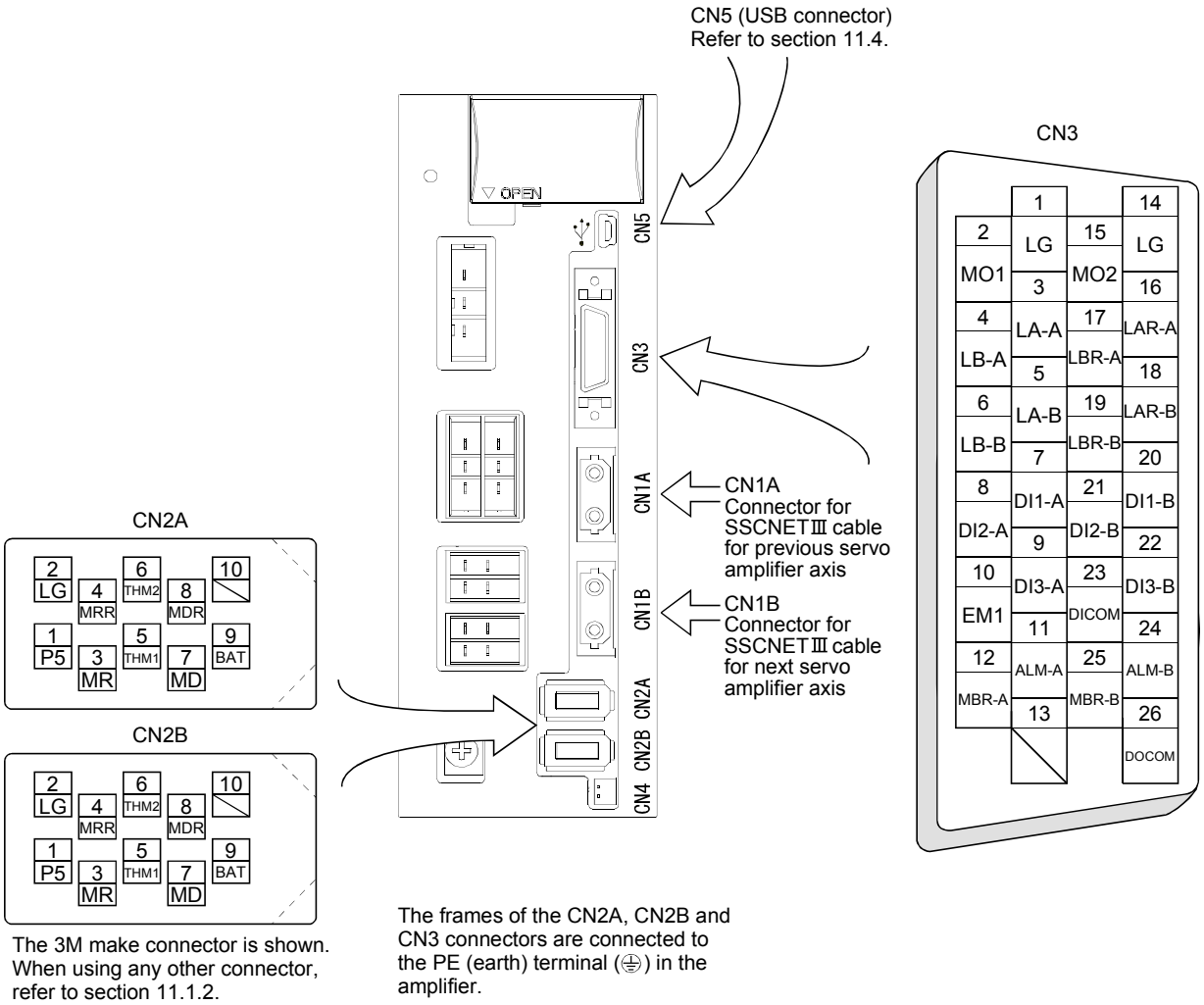
2) Inserting the wire
Insert the open tool as shown in the following figure, and push down the open tool to open the spring hole. The open tool has protrusions for the CNP1 (large size) on one side and those for the others (small size) on another side. While the open tool is pushed down, insert the stripped wire into the wire insertion hole. Check the insertion depth so that the wire sheath does not get caught by the spring. The following shows a connection example of the CNP1 connector.



3) Securing the wire
Release the open tool, and secure the wire. Pull the wire lightly, and check that the wire is connected firmly.

3.4 Connectors and signal arrangements

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



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 an MR-BTCASE battery case.

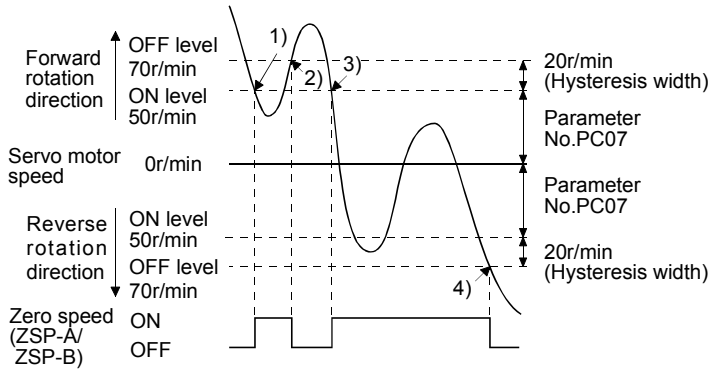
(2) I/O device

(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□・LD77MH□. 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 malfunction	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.	DO-1
B-axis malfunction	ALM-B	CN3-24	Without alarm occurring, ALM-A/ALM-B turns on within about 1.5s after power-on.	
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 and the torque 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 the position loop mode and the torque loop mode.	DO-1
B-axis speed reached	SA-B			
A-axis limiting speed	VLC-A		When using this signal, make it usable by the setting of parameter No.PD07 or PD09. VLC-A/VLC-B turns on when the servo motor speed reaches the speed set with the controller in the torque loop mode. VLC-A/VLC-B turns off when the servo turns off. This signal cannot be used in position loop mode and the torque loop mode.	DO-1
B-axis limiting speed	VLC-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. This signal cannot be used in the torque loop mode.	DO-1
B-axis limiting torque	TLC-B			

Device	Symbol	Connector pin No.	Function/Application	I/O division
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			
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 the speed loop mode and the torque 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 type. 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 sink interface, connect ⊕ of 24VDC external power supply. For 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 sink interface, connect ⊖ of 24VDC external power supply. For 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.

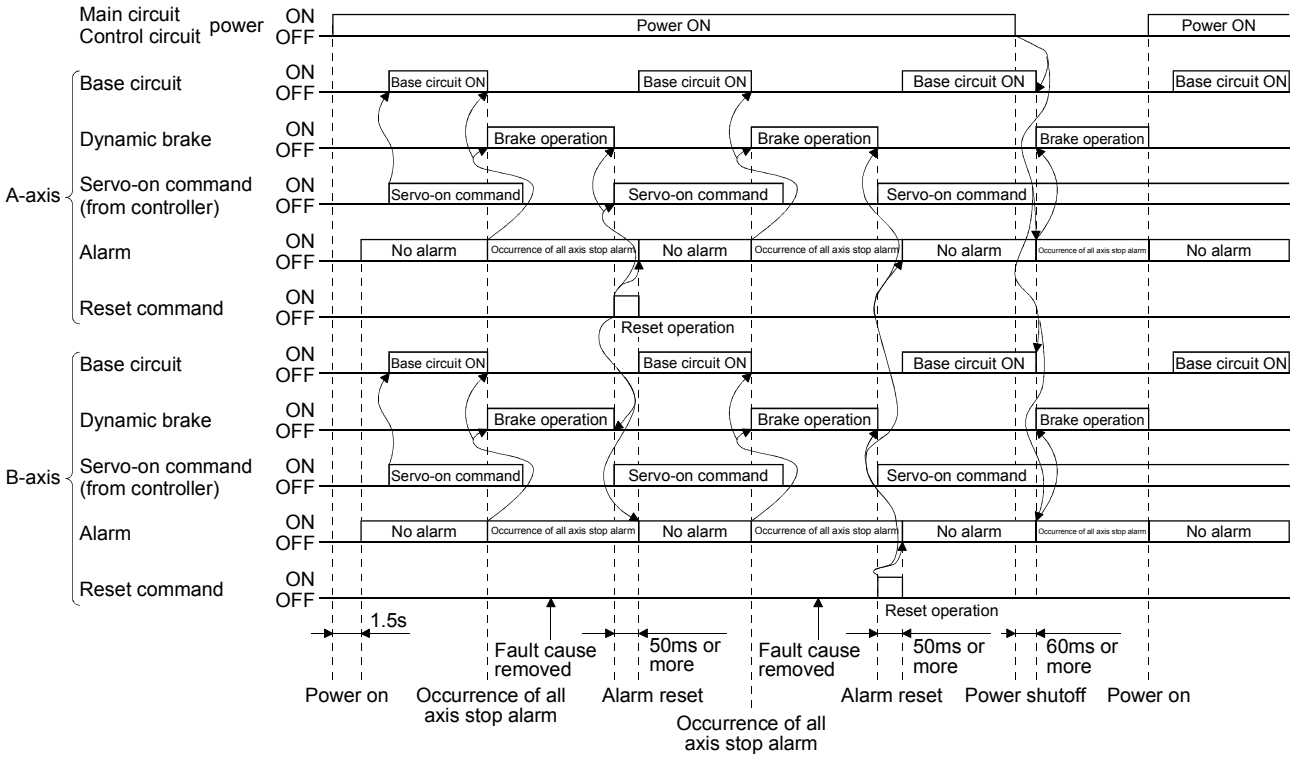
3.6 Alarm occurrence timing chart

⚠ 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.

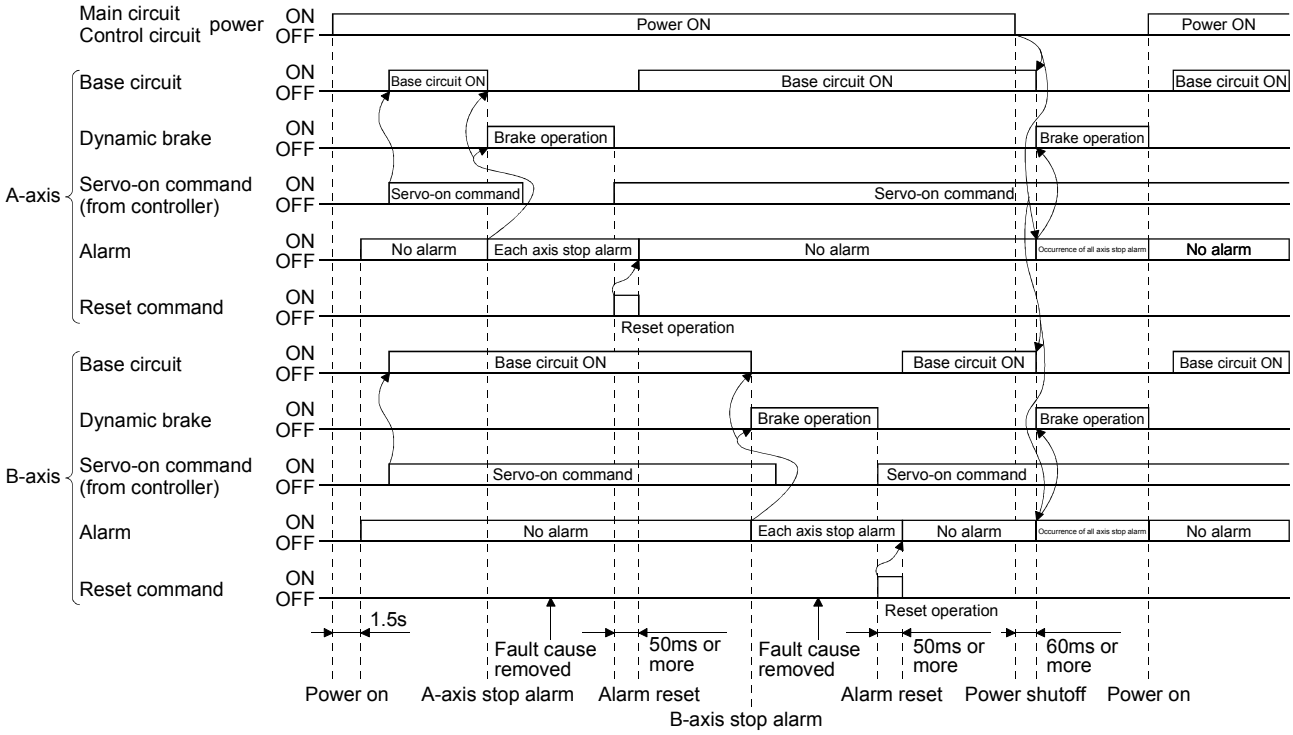
When an alarm occurs in the servo amplifier, the base circuit is shut off and the servo motor is coated to a stop. Switch off the main circuit power supply in the external sequence. To deactivate the alarm, power the control circuit off, then on or give the error reset or CPU reset command from the servo 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.

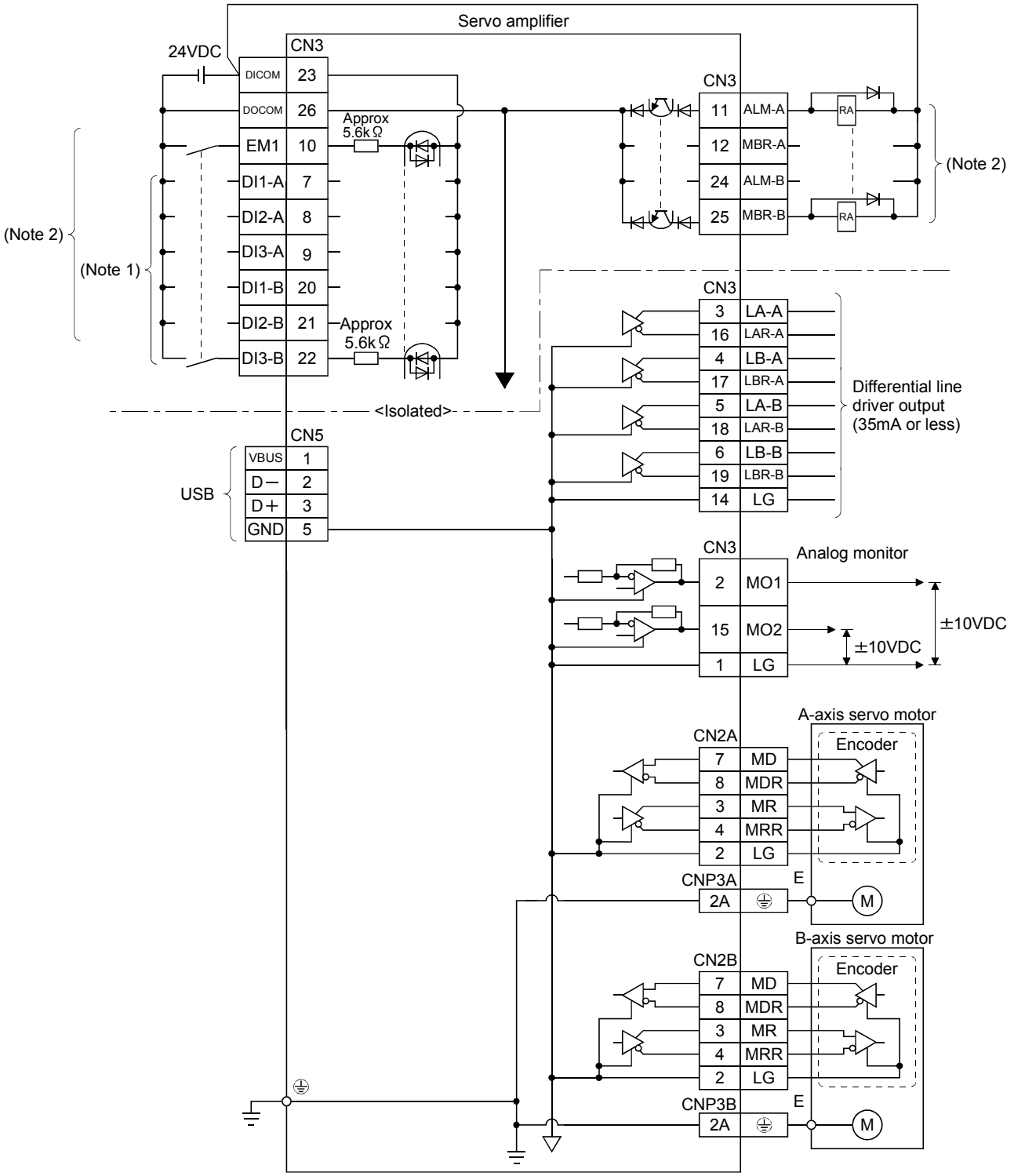
(3) Undervoltage

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

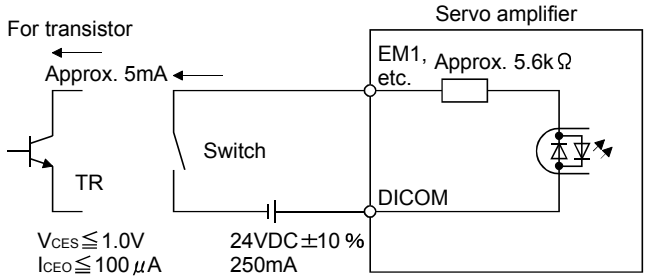


Note 1. Signal can be assigned for these pins with the controller setting.
For contents of signals, refer to the instruction manual of the controller.
2. For the sink I/O interface. For the source I/O interface, refer to section 3.7.3.

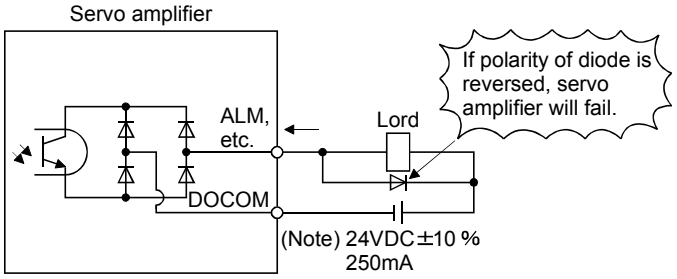
3.7.2 Detailed description of interfaces

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 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.

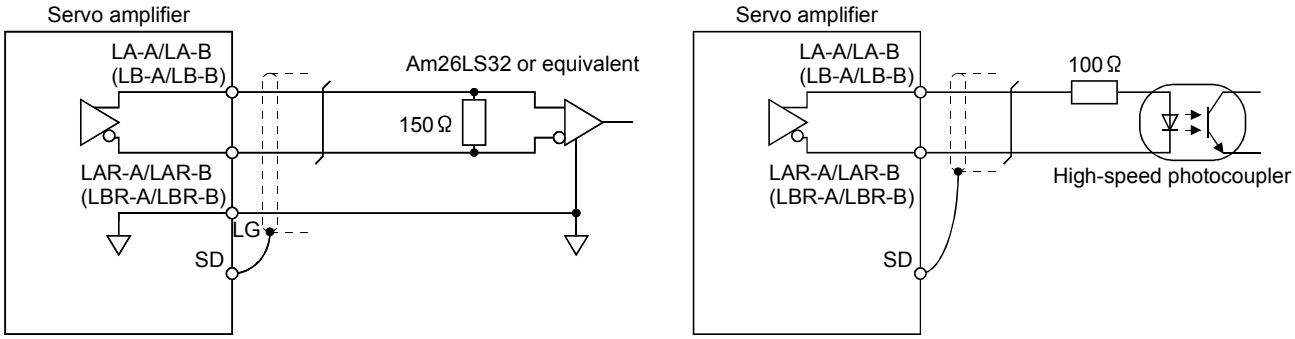


Note. If the voltage drop (maximum of 2.6V) interferes with the relay operation, apply high voltage (maximum of 26.4V) from external source.

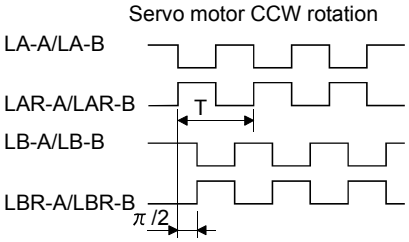
(3) Encoder output pulse DO-2 (differential line driver type)

(a) Interface

Max. output current: 35mA

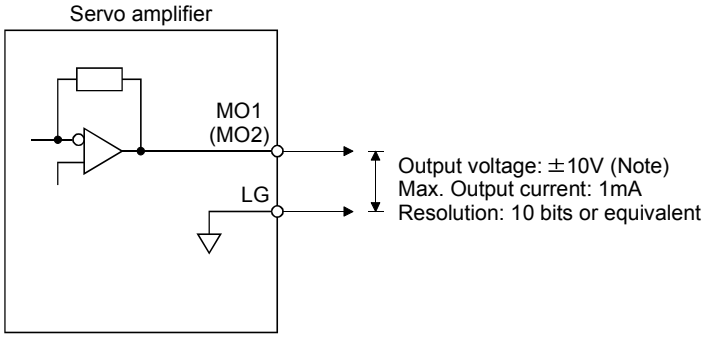


(b) Output pulse



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

(4) Analog output

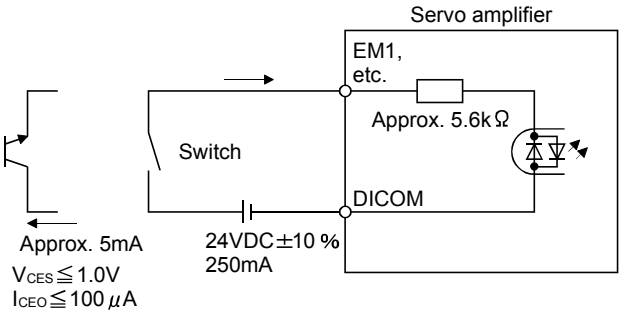


Note. Output voltage range varies depending on the monitored signal. (Refer to section 5.3.3 or 13.8.4(3).) When connecting an analog output to an external device, use one whose withstand voltage is 15VDC or more.

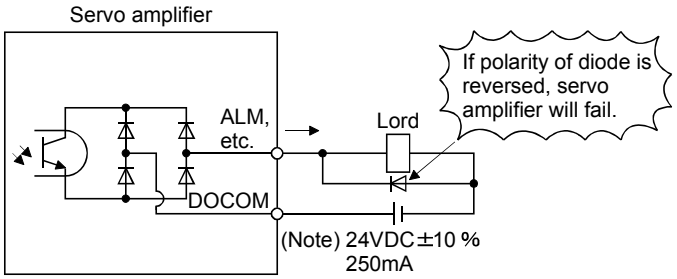
3.7.3 Source I/O interfaces

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



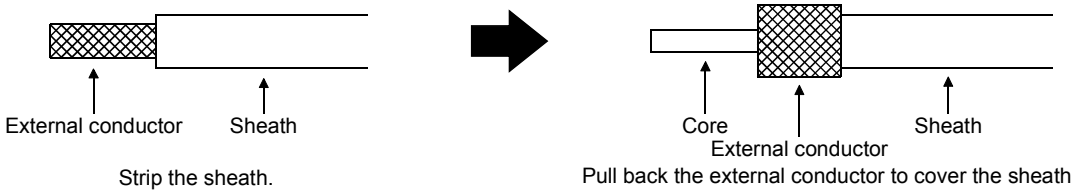
(2) Digital output interface DO-1
A maximum of 2.6V voltage drop occurs in the servo amplifier.



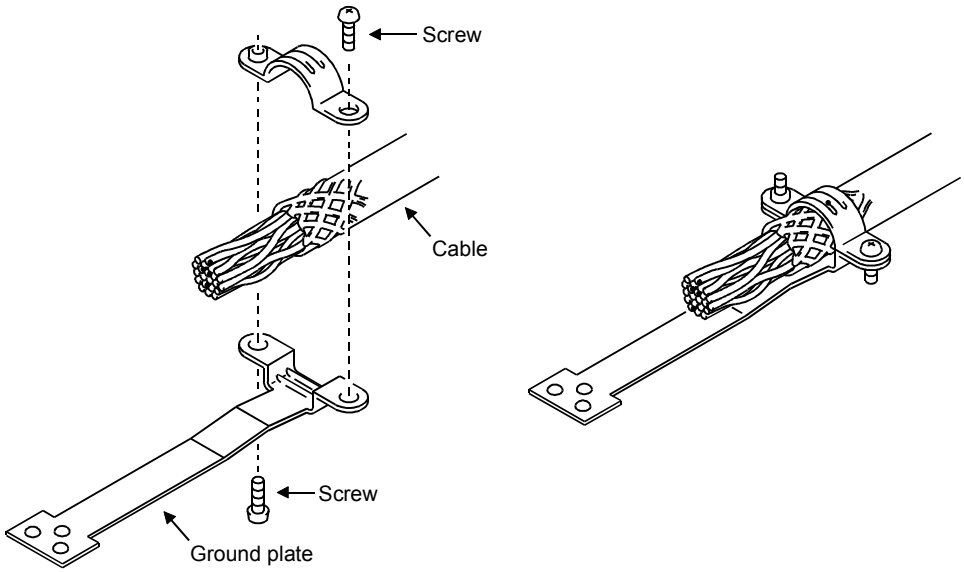
Note. If the voltage drop (maximum of 2.6V) interferes with the relay operation, apply high voltage (up to 26.4V) from external source.

3.8 Treatment of cable shield external conductor

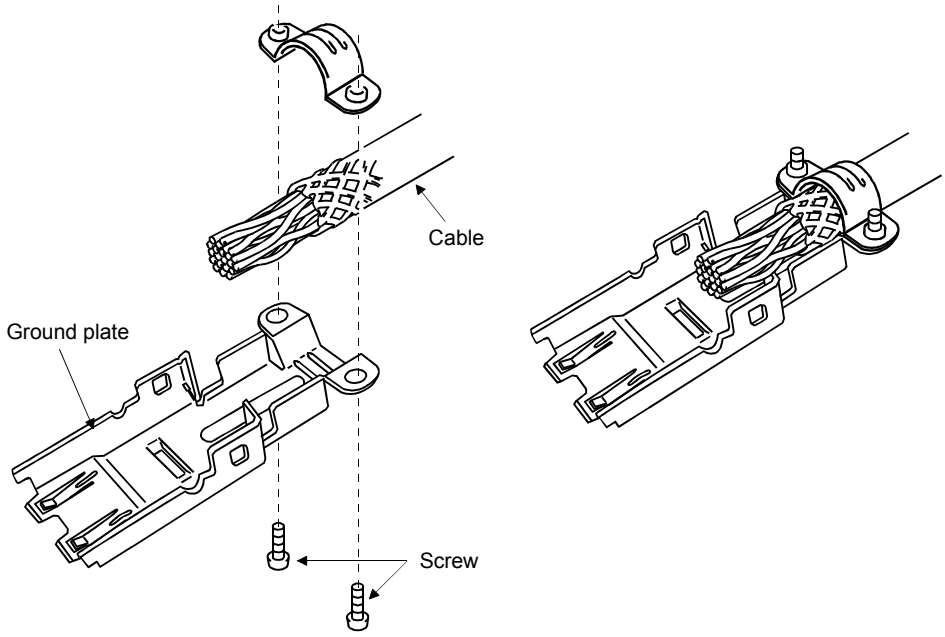
In the case of the CN3 connectors, securely connect the shielded external conductor of the cable to the ground plate as shown in this section and fix it to the connector shell.



(1) For CN3 connector (3M connector)



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

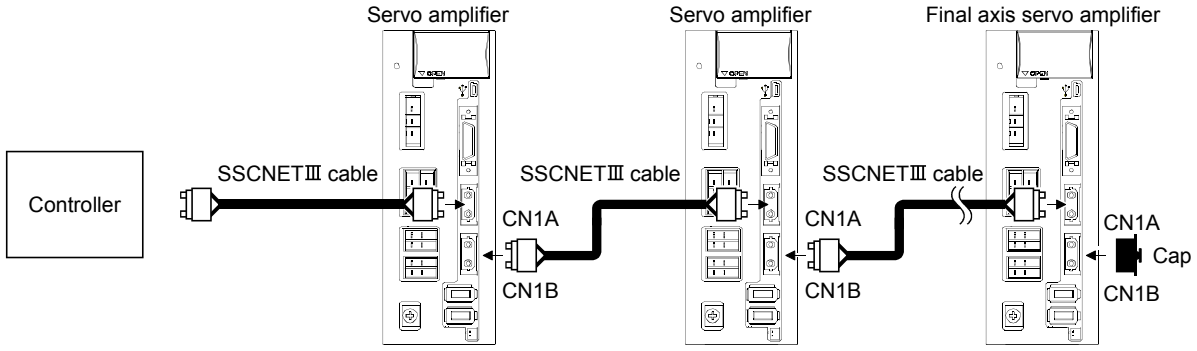


3.9 SSCNETⅢ cable connection

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.

(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.

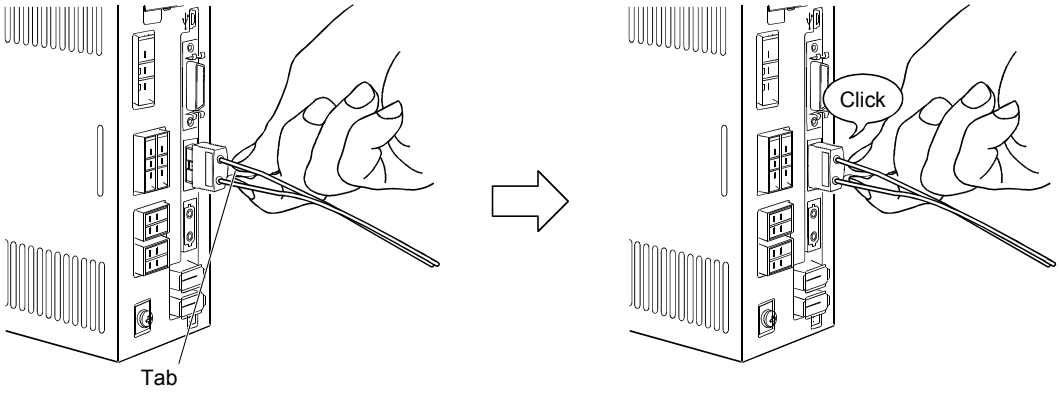
POINT
・CN1A・CN1B connector is put a cap to protect light device inside connector from dust. For this reason, do not remove a cap until just before mounting SSCNETⅢ cable. Then, when removing SSCNETⅢ cable, make sure to put a cap. ・Keep the cap for CN1A・CN1B connector and the tube for protecting optical 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.

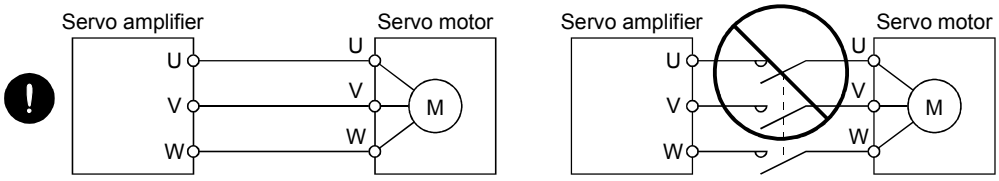


(b) Removal
With holding a tab of SSCNETⅢ cable connector, pull out the connector.
When pulling out the SSCNETⅢ cable from servo amplifier, be sure to put the cap on the connector parts of servo amplifier to prevent it from becoming dirty.
For SSCNETⅢ cable, attach the tube for protection optical cord's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

3.10 Connection of servo amplifier and servo motor

CAUTION

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



POINT

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

3.10.1 Connection instructions

WARNING

- To avoid an electric shock, insulate the connections of the power supply terminals.

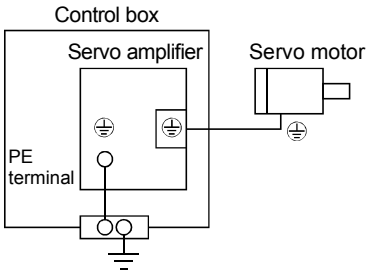
CAUTION

- 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.

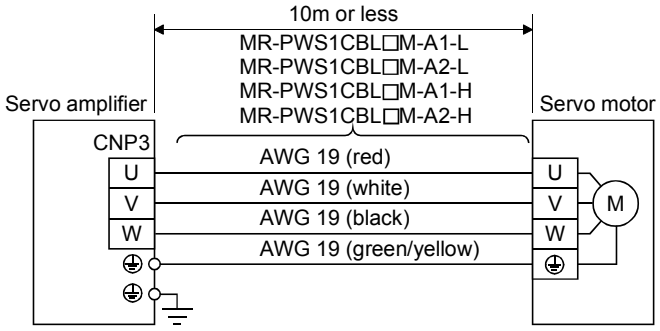
This section indicates the connection of the servo motor power (U, V, W). Use of the optional cable and connector set is recommended for connection between the servo amplifier and servo motor. When the options are not available, use the recommended products. Refer to section 11.1 for details of the options.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

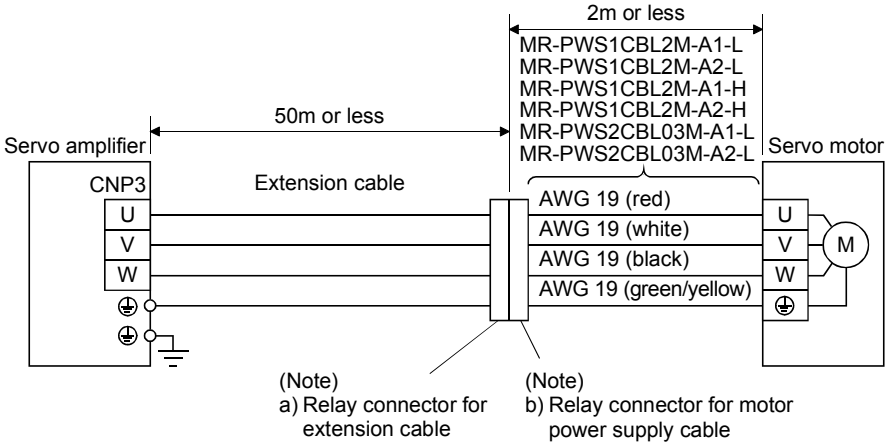
(a) When cable length is 10m or less



(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.



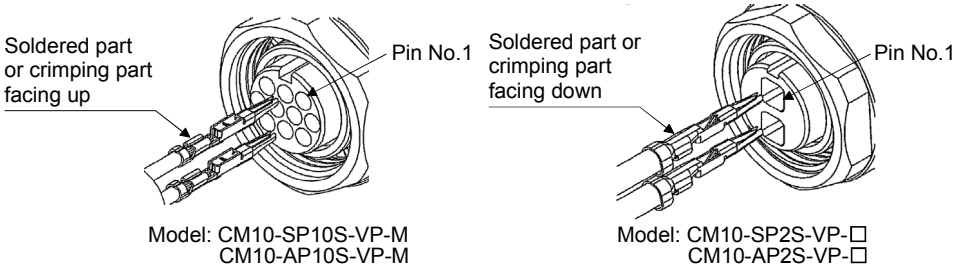
Note. Use of the following connectors is recommended when ingress protection (IP65) is necessary.

Relay connector	Description	IP rating
a) Relay connector for extension cable	Connector: RM15WTPZ-4P(71) Cord clamp: JR13WCC-5(72) (Hirose Electric) └ Numeral changes depending on the cable OD.	IP65
b) Relay connector for motor power supply cable	Connector: RM15WTJZ-4S(71) Cord clamp: JR13WCC-8(72) (Hirose Electric) └ Numeral changes depending on the cable OD.	IP65

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

POINT

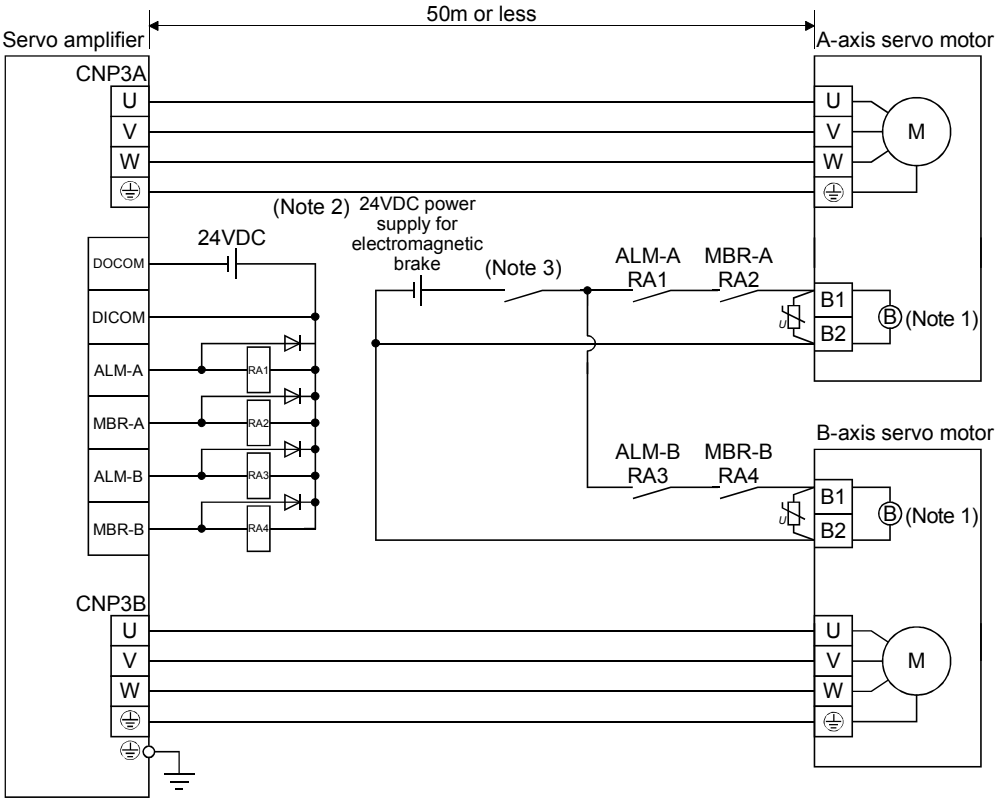
· Insert a contact in the direction shown in the figure. If inserted in the wrong direction, the contact is damaged and falls off.



(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.

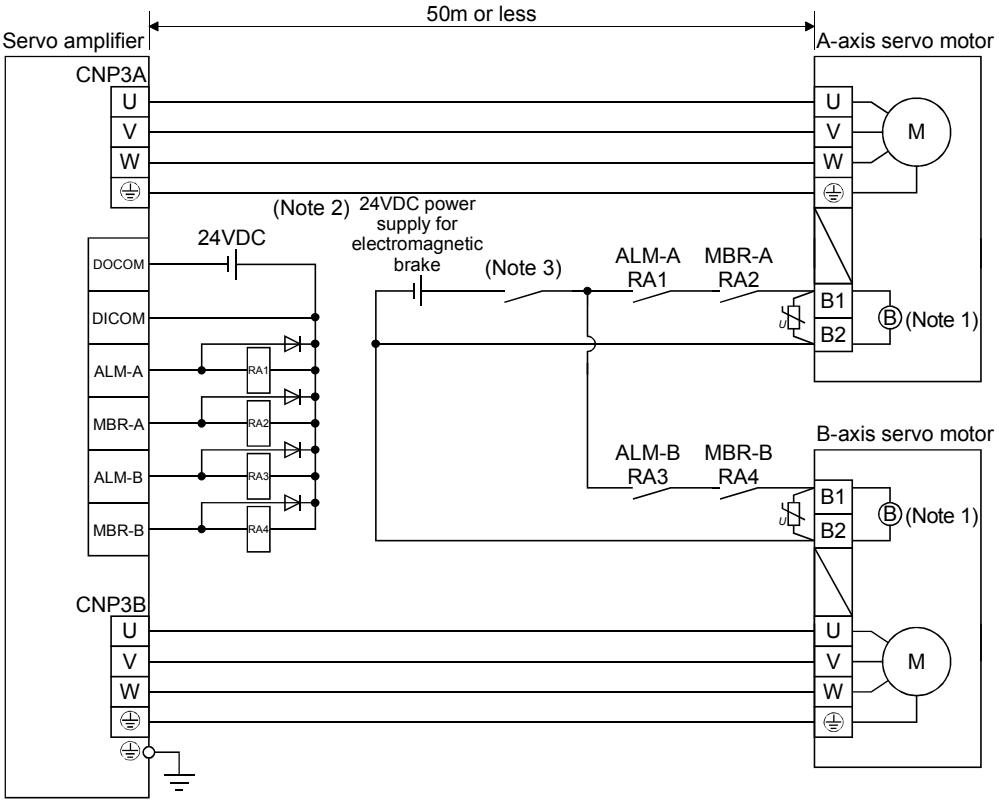


Note 1. There is no polarity in electromagnetic brake terminals B1 and B2.

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

3. 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. Do not use the 24VDC interface power supply for the electromagnetic brake.
3. Shut off the circuit by interlocking with the emergency stop switch.

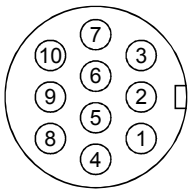
(b) Connector and signal allotment

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 HF-SP81 HF-SP52 HF-SP102	CM10-R10P (DDK)	MS3102A18-10P	CM10-R2P (DDK)
HC-UP72		CE05-2A22-23PD-B	Shared with the power supply
HC-LP52 HC-LP102			
HF-JP53 HF-JP73 HF-JP103		MS3102A18-10P	CM10-R2P (DDK)

Encoder connector signal allotment

CM10-R10P

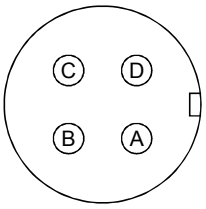


View a

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

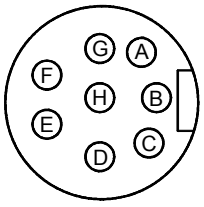


View b

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

Power supply connector signal allotment

CE05-2A22-23PD-B



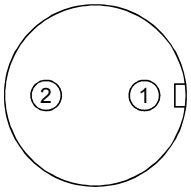
View b

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)

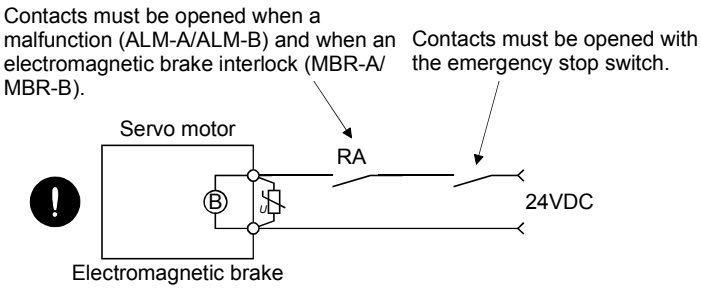
Note. For the motor with an electromagneti c brake, supply electromagneti c brake power (24VDC). There is no polarity.

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.

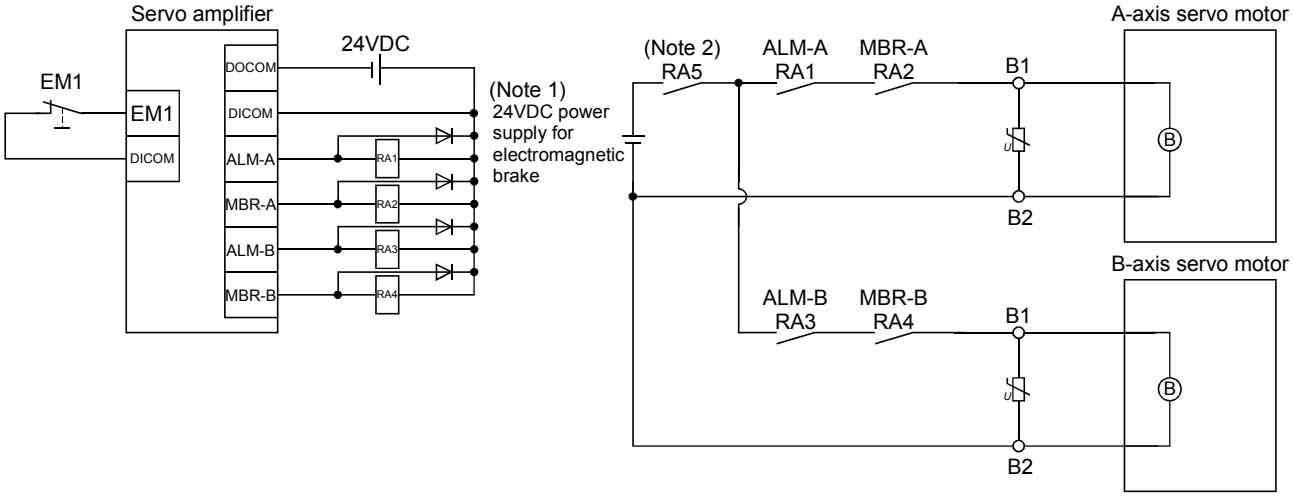
POINT

- 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 1. Do not use the 24VDC interface power supply for the electromagnetic brake.
2. Shut off the circuit by interlocking with the emergency stop switch.

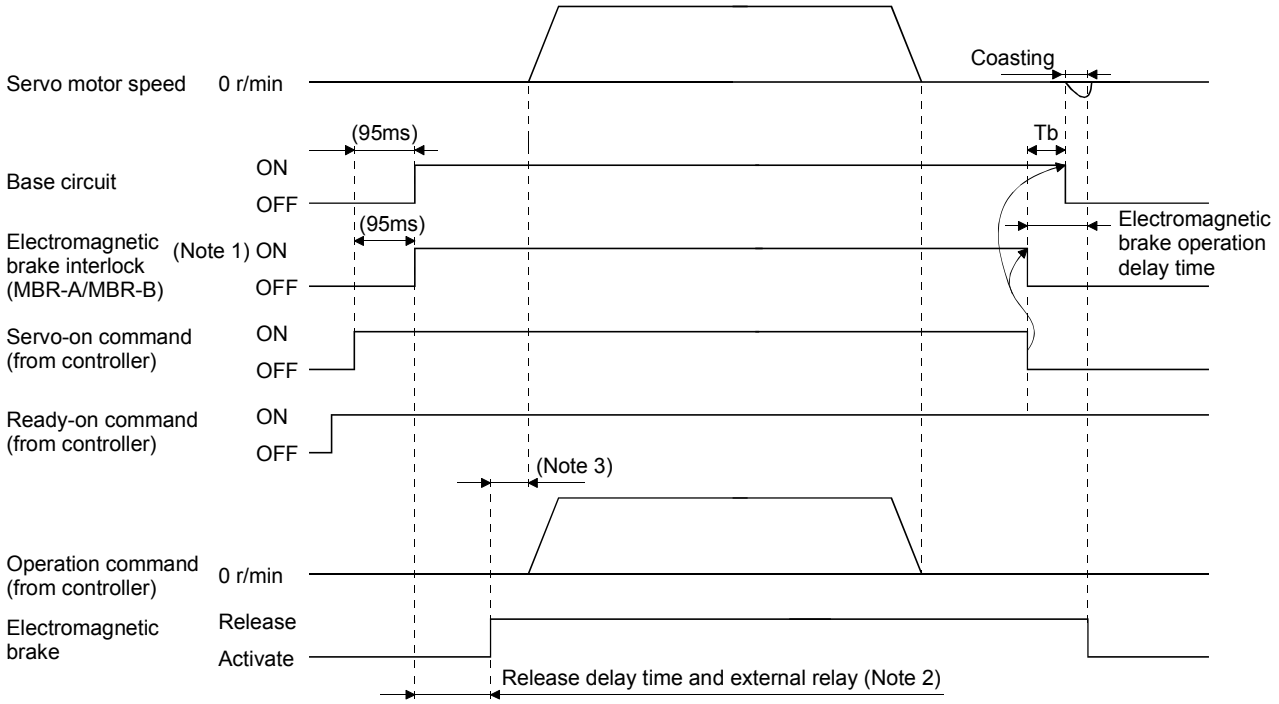
(2) Setting

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.

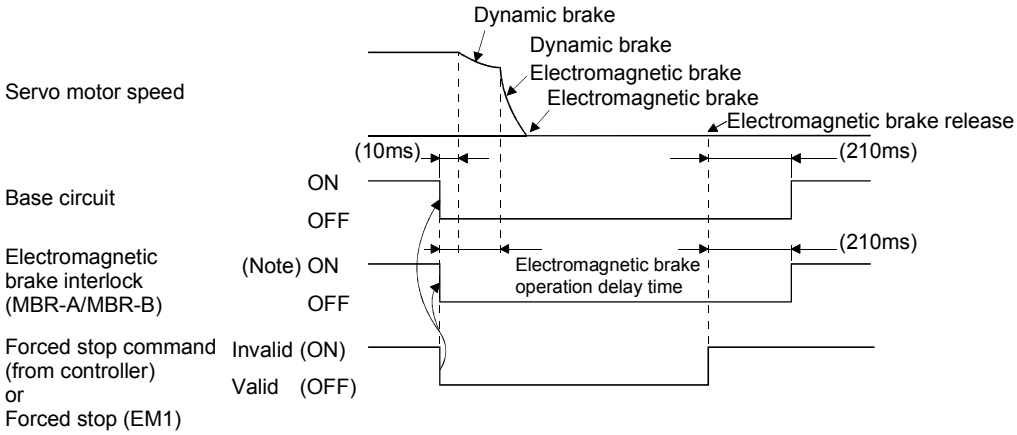


Note 1. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

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).

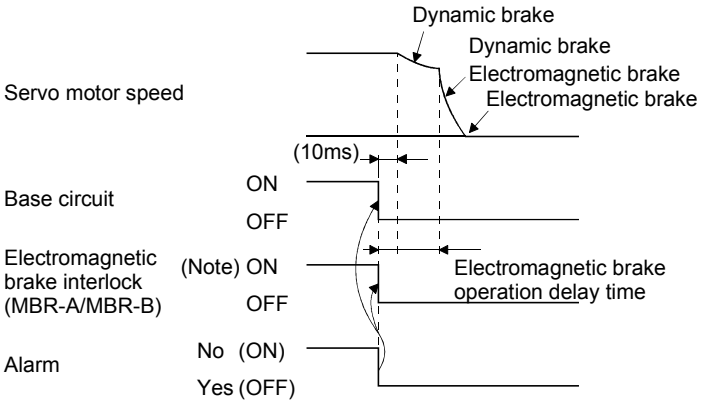
3. Give the operation command from the controller after the electromagnetic brake is released.

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



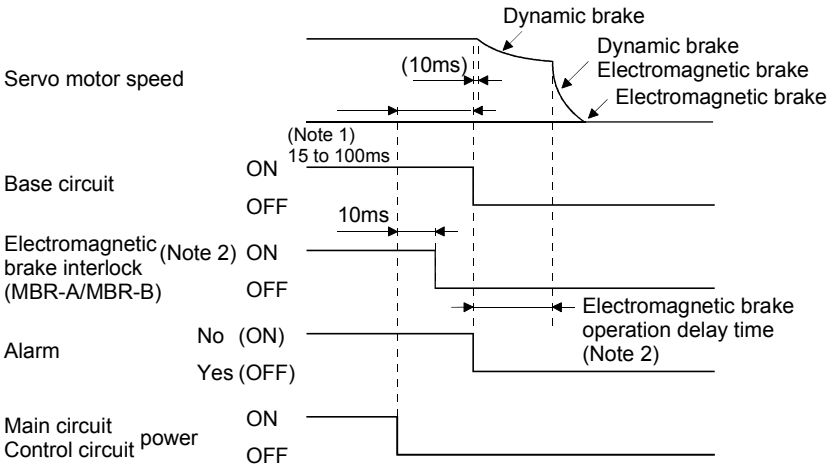
Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(3) Alarm occurrence



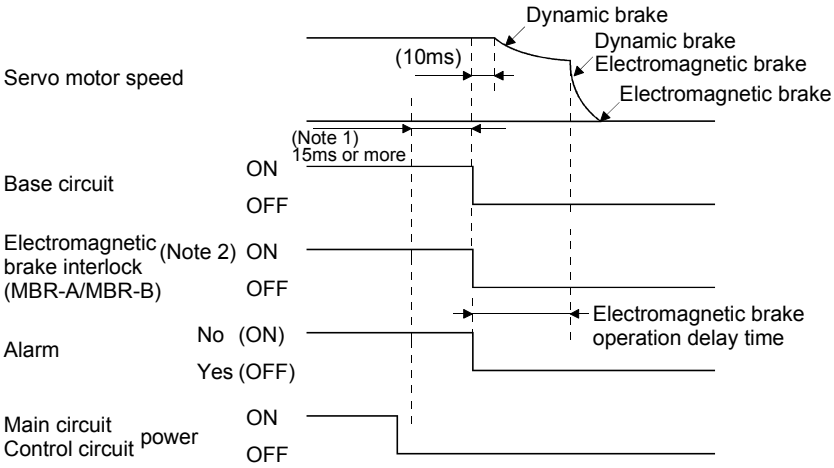
Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(4) Both main and control circuit power supplies off



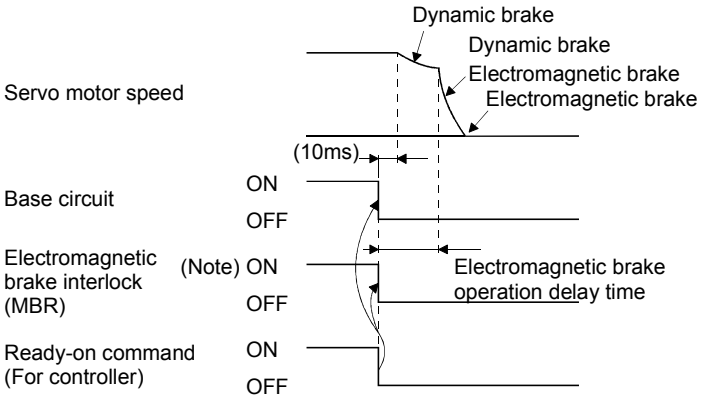
Note 1. Changes with the operating status.
2. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(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

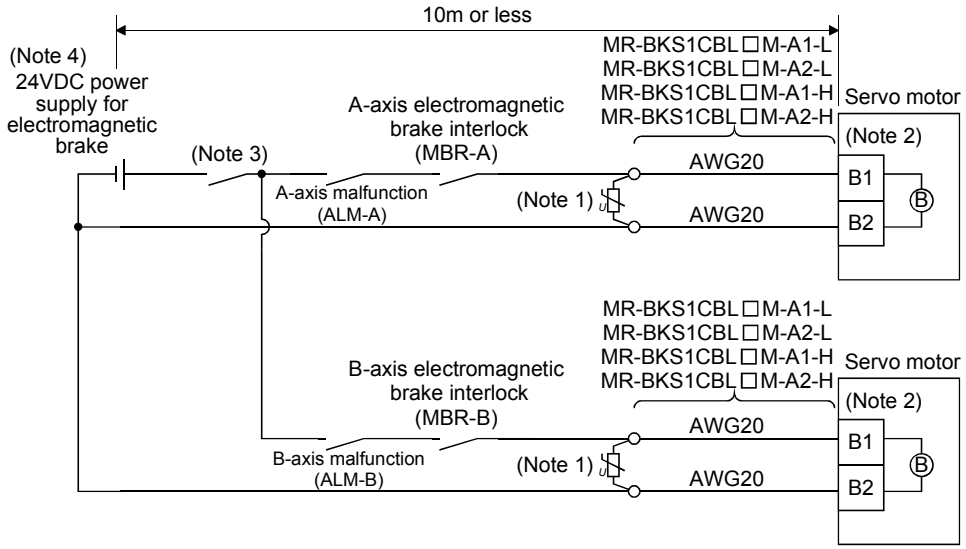


Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

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

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

(1) When cable length is 10m or less



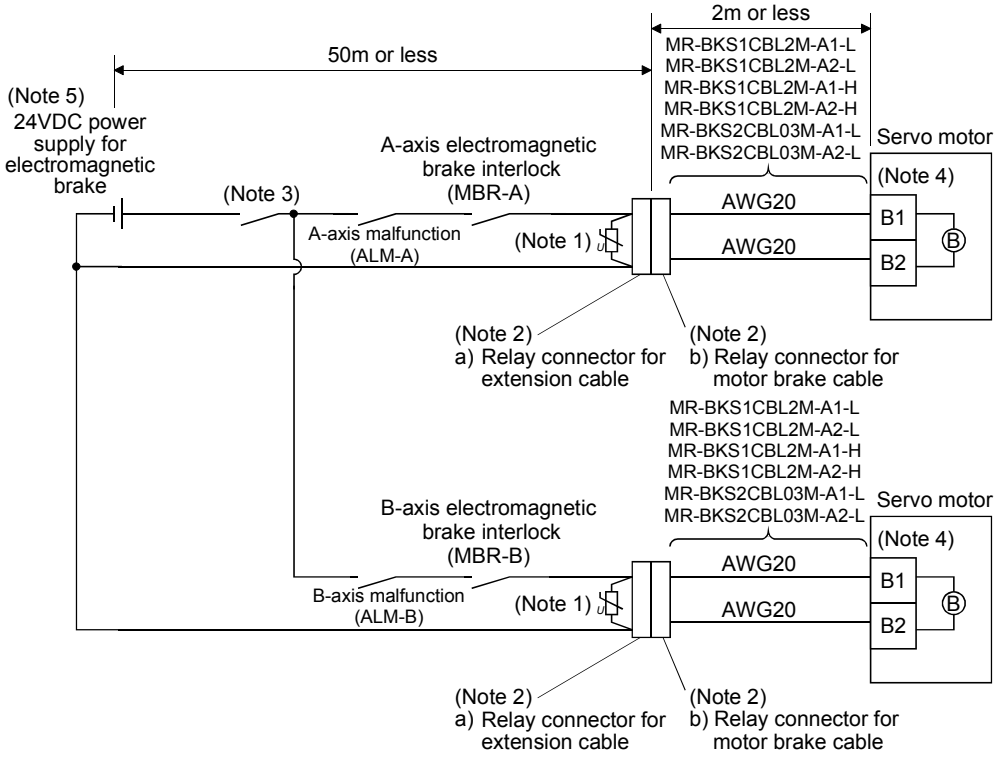
Note 1. Connect a surge absorber as close to the servo motor as possible.
2. There is no polarity in electromagnetic brake terminals (B1 and B2).
3. Shut off the circuit by interlocking with the emergency stop switch.
4. Do not use the 24VDC interface power supply for the electromagnetic brake.

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	IP rating
a) Relay connector for extension cable	CM10-CR2P-* (DDK) └ Wire size: S, M, L	IP65
b) Relay connector for motor brake cable	CMV1-SP2S-* (DDK) └ Wire size: S, M1, M2, L	IP65

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

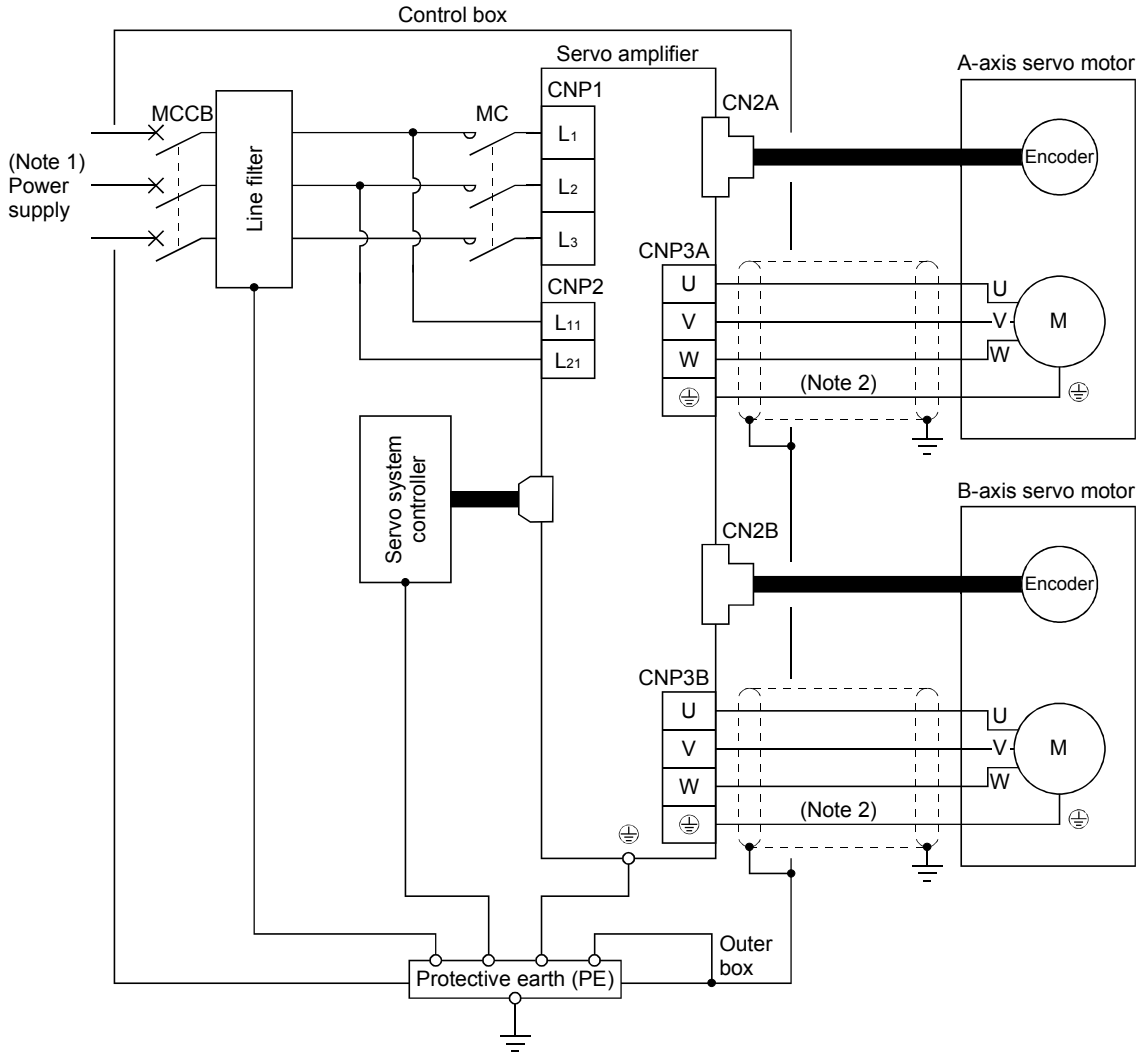
4. There is no polarity in electromagnetic brake terminals (B1 and B2).

5. Do not use the 24VDC interface power supply for the electromagnetic brake.

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).



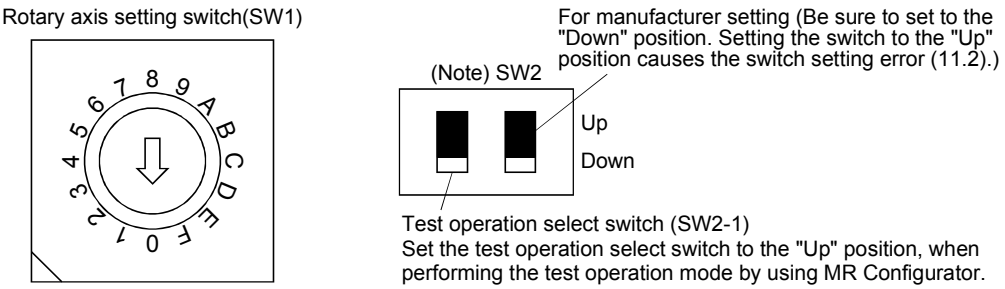
Note 1. For 1-phase 200V to 230VAC, connect the power supply to L_1 ・ L_2 and leave L_3 open. Refer to section 1.3 for the power supply specification.
2. Ensure to connect it to ⏚ of a CN3A/CN3B connector. Do not connect it directly to the protective earth of the control panel.

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].
- When the test operation mode is selected by using the test operation select switch (SW2-1), the SSCNETⅢ communication for the servo amplifier in the test operation mode and the following servo amplifiers is blocked.

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.



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

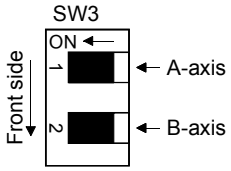
Note 1. Setting the switch to the "F" position causes the switch setting error (11.1).
2. An axis number is assigned even for the axis that is set as motor-less operation. Set SW1 so as to avoid overlapping the axis numbers.

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, linear servo motors and direct drive motor in combination.
- If the connected servo motor does not match the SW3 setting, the switch setting error (11.3) occurs.
- MR-J3W-0303BN6 does not have SW3.

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 Direct drive motor

4. STARTUP

WARNING

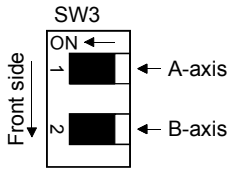
- Do not operate the switches with wet hands. You may get an electric shock.

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). MR-J3W-0303BN6 does not have SW3.

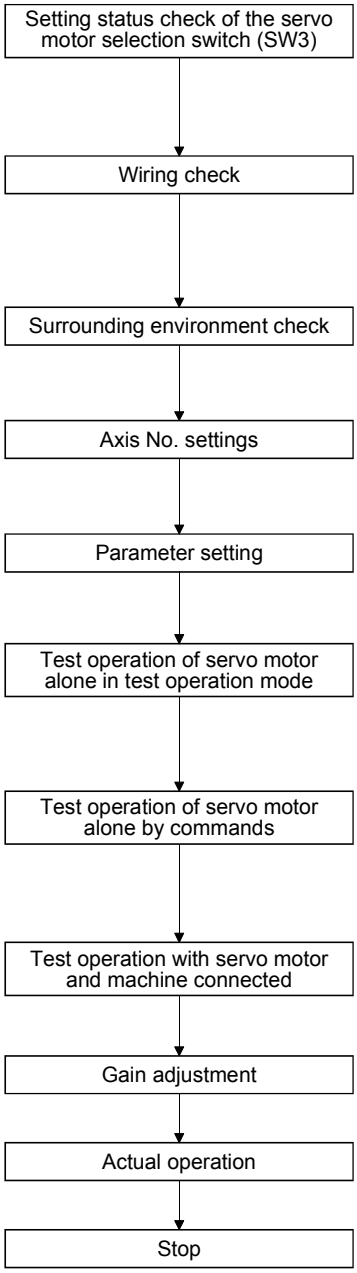


- When using only one of A-axis or B-axis, set "□□□1" in the parameter No.PC05 of the axis, which not connected to the servo motor, to select the motor-less operation.

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.)

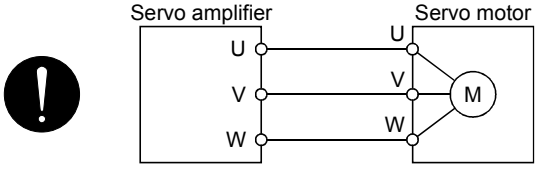
Stop giving commands and stop operation.

4.1.2 Wiring check

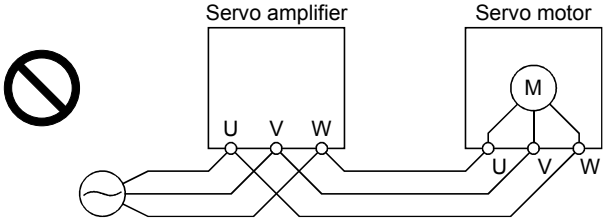
(1) Power supply system wiring
Before switching on the main circuit and control circuit power supplies, check the following items.

(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.)

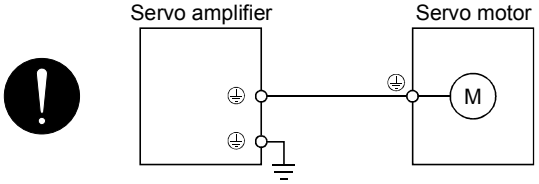
(b) Connection of servo amplifier and servo motor
1) The servo motor power supply terminals (U, V, W) of the servo amplifier match in phase with the power input terminals (U, V, W) of the servo motor.



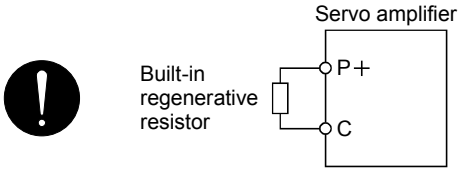
2) The power supplied to the servo amplifier should not be connected to the servo motor power supply terminals (U, V, W). To do so will fail the connected servo amplifier and servo motor.



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.



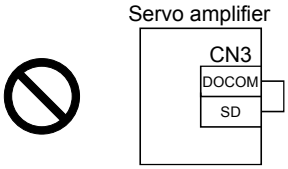
(c) When option and auxiliary equipment are used
When regenerative option is used
- The generative brake option should be connected to P+ terminal and C terminal.
- A twisted cable should be used. (Refer to section 11.2.)

(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 bending 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, QD74MH□, LD77MH□)	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

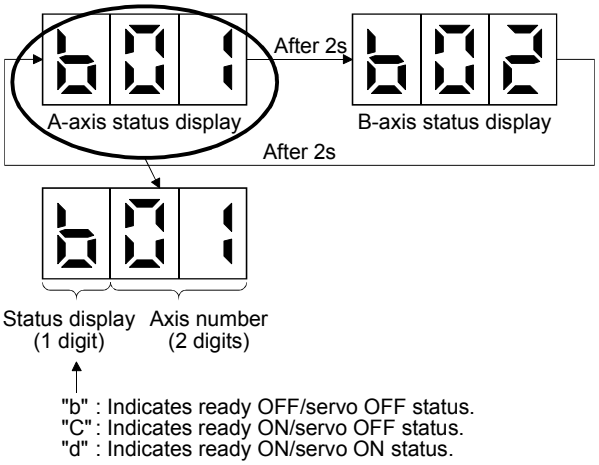
On the servo amplifier display (3-digit, 7-segment display), check the status of communication with the servo system controller at power-on, check the axis number, and diagnose a fault at occurrence of an alarm.

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.

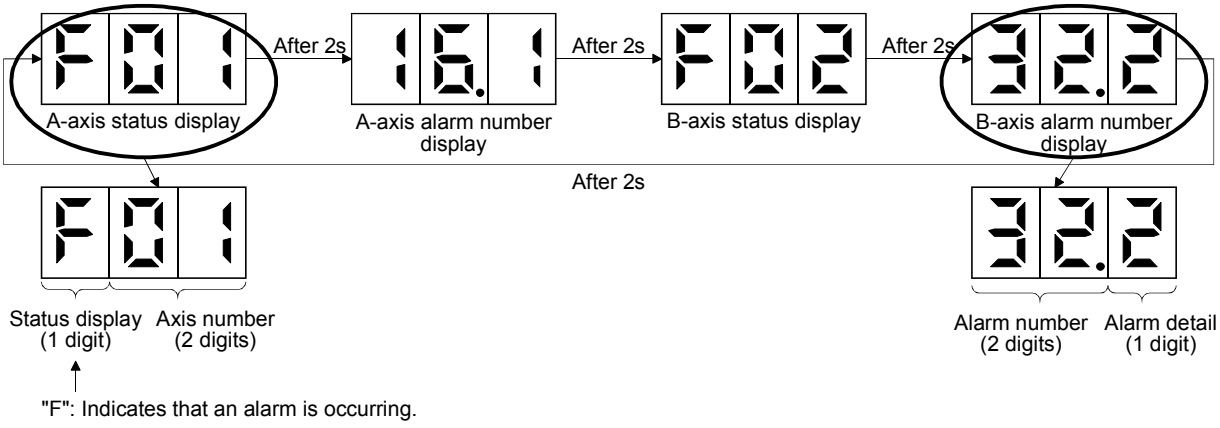
(1) Normal display

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.



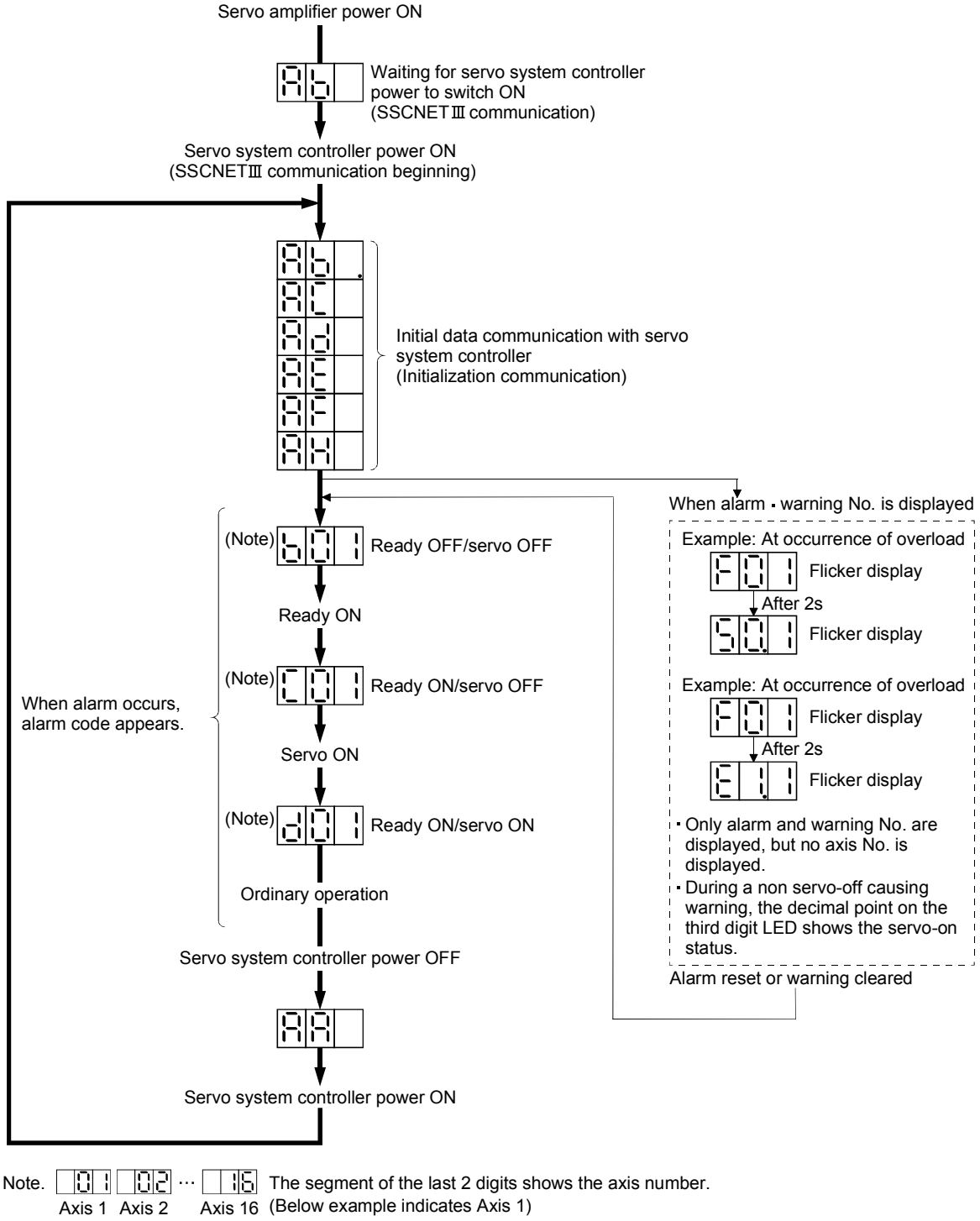
(2) Alarm display

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. Axis 1 Axis 2 … Axis 16 The segment of the last 2 digits shows the axis number. (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, program 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.

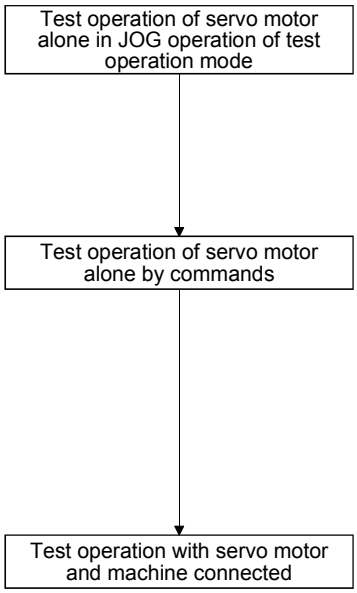
3. Requires the MR Configurator.

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. By using MR Configurator, check if the servo motor speed, the load ratio, and the other items in the status display are not incorrect.
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. ・When the test operation mode is selected by using the test operation select switch (SW2-1), the SSCNETⅢ communication for the servo amplifier in the test operation mode and the following servo amplifiers is blocked.

(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 program 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

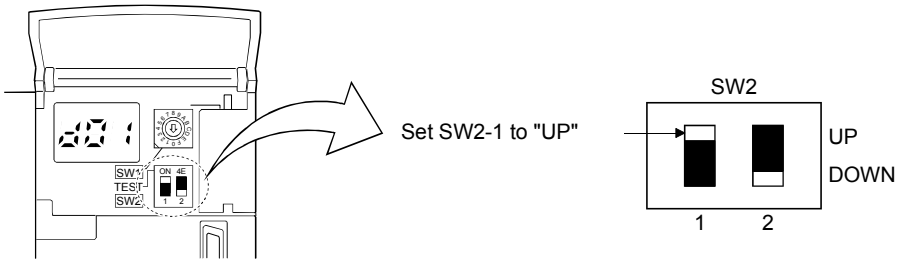
Output signals can be switched on/off forcibly independently of the servo status. Use this function for output signal wiring check, etc.

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

(2) Operation procedure

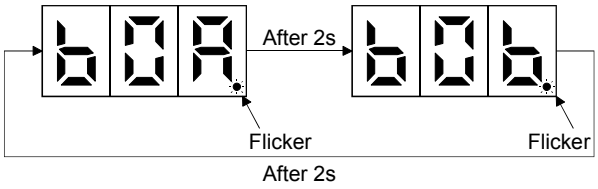
(a) Switch power off.

(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

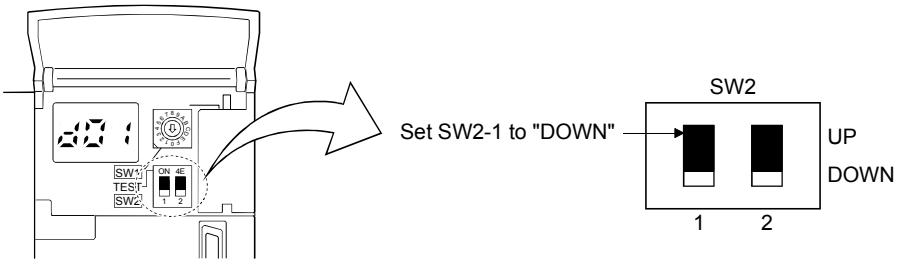
The following alarms and warning do not occur. However, the other alarms and warnings occur as when the servo motor is connected.

- 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 (92.1)
- Battery warning (9F.1)
- Main circuit off warning (E9.☐)

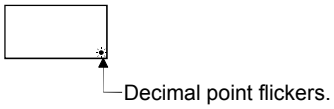
(2) Operating procedure

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. ・When the fixed values are indicated for any digits of a parameter, never change the values of the digits.

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 software 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.

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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		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.
> - The direct drive motor can be used with the servo amplifier whose software version is B3 or later.

Select the control mode.
This parameter is set as "□□0□" (rotary servo motor) in the initial setting.

Parameter No.PA01

0	0		0

Control mode selection
0: Rotary servo motor
4: Linear servo motor
6: Direct drive 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.
> - The MR-RB3B can be used with the servo amplifier whose software version is B3 or later.
> - This parameter is not for MR-J3W-0303BN6. Do not change this value by any means.

Set this parameter when using the regenerative option.

Parameter No.PA02

0	0		

Selection of regenerative option
00: Regenerative option is not used (built-in regenerative resistor is used)
0D: MR-RB14
0E: MR-RB34
10: MR-RB3B

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

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

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

0		0	0

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

POINT
・This parameter cannot be used in the torque control mode.

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

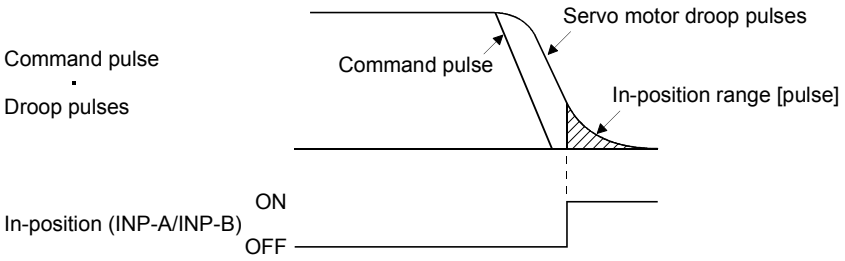
Setting	Response	Guideline for machine resonance frequency [Hz]
17	Middle response	67.1
18	↑	75.6
19		85.2
20		95.9
21		108.0
22		121.7
23		137.1
24		154.4
25		173.9
26		195.9
27		220.6
28		248.5
29		279.9
30		315.3
31	↓	355.1
32	High response	400.0

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 and the torque 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

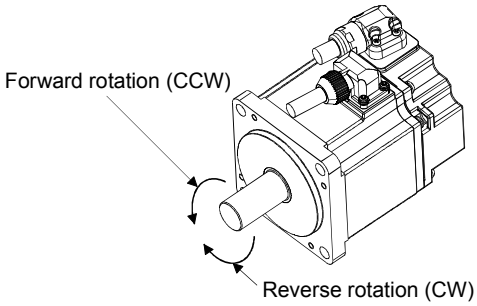
Parameter			Setting	Factory setting	Unit	Setting range
No.	Symbol	Name				
PA14	*POL	Rotation direction selection	Each axis	0		0 ▪ 1

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 (Note)	
	When positioning address increases (Position control) Command speed in the positive direction (Speed control) Command torque in the positive direction (Torque control)	When positioning address decreases (Position control) Command speed in the negative direction (Speed control) Command torque in the negative direction (Torque control)
0	CCW	CW
1	CW	CCW

Note. Torque generation direction for the torque control



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/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/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.
- The gain/filter parameters (No.PB□□) cannot be used in the torque loop mode.

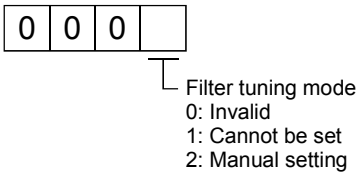
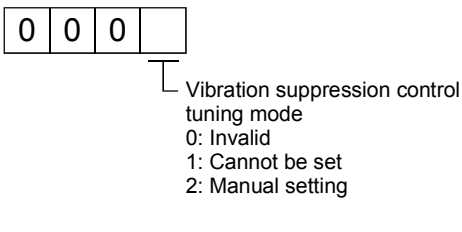
5.2.1 Parameter list

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		This parameter is not used. Do not change the value.		0	
PB04	FFC	Feed forward gain	Each axis	0	%
PB05		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		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

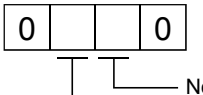
No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit
PB35		This parameter is not used. Do not change the value.		0.00	
PB36				0.00	
PB37				100	
PB38				0.0	
PB39				0.0	
PB40				0.0	
PB41				1125	
PB42				1125	
PB43				0004h	
PB44				0.0	
PB45				0000h	

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.  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.  If "□□□1" is set for this parameter, it is automatically rewritten as "□□□0".	Each axis	0000h		Refer to Name and function column.
PB03		This parameter is not used. Do not change the value.		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 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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		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.

Notch depth selection
<table><tr><th>Setting value</th><th>Depth</th><th>Gain</th></tr><tr><td>0</td><td rowspan="4">Deep
to
Shallow</td><td>−40dB</td></tr><tr><td>1</td><td>−14dB</td></tr><tr><td>2</td><td>−8dB</td></tr><tr><td>3</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 rowspan="4">Standard
to
Wide</td><td>2</td></tr><tr><td>1</td><td>3</td></tr><tr><td>2</td><td>4</td></tr><tr><td>3</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.

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 rowspan="4">Deep
to
Shallow</td><td>−40dB</td></tr><tr><td>1</td><td>−14dB</td></tr><tr><td>2</td><td>−8dB</td></tr><tr><td>3</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 rowspan="4">Standard
to
Wide</td><td>2</td></tr><tr><td>1</td><td>3</td></tr><tr><td>2</td><td>4</td></tr><tr><td>3</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		This parameter is not used. Do not change the value.		0.00		
PB22				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", the slight vibration suppression control is enabled. (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		This parameter is not used. Do not change the value.		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 pulses 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		This parameter is not used. Do not change the value.		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.

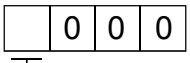
5.3.1 Parameter list

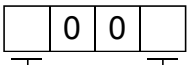
No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit
PC01	ERZ	Error excessive alarm level	Each axis	0	rev
PC02	MBR	Electromagnetic brake sequence output	Each axis	0	ms
PC03	*ENRS	Encoder output pulses selection	Each axis	0010h	
PC04	**COP1	Function selection C-1	Each axis	0000h	
PC05	**COP2	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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		0	
PC14				0	
PC15	SNO	Station number selection	Common	0	
PC16		This parameter is not used. Do not change the value.		0000h	
PC17	**COP4	Function selection C-4	Each axis	0000h	
PC18		This parameter is not used. Do not change the value.		0000h	
PC19				0000h	
PC20				0000h	
PC21	*BPS	Alarm history clear	Each axis	0000h	
PC22		This parameter is not used. Do not change the value.		0000h	
PC23				0000h	
PC24				0000h	
PC25				0000h	
PC26				0000h	
PC27				0000h	
PC28				0000h	
PC29				0000h	
PC30				0000h	
PC31				0000h	
PC32				0000h	

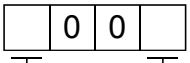
Note 1. Each axis: Set a value for each of the A-axis and the B-axis.
Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.
2. Valid for the A-axis and the B-axis.

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 and the torque 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. 0 0 ☐ ☐ Encoder output pulse phase changing Changes the phases of A/B-phase encoder pulses output . Set value: 0 — CCW: A-phase, B-phase; CW: A-phase, B-phase Set value: 1 — CCW: A-phase, B-phase; CW: A-phase, B-phase 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. ☐ 0 0 0 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. 0 0 0 ☐ 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.


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>This parameter is not used. Do not change the value.</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)


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)</td></tr><tr><td>7</td><td>Droop pulses (±10V/1000 pulses)</td></tr><tr><td>8</td><td>Droop pulses (±10V/10000 pulses)</td></tr><tr><td>9</td><td>Droop pulses (±10V/100000 pulses)</td></tr><tr><td>D</td><td>Bus voltage (±8V/400V)</td></tr><tr><td>E</td><td>Speed command 2 (8V/max. current command)</td></tr></table>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)


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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		0000h		
PC17	**COP4	Function Selection C-4 This parameter cannot be used in the speed control mode and the torque control mode. This is used to select a home position setting condition. 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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		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

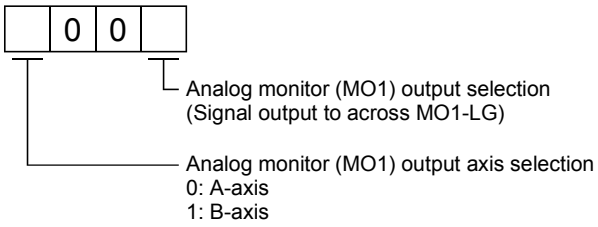
POINT
▪ A voltage of analog monitor output may be irregular at power-on.

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

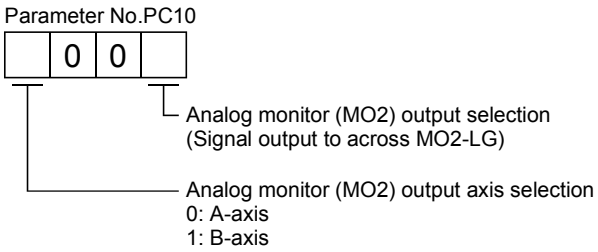
(1) Setting

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

Parameter No.PC09



Parameter No.PC10



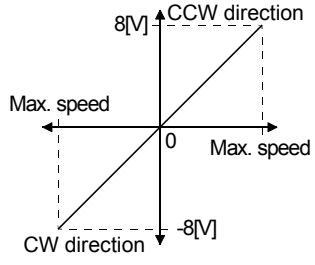
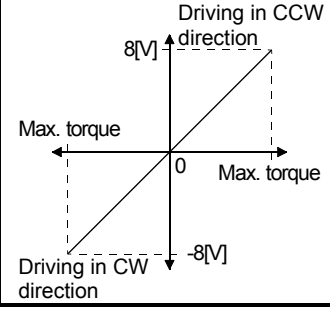
Parameters No.PC11 and PC12 can be used to set the offset voltages to the analog output voltages. The setting range is between −999 and 999mV.

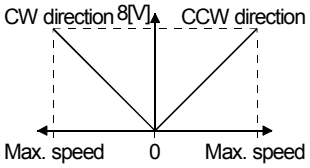
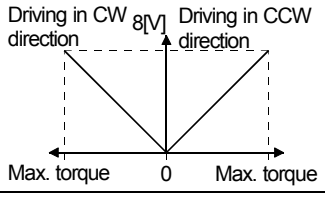
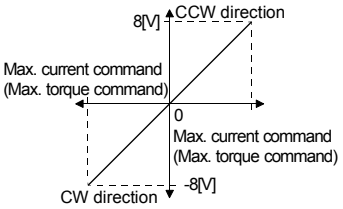
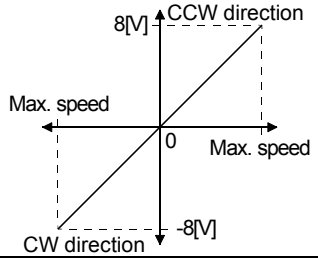
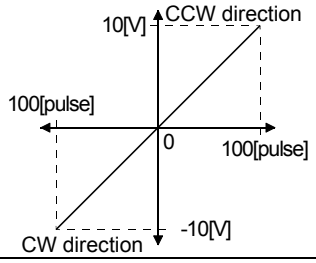
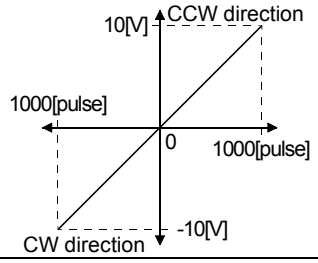
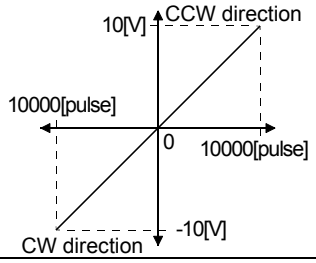
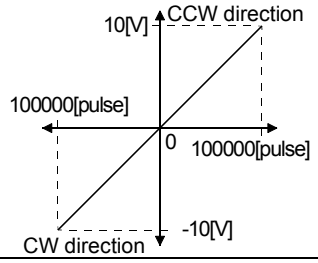
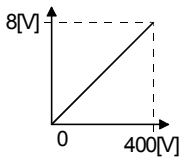
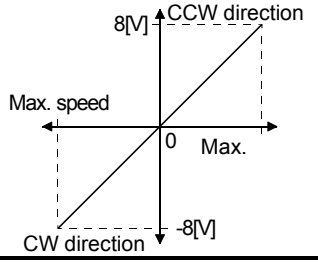
Parameter No.	Description	Setting range [mV]
PC11	Used to set the offset voltage for the analog monitor 1 (MO1).	−999 to 999
PC12	Used to set the offset voltage for the analog monitor 2 (MO2).	

(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	

Setting	Output item	Description	Setting	Output item	Description
2	Servo motor speed		3	Torque	
4	Current command		5	Speed command	
6	Droop pulses (Note 1, 2, 3) (±10V/100 pulses)		7	Droop pulses (Note 1, 2, 3) (±10V/1000 pulses)	
8	Droop pulses (Note 1, 2, 3) (±10V/10000 pulses)		9	Droop pulses (Note 1, 2, 3) (±10V/100000 pulses)	
D	Bus voltage		E	Speed command 2 (Note 2, 4)	

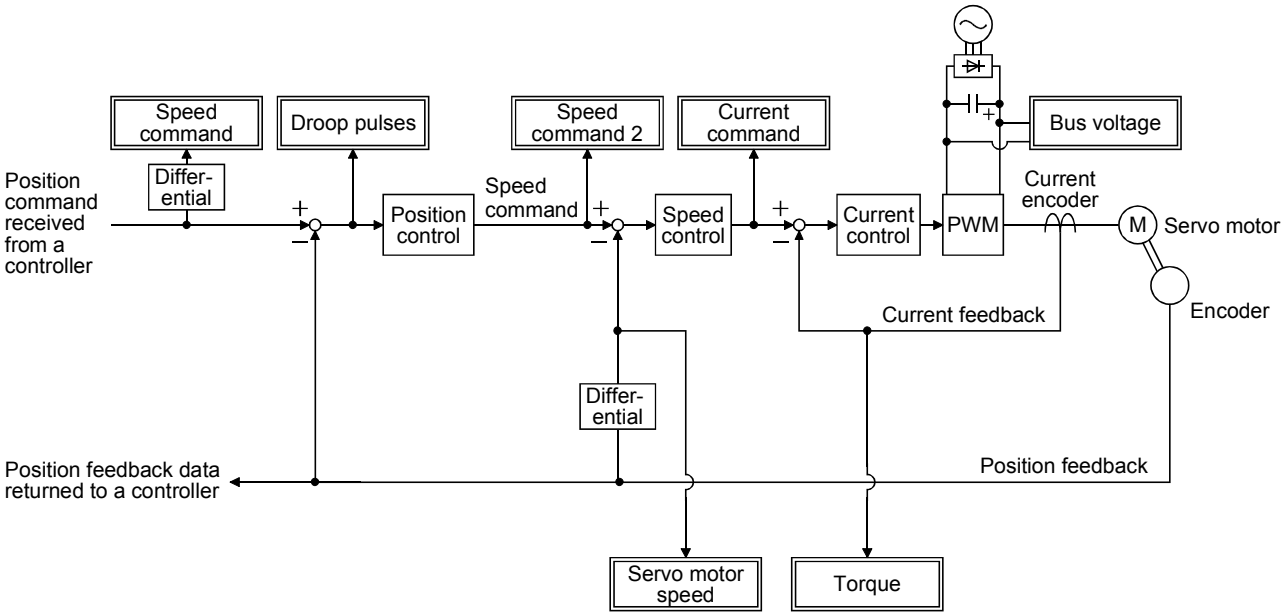
Note 1. Encoder pulse unit.

2. Cannot be used in the torque loop mode.

3. Cannot be used in the speed loop mode.

4. This setting can be used with the servo amplifier whose software version is B3 or later and with MR Configurator whose software version is C5 or later.

(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.

Parameter No.PC21

0	0	0	

Alarm history clear
0: Invalid (not cleared)
1: Valid (cleared)

5.4 I/O setting parameters (No.PD□□)

POINT

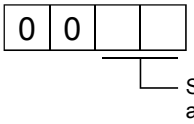
- The parameter whose symbol preceded by * can be validated with the following conditions.
  * : Turn off the power and then on again, or reset the controller after setting the parameter.

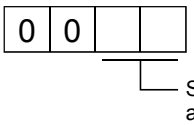
5.4.1 Parameter list

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit
PD01		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		0004h	
PD09	*DO3	Output signal device selection 3 (CN3-11 for A-axis and CN3-24 for B-axis)	Each axis	0003h	
PD10		This parameter is not used. Do not change the value.		0000h	
PD11				0004h	
PD12				0000h	
PD13				0000h	
PD14	*DOP3	Function selection D-3	Each axis	0000h	
PD15		This parameter is not used. Do not change the value.		0000h	
PD16				0000h	
PD17				0000h	
PD18				0000h	
PD19				0000h	
PD20				0000h	
PD21				0	
PD22				0	
PD23				0	
PD24				0	
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.

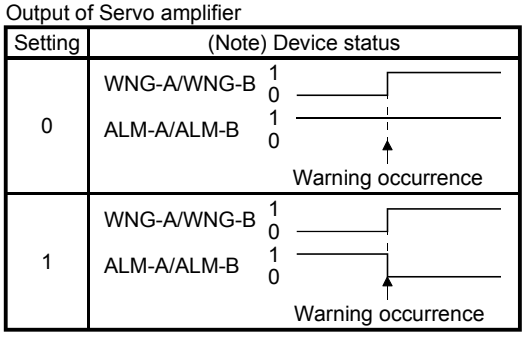
5.4.2 List of details

<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">This parameter is not used. Do not change the value.</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.


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>SA-A/SA-B (Note 2)</td></tr><tr><td>01</td><td>For manufacturer setting (Note 3)</td><td>0B</td><td>VLC-A/VLC-B (Note 5)</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, 4)</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 (Note 4)</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. Always off in the speed loop mode.
2. Always off in the position control mode and the torque loop mode.
3. For manufacturer setting. Never change this setting.
4. Always off in the torque loop mode.
5. Always off in the position control mode and the torque loop mode.</td><td>Each axis</td><td>0005h</td><td rowspan="3"></td><td>Refer to Name and function column.</td></tr>
<tr><td>PD08</td><td></td><td>This parameter is not used. Do not change the value.</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.

</td><td>Each axis</td><td>0003h</td><td>Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Setting</th><th>Factory setting</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD10</td><td rowspan="4"></td><td rowspan="4">This parameter is not used. Do not change the value.</td><td rowspan="4"></td><td>0000h</td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>PD11</td><td>0004h</td></tr>
<tr><td>PD12</td><td>0000h</td></tr>
<tr><td>PD13</td><td>0000h</td></tr>
<tr><td>PD14</td><td>*DOP3</td><td>Function selection D-3
Set the ALM-A/ALM-B output signal at warning occurrence.

0 0 _ 0
└ Selection of output device at warning occurrence
Select the warning (WNG-A/WNG-B) and malfunction (ALM-A/ALM-B) output status at warning occurrence.

Output of Servo amplifier


Note. 0: OFF
1: ON</td><td>Each axis</td><td>0000h</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>PD15</td><td rowspan="18"></td><td rowspan="18">This parameter is not used. Do not change the value.</td><td rowspan="18"></td><td>0000h</td><td rowspan="18"></td><td rowspan="18"></td></tr>
<tr><td>PD16</td><td>0000h</td></tr>
<tr><td>PD17</td><td>0000h</td></tr>
<tr><td>PD18</td><td>0000h</td></tr>
<tr><td>PD19</td><td>0000h</td></tr>
<tr><td>PD20</td><td>0</td></tr>
<tr><td>PD21</td><td>0</td></tr>
<tr><td>PD22</td><td>0</td></tr>
<tr><td>PD23</td><td>0</td></tr>
<tr><td>PD24</td><td>0000h</td></tr>
<tr><td>PD25</td><td>0000h</td></tr>
<tr><td>PD26</td><td>0000h</td></tr>
<tr><td>PD27</td><td>0000h</td></tr>
<tr><td>PD28</td><td>0000h</td></tr>
<tr><td>PD29</td><td>0000h</td></tr>
<tr><td>PD30</td><td>0000h</td></tr>
<tr><td>PD31</td><td>0000h</td></tr>
<tr><td>PD32</td><td>0000h</td></tr>
</table>

5.5 Option setting parameters (No.Po□□)

POINT

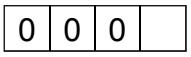
- The parameter whose symbol preceded by * can be validated with the following conditions.
  * : Turn off the power and then on again, or reset the controller after setting the parameter.
  **: Turn off the power and then on again after setting the parameter.

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 data (MR Configurator)	Common	0000h	
Po03	SGRD	Axis selection for graphing digtal data (MR Configurator)	Common	0000h	
Po04	**OOP2	Function selection O-2	Common	0000h	
Po05		This parameter is not used. Do not change the value.		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).  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 that communicates with MR Configurator 1: Axis that does not communicate with MR Configurator 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 digital data (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 that communicates with MR Configurator 1: Axis that does not communicate with MR Configurator 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

0 0 _ 0
Special servo motor combination
0: Normal combination
1: When using the servo amplifiers and the servo motors as shown below in combination in addition to the normal 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>
This parameter is dedicated to the servo amplifier whose software version is B2 or earlier. For the servo amplifier whose software version is B3 or later, this parameter setting is not required.</td><td>Common</td><td>0000h</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>Po05</td><td></td><td rowspan="12">This parameter is not used. Do not change the value.</td><td rowspan="12"></td><td>0000h</td><td rowspan="12"></td><td rowspan="12"></td></tr>
<tr><td>Po06</td><td></td><td>0000h</td></tr>
<tr><td>Po07</td><td></td><td>0000h</td></tr>
<tr><td>Po08</td><td></td><td>0000h</td></tr>
<tr><td>Po09</td><td></td><td>0000h</td></tr>
<tr><td>Po10</td><td></td><td>0000h</td></tr>
<tr><td>Po11</td><td></td><td>0000h</td></tr>
<tr><td>Po12</td><td></td><td>0000h</td></tr>
<tr><td>Po13</td><td></td><td>0000h</td></tr>
<tr><td>Po14</td><td></td><td>0000h</td></tr>
<tr><td>Po15</td><td></td><td>0000h</td></tr>
<tr><td>Po16</td><td></td><td>0000h</td></tr>
</table>

MEMO

6. GENERAL GAIN ADJUSTMENT

POINT

- Consider differences among machines, and adjust the gain. It is recommended that the amount of torque generated from the servo motor in operation be set to 90% of the maximum torque of the servo motor.
- The torque loop mode does not require the gain adjustment.

6.1 Different adjustment methods

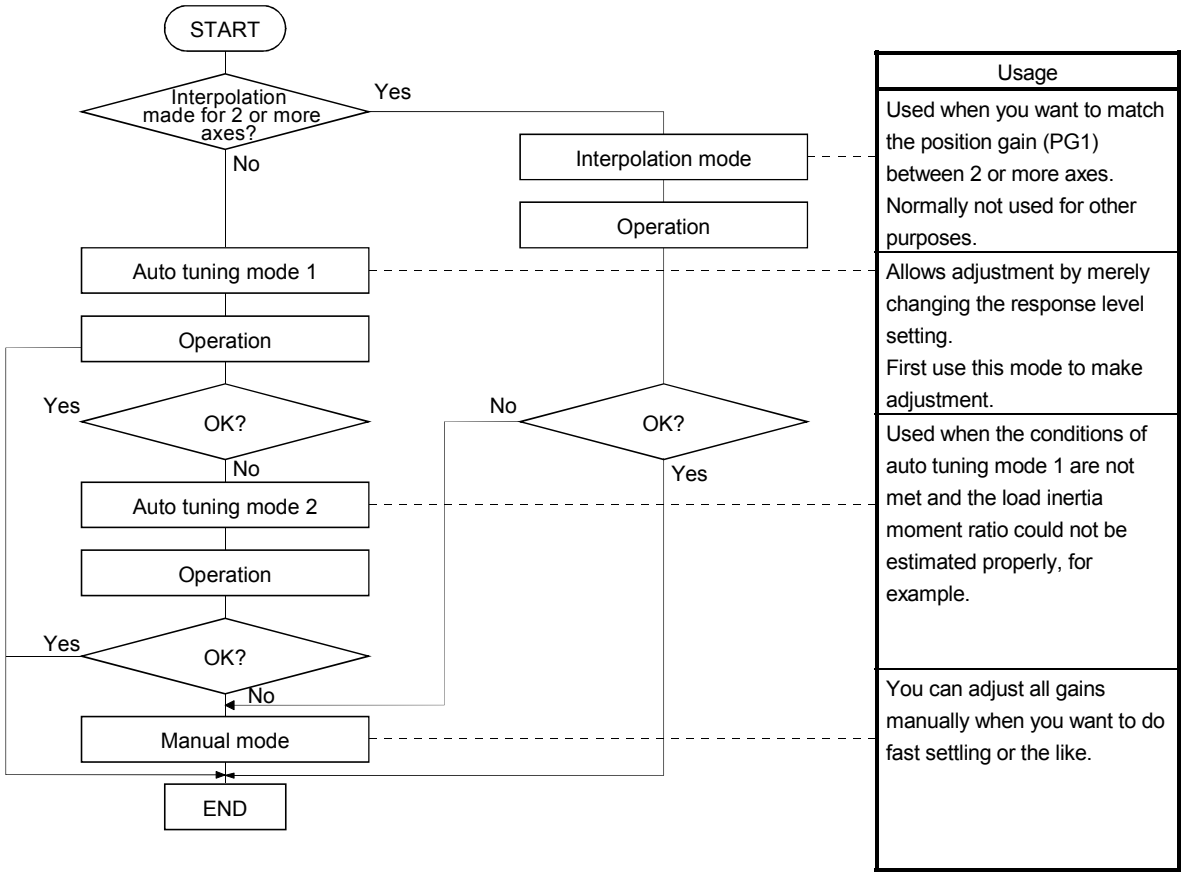
6.1.1 Adjustment on a single servo amplifier

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



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

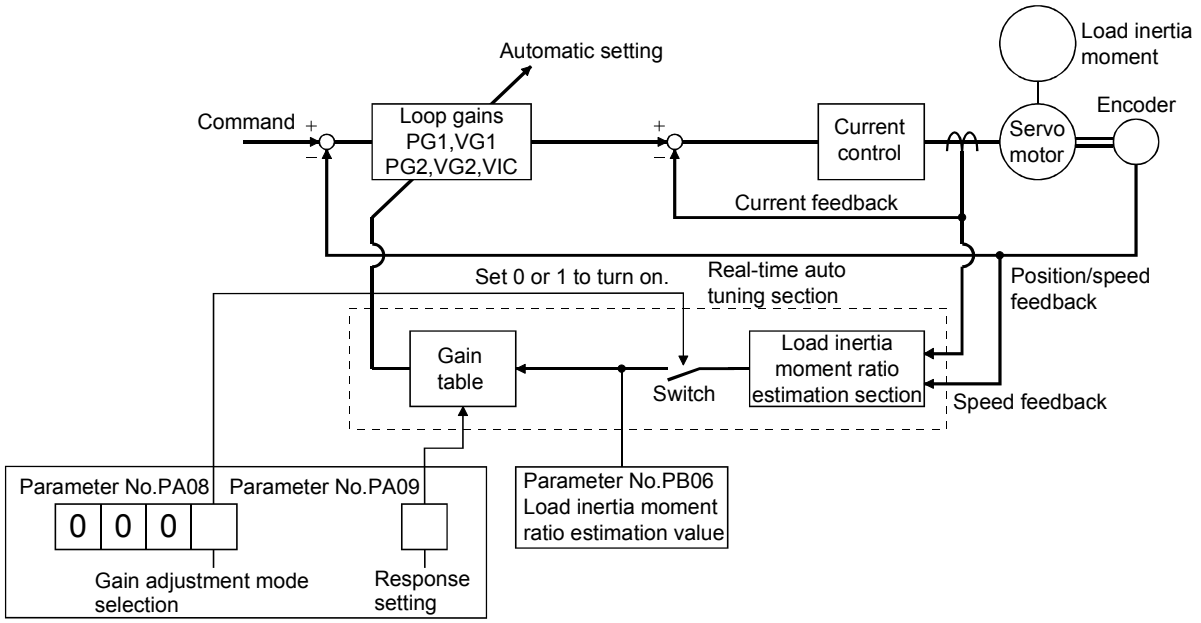
Use the auto tuning mode 2 when proper gain adjustment cannot be made by auto tuning mode 1. Since the load inertia moment ratio is not estimated in this mode, set the value of a correct load inertia moment ratio (parameter No.PB06).

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.



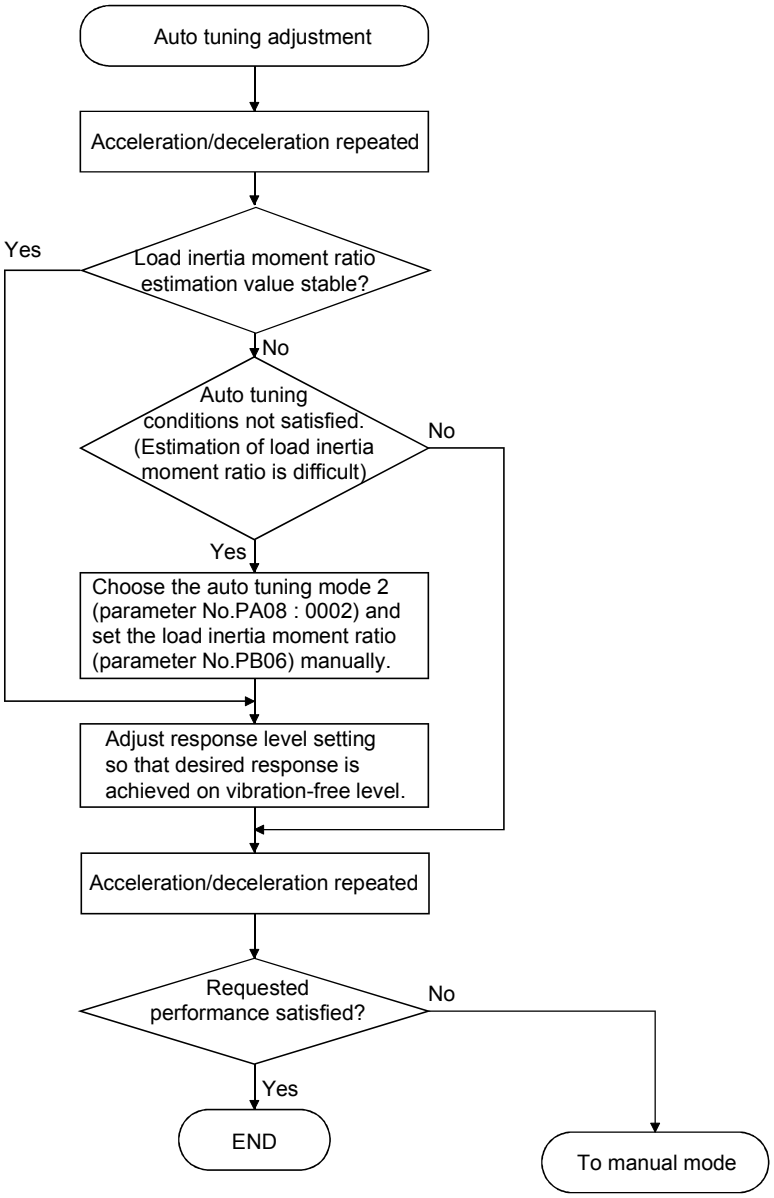
When a servo motor is accelerated/decelerated, the load inertia moment ratio estimation section always estimates the load inertia moment ratio from the current and speed of the servo motor. The results of estimation are written to parameter No.PB06 (the ratio of load inertia moment to servo motor). These 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

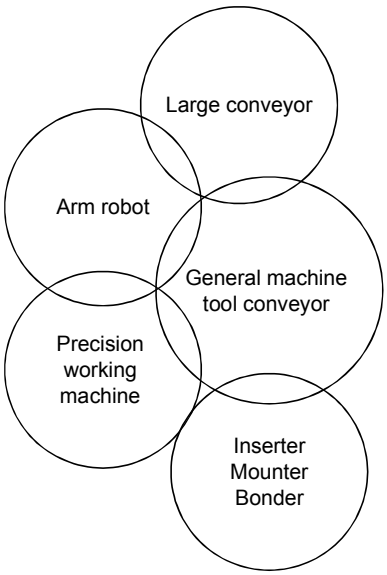
Since auto tuning is made valid before shipment from the factory, simply running the servo motor automatically sets the optimum gains that match the machine. Merely changing the response level setting value as required completes the adjustment. The adjustment procedure is as follows.



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.

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

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.

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

3) Position loop gain (PG2: Parameter No.PB08)
This parameter determines the response level to a disturbance to the position control loop. Increasing the value increases the response level to the disturbance, but a too high value will increase vibration of the mechanical system.

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

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 pulses value is determined by the following expression.

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

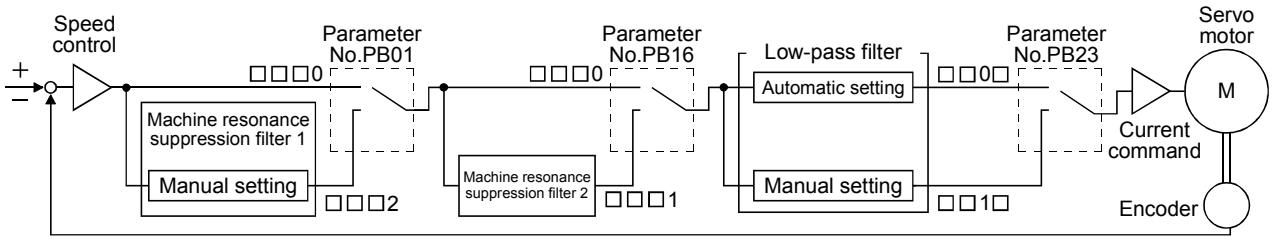
MEMO

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.

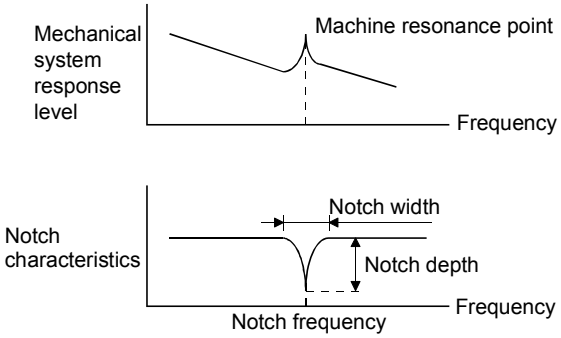
7.1 Function block diagram



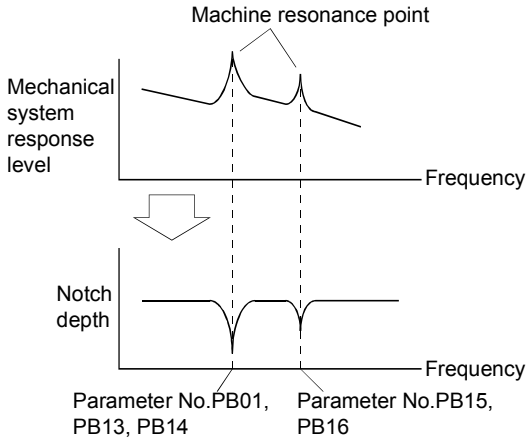
7.2 Machine resonance suppression filter

(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

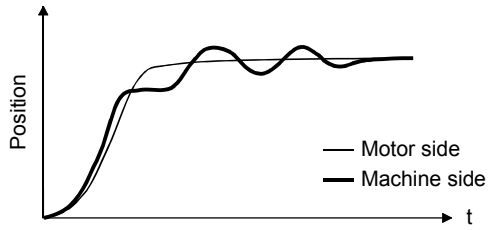
- The machine resonance suppression filter is a delay factor for the servo system. Hence, vibration may increase if you set a wrong resonance frequency or a too deep notch.
- If the frequency of machine resonance is unknown, decrease the notch frequency from higher to lower ones in order. The optimum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

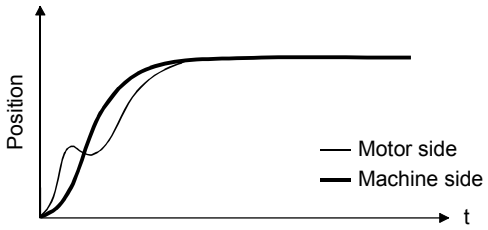
Measure work side vibration and device shake with the machine analyzer or external measuring instrument, and set the vibration suppression control vibration frequency (parameter No.PB19) and vibration suppression control resonance frequency (parameter No.PB20) to set vibration suppression control manually.

(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.

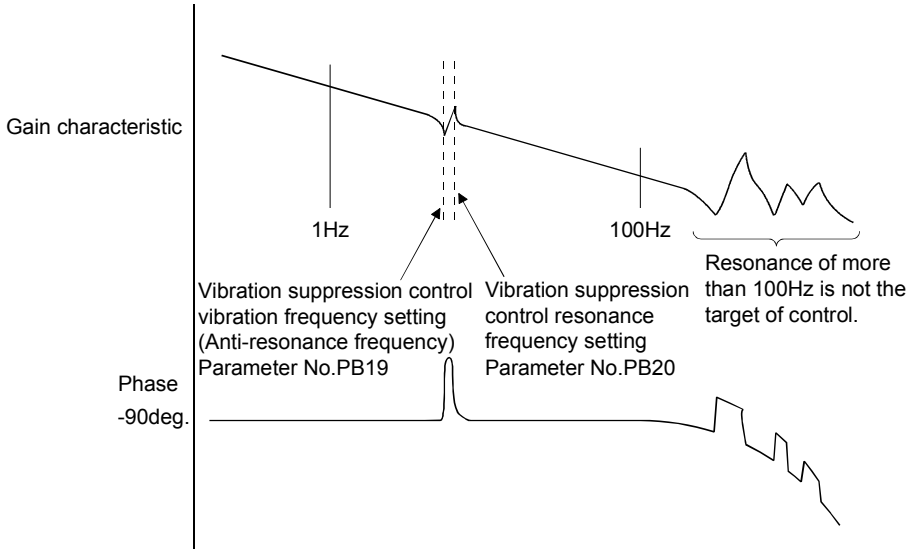
Parameter No.PB02

0	0	0	2

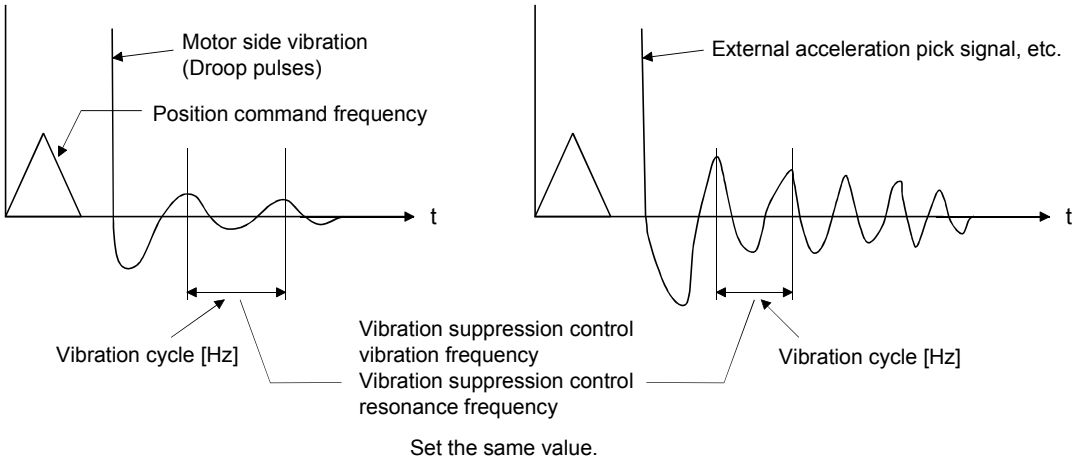
Manual setting

(3) Checking the vibration frequency and the resonance frequency

(a) When a vibration peak can be confirmed using MR Configurator, machine analyzer or external measuring instrument



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



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 measuring instrument, 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

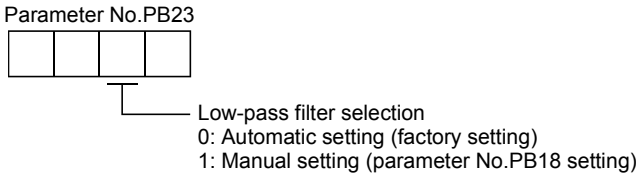
When a ball screw or the like is used, resonance of high frequency may occur as the response level of the servo system is increased. To prevent this, the low-pass filter is factory-set to be valid for a torque command. The filter frequency of this low-pass filter is automatically adjusted to the value 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.)



7.5 Gain changing function

This function can change the gains. The gains are switched by using the control instruction from the controller or gain switching conditions (including the servo motor speed).

7.5.1 Applications

This function is used when.

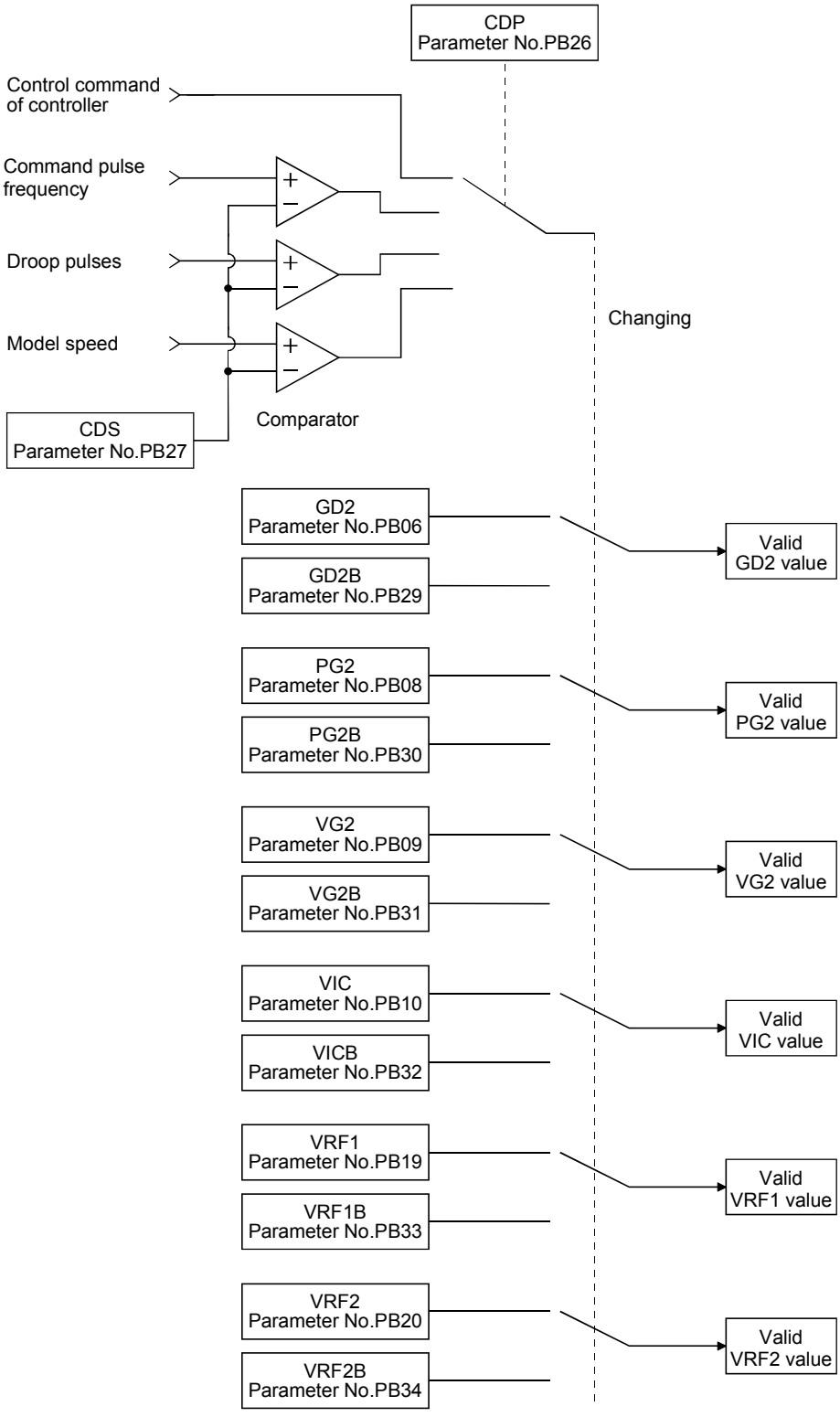
(1) You want to increase the gains during servo lock but decrease the gains to reduce noise during rotation.

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

(3) You want to change the gains by using the control instruction from the controller 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, GD2, VRF1 and VRF2 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.

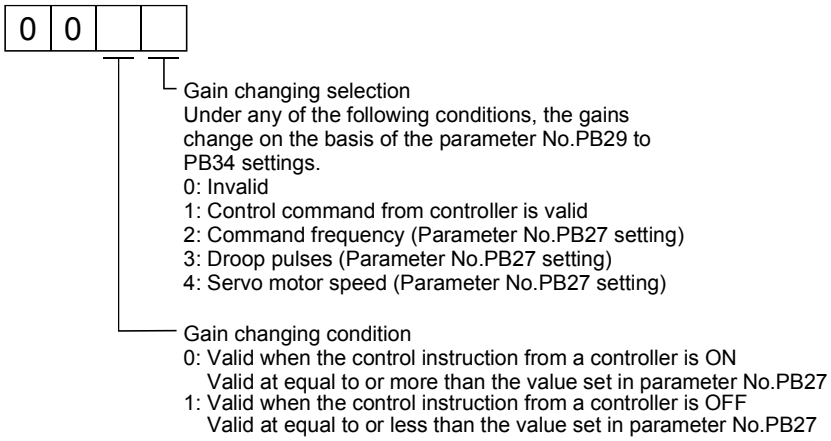
Parameter No.	Abbreviation	Name	Unit	Description
PB06	GD2	Load to motor inertia moment ratio	Multi-plier (×1)	Control parameters before changing
PB07	PG1	Model loop gain	rad/s	Position and speed gains of a model used to set the response level to a command. Always valid.
PB08	PG2	Position loop gain	rad/s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



(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

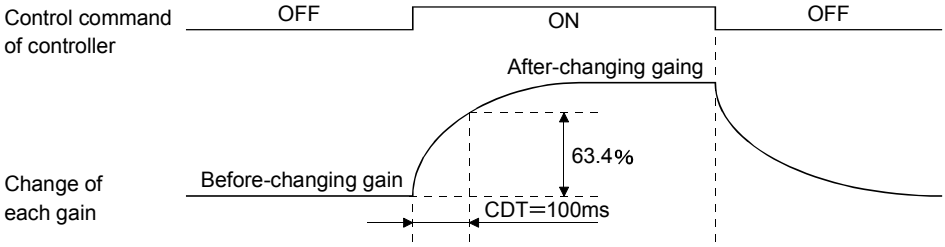
This operation will be described by way of setting examples.

(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

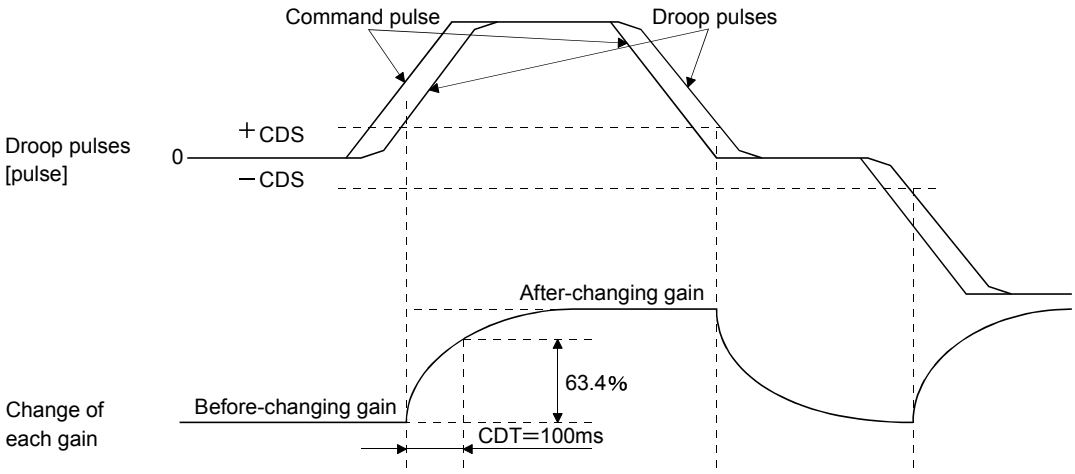
(2) When you choose changing by droop pulses

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 alarm with "Each axis" indicated in the "Stop method" column 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 an error 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)	Deceleration method when an alarm occurs (Note 5)	
			Power OFF→ON	Error reset	CPU reset			MR-J3W-22B to MR-J3W-1010B	MR-J3W-0303BN6 (Note 6)
Alarms	10	Undervoltage	○	○	○	Common	All axis	DB	EDB
	11	Switch setting error	○			Common	All axis	DB	FR
	12	Memory error 1 (RAM)	○			Common	All axis	DB	FR
	13	Clock error	○			Common	All axis	DB	EDB
	15	Memory error 2 (EEP-ROM)	○			Common	All axis	DB	EDB
	16	Encoder initial communication error 1	○			Each axis	Each axis	DB	FR
	17	Board error	○			Common	All axis	DB	EDB
	19	Memory error 3 (Flash-ROM)	○			Common	All axis	DB	FR
	1A	Motor combination error	○			Each axis	Each axis	DB	FR
	1E	Encoder initial communication error 2	○			Each axis	Each axis	DB	FR
	1F	Encoder initial communication error 3	○			Each axis	Each axis	DB	FR
	20	Encoder normal communication error 1	○			Each axis	Each axis	DB	EDB
	21	Encoder normal communication error 2	○			Each axis	Each axis	DB	EDB
	24	Main circuit error	○	○	○	Each axis	All axis	DB	FR
	25	Absolute position erase	○			Each axis	Each axis	DB	FR
	30	Regenerative error	(Note 1) ○	(Note 1) ○	(Note 1) ○	Common	All axis	DB	EDB (Note 7)
	31	Overspeed	○	○	○	Each axis	Each axis	DB	EDB
	32	Overcurrent	○			Each axis	All axis	DB	EDB (Note 8)
	33	Overvoltage	○	○	○	Common	All axis	DB	EDB
	34	SSCNET receive error 1	○	(Note 2) ○	○	Each axis	Each axis	DB	EDB
	35	Command frequency error	○	○	○	Each axis	Each axis	DB	EDB
	36	SSCNET receive error 2	○	○	○	Each axis	Each axis	DB	EDB
	37	Parameter error	○			Each axis	Each axis	DB	FR
	45	Main circuit device overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○	Common	All axis	DB	EDB
	46	Servo motor overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each axis	Each axis	DB	EDB
	47	Cooling fan error	○			Common	All axis	DB	FR

	Display	Name	Alarm deactivation			Detection method (Note 3)	Stop method (Note 4)	Deceleration method when an alarm occurs (Note 5)	
			Power OFF→ON	Error reset	CPU reset			MR-J3W-22B to MR-J3W-1010B	MR-J3W-0303BN6 (Note 6)
Alarms	50	Overload 1	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each axis	Each axis	DB	EDB
	51	Overload 2	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each axis	Each axis	DB	EDB
	52	Error excessive	○	○	○	Each axis	Each axis	DB	EDB
	8A	USB communication time-out error	○	○	○	Common	All axis	DB	EDB
	8E	USB communication error	○	○	○	Common	All axis	DB	EDB
	888	Watchdog	○			Common	All axis	DB	FR
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	DB	EDB
	E7	Controller forced stop warning				Common	All axis	DB	EDB
	E8	Cooling fan speed reduction warning				Common			
	E9	Main circuit off warning				Common	All axis	DB	FR
	EB	The other axis fault warning				Each axis	All axis	DB	EDB
	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 method is for enabled dynamic brake.
   DB: Dynamic brake deceleration
   EDB: Electronic dynamic brake deceleration
   FR: Coasting

6. When an alarm or warning occurs during servo-on, the deceleration method will be electronic dynamic brake.

7. When Regenerative transistor error (30.2) or Regenerative transistor feedback data error (30.3) occurs, it will be FR.

8. When Overcurrent detected at hardware detection circuit (during operation) (32.1) or Overcurrent detected at hardware detection circuit (during a stop) (32.3) occurs, it will be FR.

8.2 Troubleshooting at power on

POINT

- Refer to section 15.4.2 for MR-J3W-0303BN6.

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.☐)
- ・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 malfunction (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 circuit power has dropped. ・Voltage of the main circuit power has dropped.				
Display	Name	Cause		Checkpoint	Finding	Action
10.1	Voltage drop in the control circuit power	(1)	Connector for the control circuit power is disconnected or poorly connected.	Check the connector of the control circuit power.	Disconnected or poorly connected.	Connect properly.
					No problem found.	Check (2).
		(2)	Voltage of control circuit power is low.	Check if the control circuit power voltage is 160VAC or less.	160VAC or less.	Increase the voltage in the control circuit power.
					Over 160VAC.	Check (3).
		(3)	Instantaneous control circuit 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 Direct drive 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□" Direct drive motor: "□□6□"	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 Direct drive motor: on	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.	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.			
12.3	Custom IC RAM error	(1)	Part in the servo amplifier is faulty.			
		(2)	Fault is generated from the surrounding environment.			

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.	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.	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.	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.			
		(3)	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
16.3	Encoder receive data error 3	(1)	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 (2).
		(2)	The encoder cable is unplugged.	Check if the encoder cable is connected properly.	Not connected properly.	Connect properly.
					Connected properly.	Check (3).
		(3)	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 (4).
		(4)	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 (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.	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.	Check for noise, and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Encoder is faulty.	Replace the servo motor and check the reproducibility of the error.	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.			
		(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.			
		(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.	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.			
17.3	Custom IC error	(1)	Current detection circuit error.			
		(2)	Fault is generated from the surrounding environment.			
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.	Replace the servo motor and check the reproducibility of the error.	Reproduced.	Replace the servo motor.
					Not reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment.	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.	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.			
		(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.	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.	Check for noise, and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Encoder is faulty.	Replace the servo motor and check the reproducibility of the error.	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.			
		(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.			
		(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.	Check for noise and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Encoder is faulty.	Replace the servo motor and check the reproducibility of the error.	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.	Replace the servo motor and check the reproducibility of the error.	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.	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.			

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 circuit 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.	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.			
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.			
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.			

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				
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 circuit 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 the servo amplifier 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)	Fault is generated from the surrounding environment.	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.			

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.			
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.			

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.	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				
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 the servo amplifier 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.	Check for noise, etc.	Problem found.	Take countermeasure according to the cause.

Alarm No.37		Name: Parameter error				
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 the 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℃.	Check that surrounding air temperature is 55℃ or less.	Surrounding air temperature is over 55℃.	Lower the surrounding air temperature.
					Surrounding air temperature is 55℃ 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 heat sink.	Clean the cooling fan and heat sink, and check the reproducibility of the error.	Not reproduced.	Clean periodically.
					Reproduced.	Check (5).
		(5)	Servo amplifier is faulty.	Replace the servo amplifier and check the reproducibility of the error.	Not reproduced.	Use a properly operating servo amplifier.
45.5	Board temperature error	(1)	Surrounding air temperature is over 55℃.	Examine checkpoints described in the alarm display "45.1".		
		(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 heat sink.			
		(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	Encoder thermal sensor error	(1)	Surrounding air temperature of the servo motor is over 40℃.	Check the surrounding air temperature of the servo motor.	Surrounding air temperature is over 40℃.	Lower the surrounding air temperature of the servo motor.
					Surrounding air temperature is 40℃ or less.	Check (2).
		(2)	Servo motor is overloaded.	Check the effective load ratio with MR Configurator.	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 with MR Configurator.	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 phases.	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 with MR Configurator.	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 phases.	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 phases.	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 pulses 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 phases.	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.	Replace the servo motor and check the reproducibility of the error.	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				
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				
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.

Alarm No. 8E		Name: USB communication error				
Alarm description		・USB communication error occurs between the servo amplifier and a communication device (PC, etc.)				
Display	Name	Cause		Checkpoint	Finding	Action
8E.4	USB communication command error	(1)	Command not in the specification is transmitted.	Check the command code at transmission.	Command not in the specification is transmitted.	Modify the send command.
					Only commands 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.
8E.5	USB communication data No. error	(1)	Data No. not in the specification is transmitted.	Check the data No. at transmission.	Data No. not in the specification is transmitted.	Modify the send command.
					Only data No. in the specification is transmitted.	Check (2).
		(2)	Communication protocol is faulty.	Check that 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.

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.

Warning No. 91		Name: Main circuit device overheat warning			Stop method: Axes can operate (warning detected at both axes)	
Warning 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	(1)	The temperature inside of the servo amplifier is high.	Check the surrounding air temperature of the servo amplifier.	Surrounding temperature is high. (over 55℃)	Lower the surrounding air temperature.
					Surrounding temperature is low.	Check (2).
		(2)	Specification of close mounting is not met.	Check the specification of close mounting.	Specification not met.	Use according to the specification.
91.2	Board temperature warning	(1)	The temperature inside of the servo amplifier is high.	Examine checkpoints described in the alarm display "91.1".		
		(2)	Specification of close mounting is not met.			

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".		

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

Warning No. E4		Name: Parameter warning			Stop method: Axes can operate (detected at the corresponding axis)	
Warning 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	(1)	Parameter value set from the servo system controller is outside of the setting range.	Check the parameter set from the servo system controller.	Outside of the setting range.	Set a parameter within the range.

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

Warning No. E7		Name: Controller forced stop warning			Stop method: All axes stop	
Warning description		・Forced stop signal is input from the servo system controller.				
Display	Name	Cause		Checkpoint	Finding	Action
E7.1	Controller forced stop warning	(1)	Forced stop signal was input from the servo system controller.	Check if the servo system controller is in forced stop status.	In forced stop status.	Ensure safety and deactivate forced stop signal of the controller.

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.
E9.3	Ready-on signal on at main circuit off	(1)	Main circuit power is off.	Examine checkpoints described in the alarm display "E9.1".		
		(2)	Connector for the main circuit power is disconnected.			
		(3)	Bus voltage is below 215VDC.			

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.	Check the effective load ratio with MR Configurator.	Effective load ratio is large.	Reduce the load. Use servo amplifier and servo motor with larger capacities.

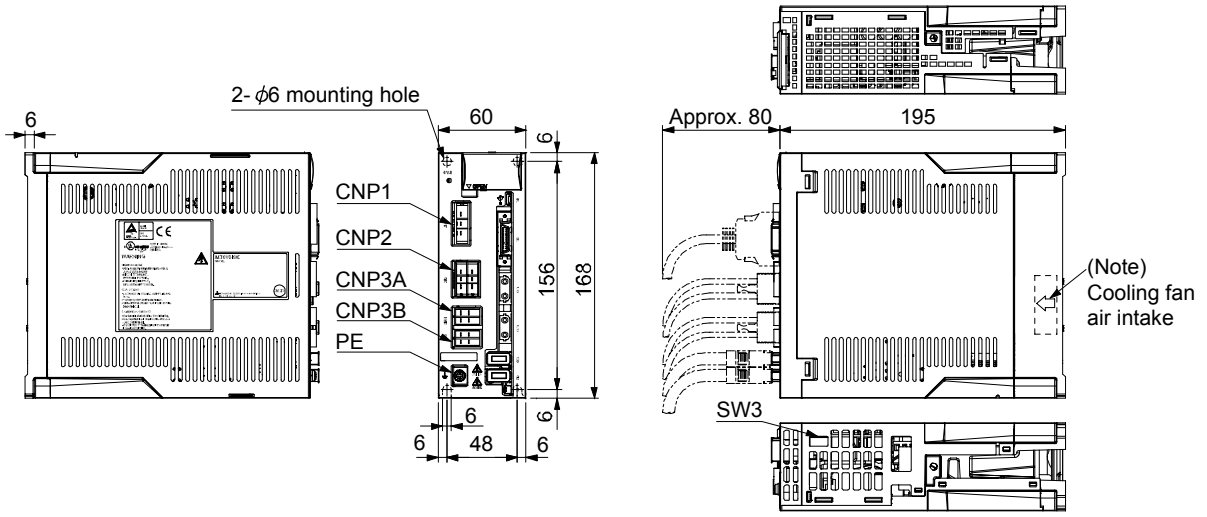
Warning No. ED		Name: Output watt excess warning			Stop method: Axes can operate (detected at the corresponding axis).	
Warning description		・The status, in which the output wattage (speed x torque) of the servo motor exceed the rated output, continues steadily.				
Display	Name	Cause		Checkpoint	Finding	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.

9. OUTLINE DRAWINGS

9.1 Servo amplifier

(1) MR-J3W-22B/MR-J3W-44B

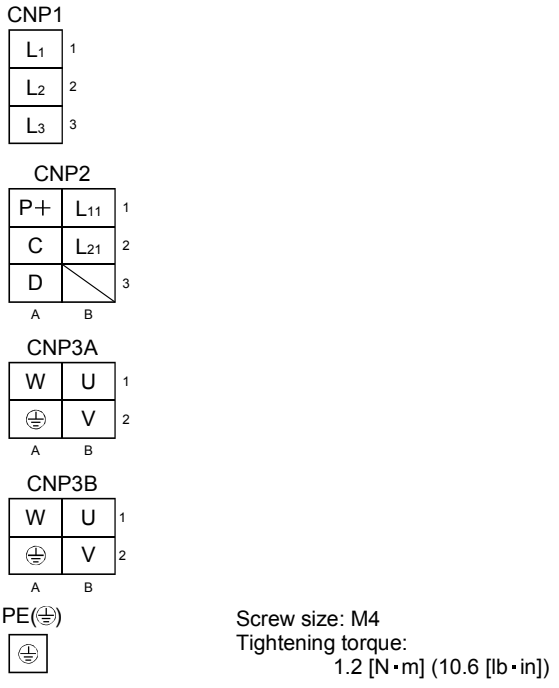
[Unit: mm]



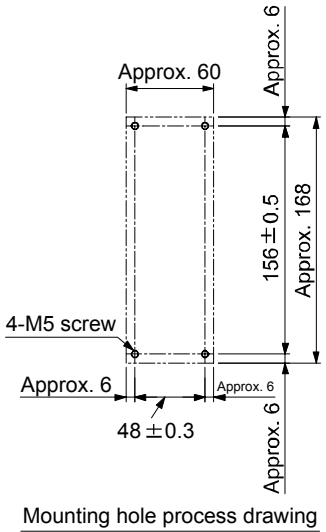
Note. Cooling fan is equipped only with MR-J3W-44B. It is not necessary to drill air holes on the control box surface for the cooling fan.

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

Terminal signal layout



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

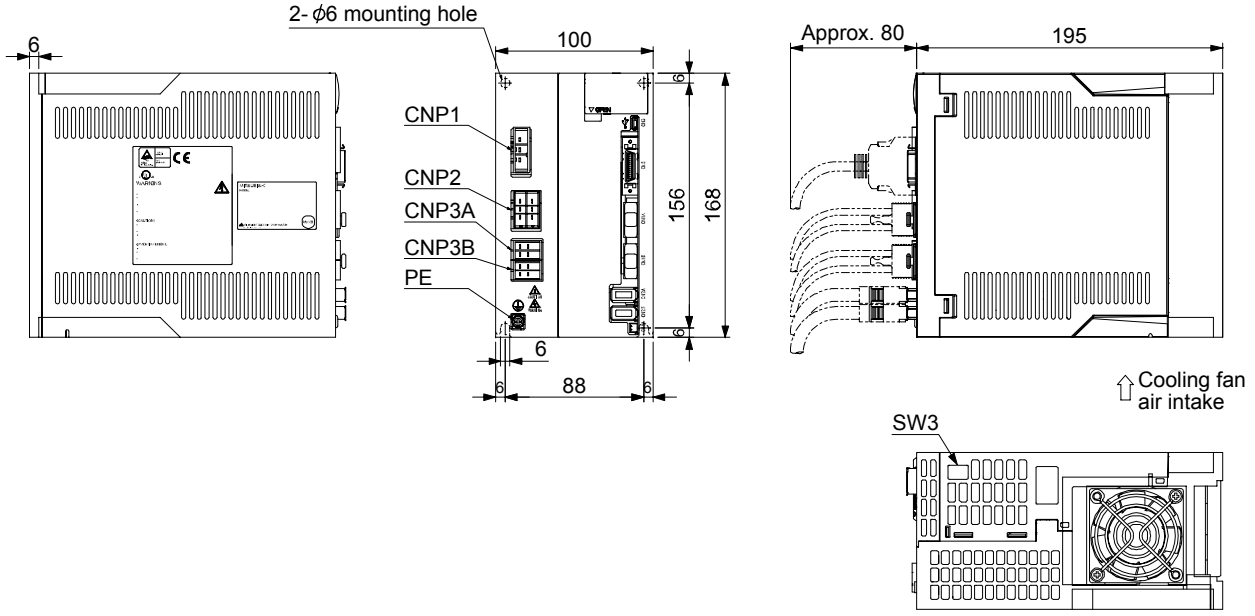


Mounting hole process drawing

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

(2) MR-J3W-77B/MR-J3W-1010B

[Unit: mm]



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

Terminal signal layout

CNP1

L_1	1
L_2	2
L_3	3

CNP2

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

CNP3A

W	U	1
⏚	V	2
A	B	

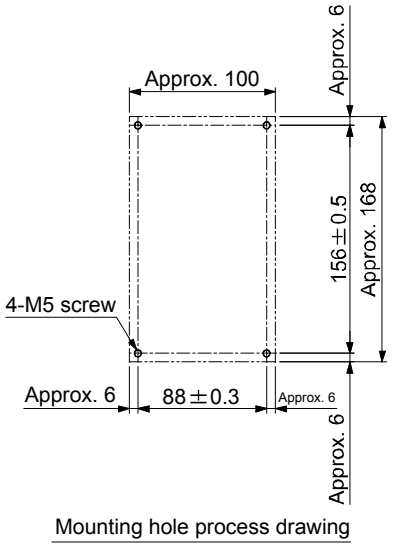
CNP3B

W	U	1
⏚	V	2
A	B	

PE(⏚)

⏚

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



Mounting hole process drawing

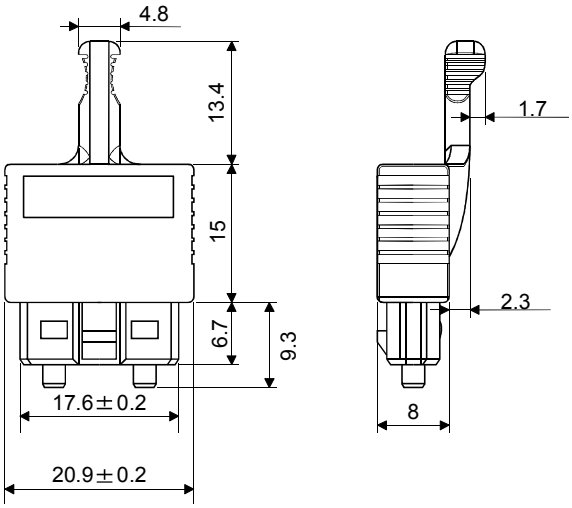
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N・m] (28.7 [lb・in])

9.2 Connector

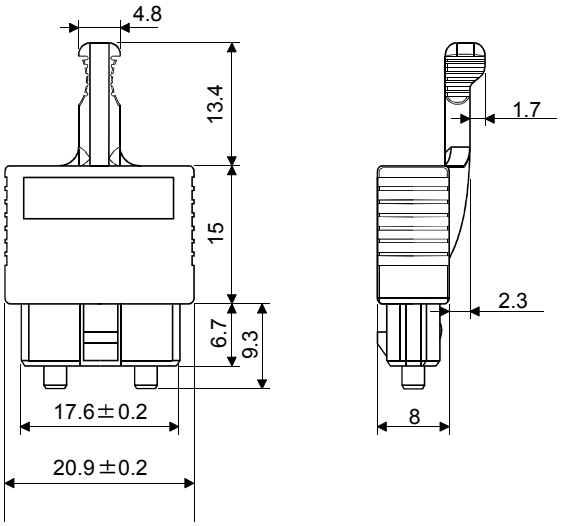
(1) CN1A・CN1B connector

[Unit: mm]

F0-PF2D103



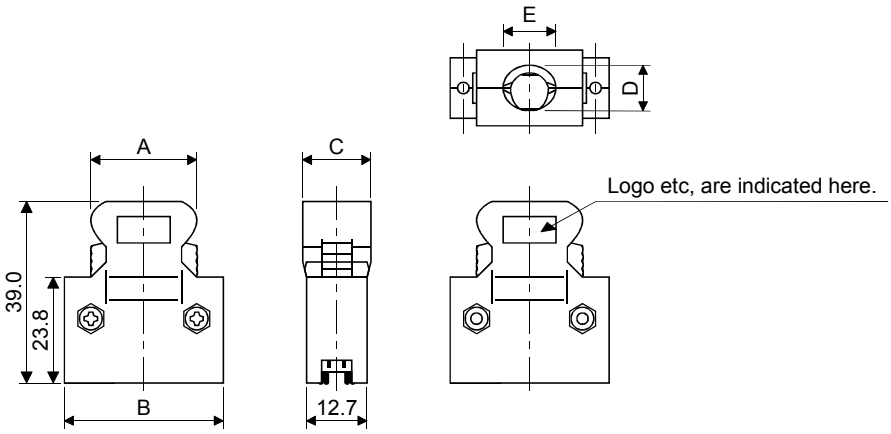
F0-PF2D103-S



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

(a) One-touch lock type

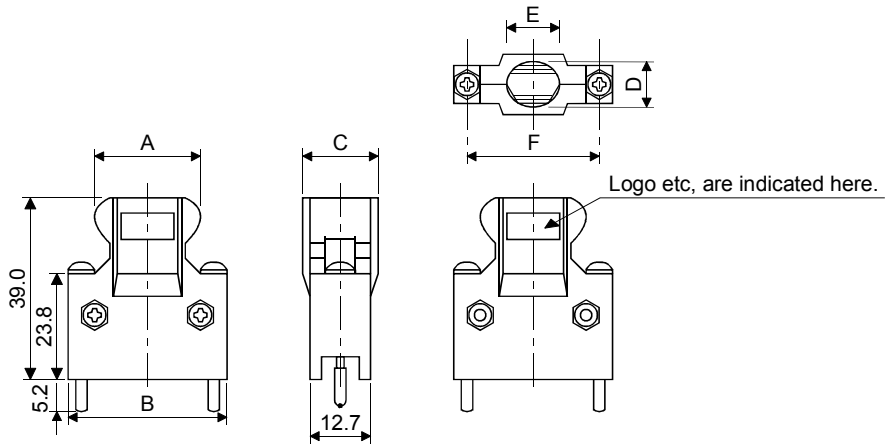
[Unit: mm]



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

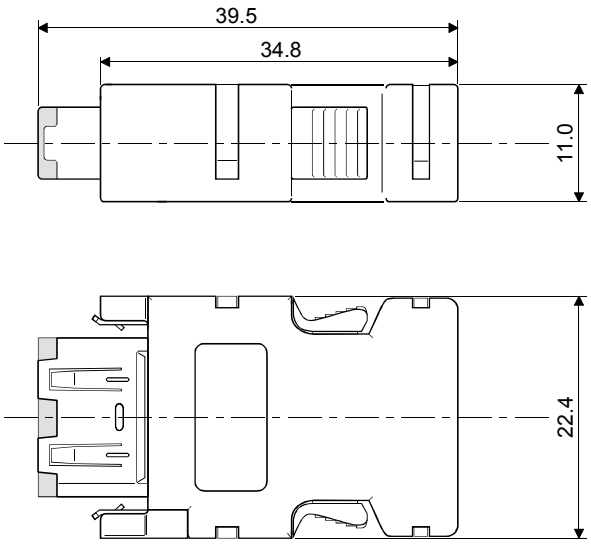
(b) Jack screw M2.6 type
This is not available as option.

[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

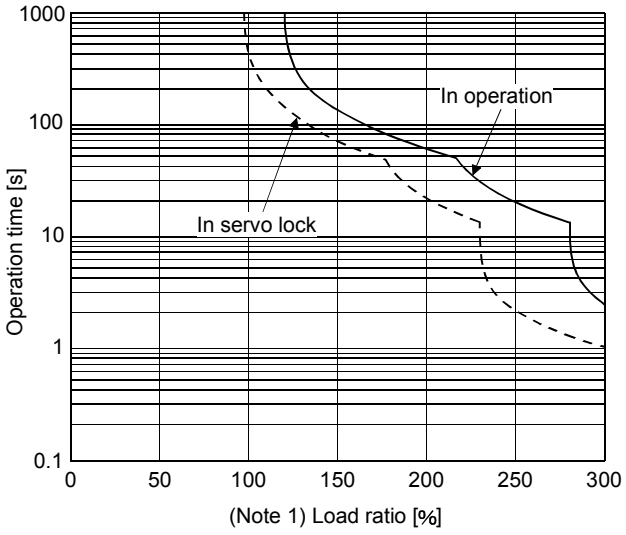
(3) SCR connector system (3M)
Receptacle: 36210-0100PL
Shell kit : 36310-3200-008



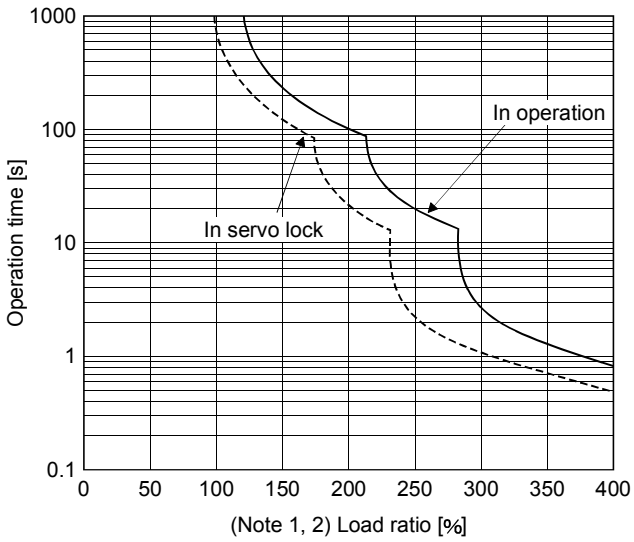
10. CHARACTERISTICS

10.1 Overload protection characteristics

An electronic thermal relay is built in the servo amplifier to protect the servo motor, the servo amplifier and the servo motor power lines 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-SP51/81/52/102
HC-UP72
HC-LP52/102
HF-JP53/73/103

Note 1. If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor stop status (servo lock status) or in a 30r/min or less low-speed operation status, the servo amplifier may fail even when the electronic thermal relay protection is not activated.
2. The operation time at the load ratio of 300 to 400 applies when the maximum torque of HF-JP servo motor is increased to 400.

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 [m^2]
		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-SP81	3.0	90	15	1.8
HF-SP52	2.0	55	15	1.1
HF-SP102	3.4	90	15	1.8
HC-LP52	2.0	55	15	1.1
HC-LP102	3.4	90	15	1.8
HC-UP72	2.6	85	15	1.7
HF-JP53	2.0	55	15	1.1
HF-JP73	2.6	85	15	1.7
HF-JP103	3.4	90	15	1.8

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 AC reactor is not used.

2. Heat generated during regeneration is not included in the servo amplifier-generated heat. To calculate heat generated by the regenerative option, refer to section 11.2.

(2) Heat dissipation area for 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°C at the ambient temperature of 40°C. (With a 5°C (41°F) safety margin, the system should operate within a maximum 55°C (131°F) limit.) The necessary enclosure heat dissipation area can be calculated by Equation 10.1.

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

where, A : Heat dissipation area [m^2]
P : Loss generated in the control box [W]
ΔT : Difference between internal and ambient temperatures [°C]
K : Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with Equation 10.1, assume that P is the sum of all losses generated in the 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°C (104°F) under rated load.

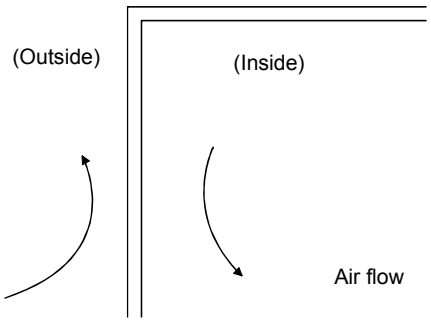


Fig. 10.2 Temperature distribution in enclosure

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.
- For a machine operating at the recommended load to motor inertia ratio or less, the estimated number of usage times of the dynamic brake is 1000 times while the machine decelerates from the rated speed to a stop once in 10 minutes.
- Be sure to 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.)

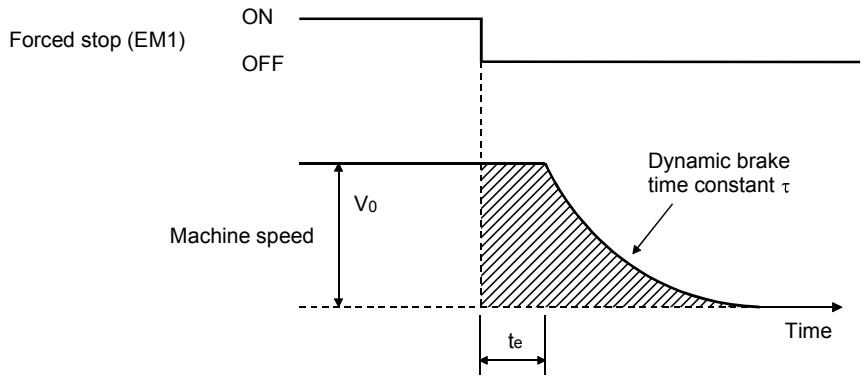


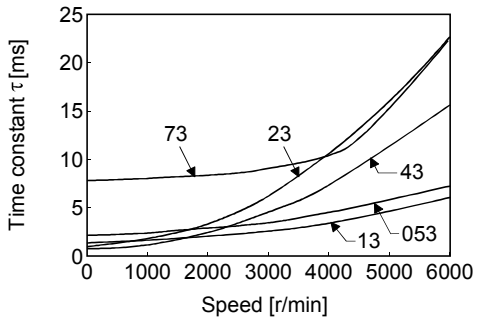
Fig. 10.3 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ te + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \quad (10.2)$$

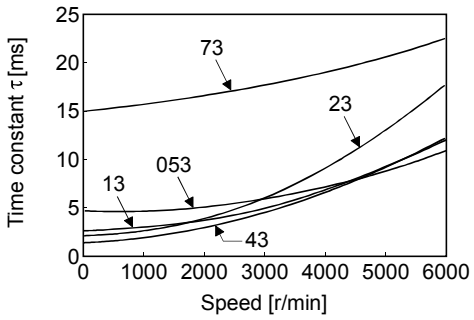
L_{max} : Maximum coasting distance ..... [mm][in]
Vo : Machine rapid feed rate .....[mm/min][in/min]
J_M : Servo motor inertial moment.....[$\times 10^{-4}$ kg・m^2][oz・in^2]
J_L : Load inertia moment converted into equivalent value on servo motor shaft ....[$\times 10^{-4}$ kg・m^2][oz・in^2]
τ : Dynamic brake time constant .....[s]
te : Delay time of control section..... [s]
There is internal relay delay time of about 10ms.

(2) Dynamic brake time constant

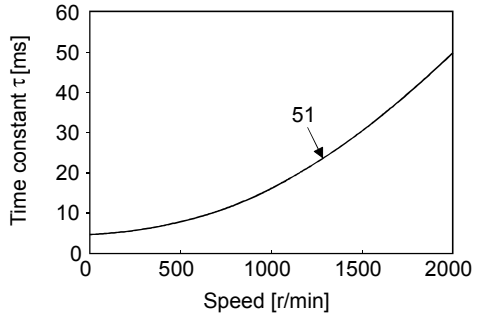
The following shows necessary dynamic brake time constant τ for the equations (10.2).



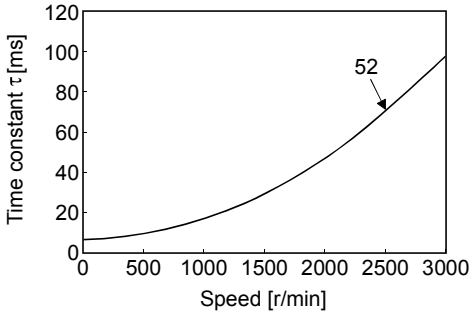
HF-MP series



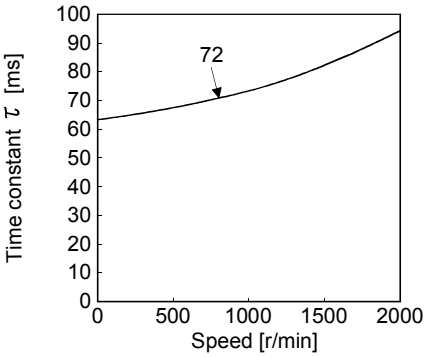
HF-KP series



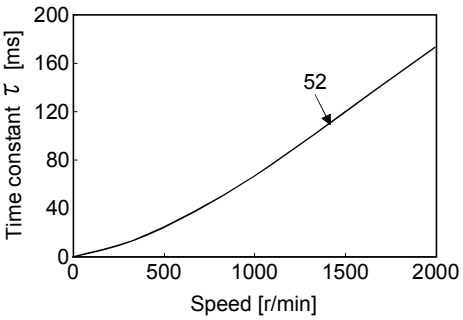
HF-SP1000r/min series



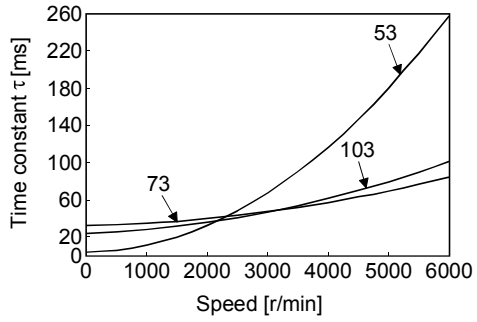
HF-SP2000r/min series



HC-UP series



HC-LP series



HF-JP3000r/min series

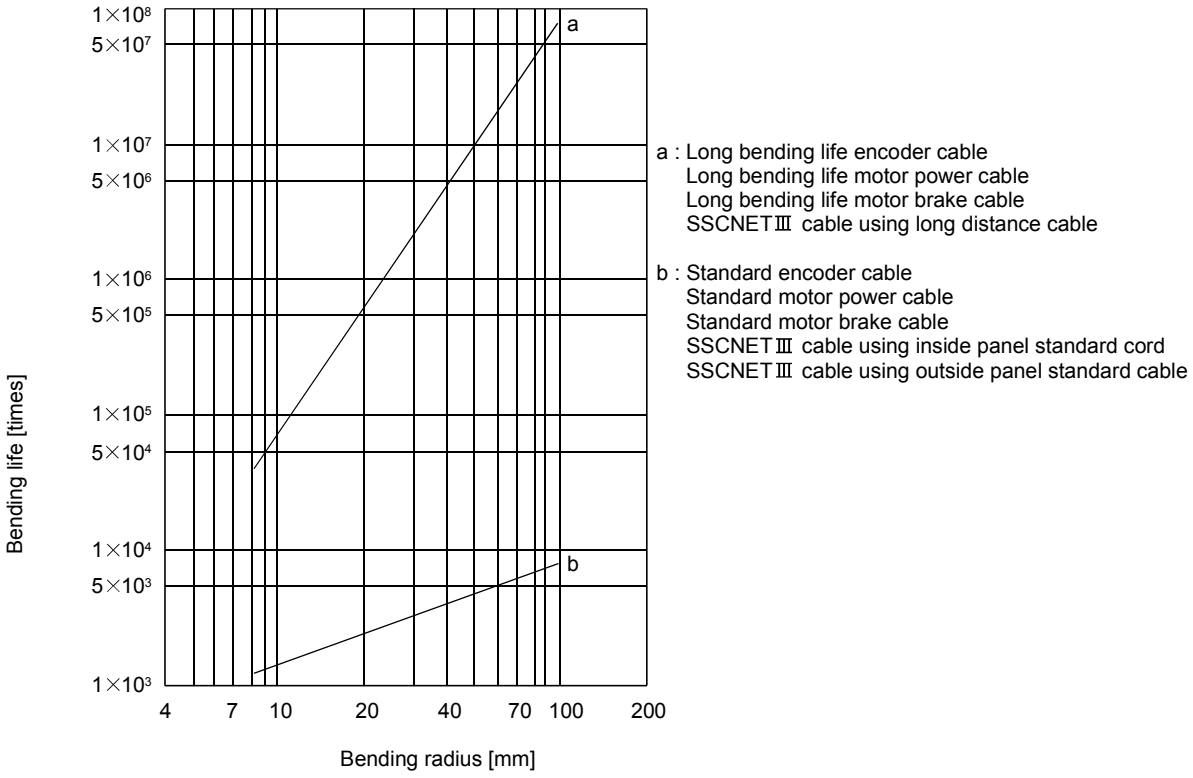
10.3.2 The dynamic brake at the load inertia moment

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	
HF-JP	

10.4 Cable bending life

The bending life of the cables is shown below. This graph calculated values. Since they are not guaranteed values, provide a little allowance for these values.



10.5 Inrush currents at power-on of main circuit and control circuit

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. Even when you use a 1-phase 200VAC power supply with MR-J3W-22B and MR-J3W-44B, the inrush currents of the main circuit power supply is the same.

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)	
MR-J3W-1010B		

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.

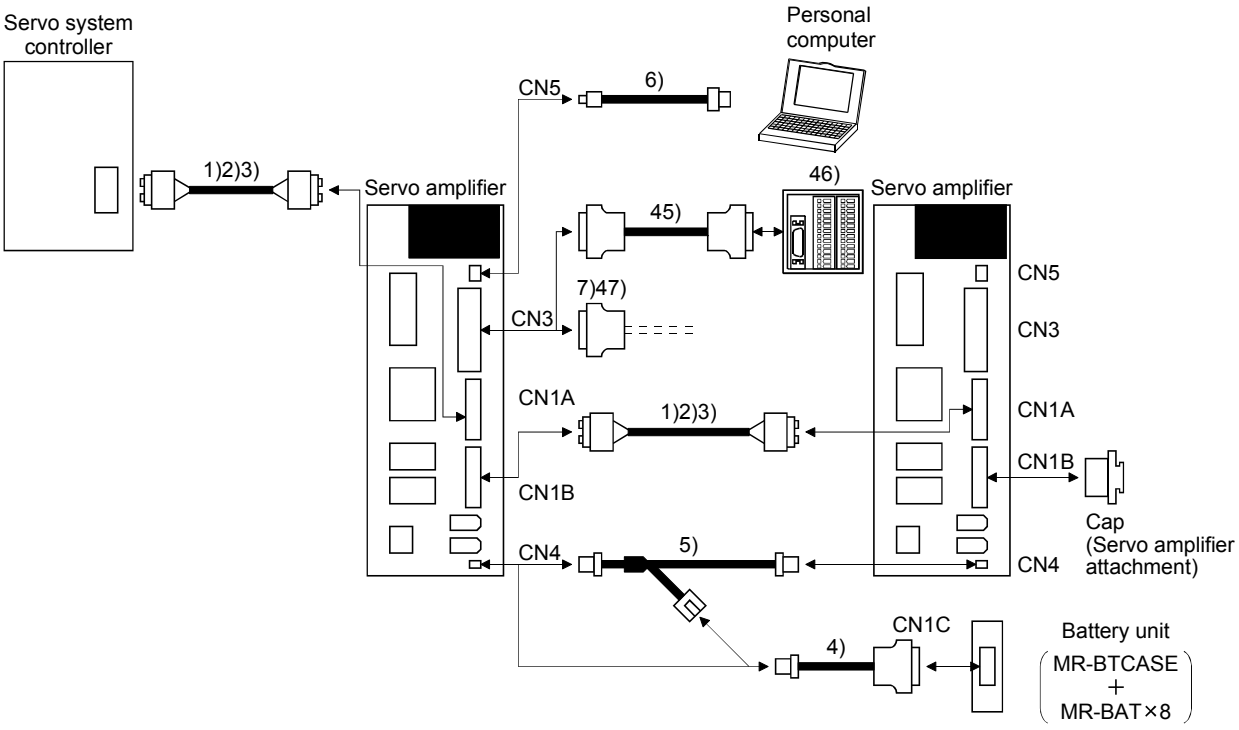
11.1 Cable/connector sets

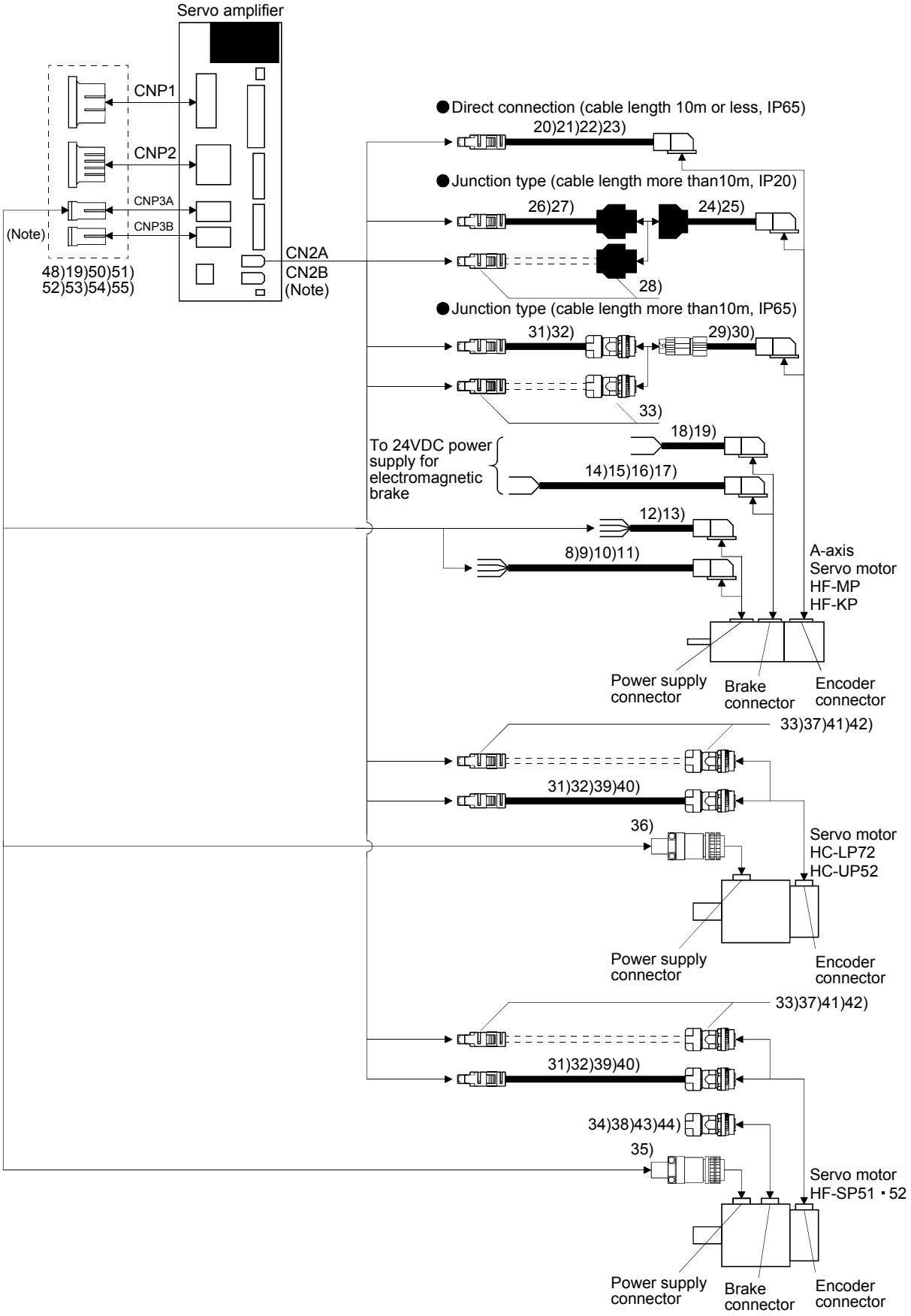
POINT

・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.

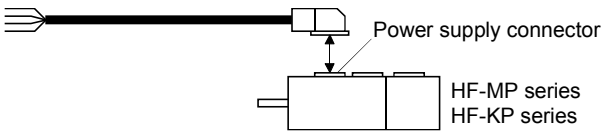
As the cables and connectors used with this servo, purchase the options indicated in this section.

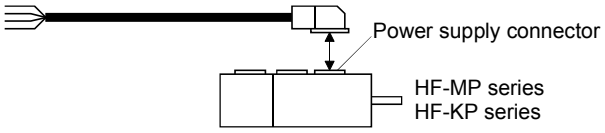
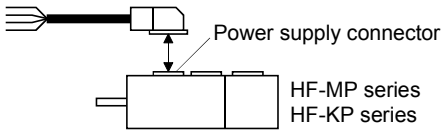
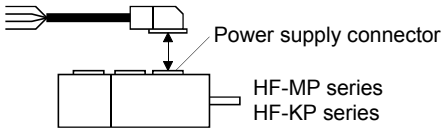
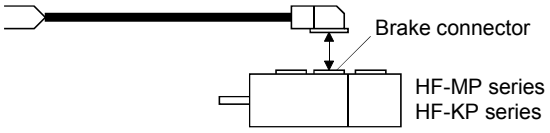
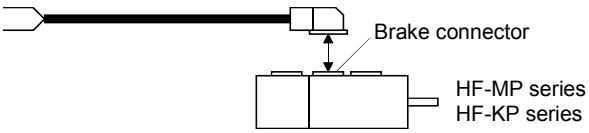
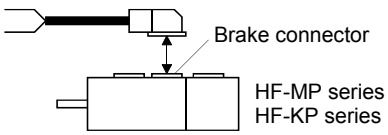
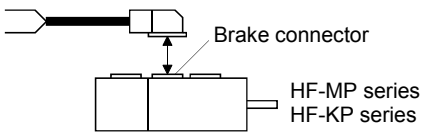
11.1.1 Combinations of cable/connector sets

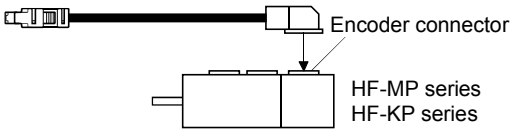
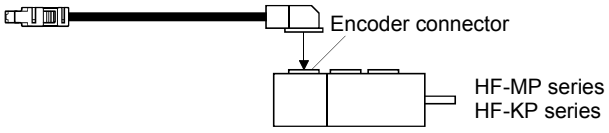
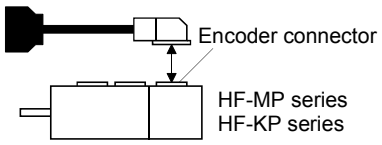
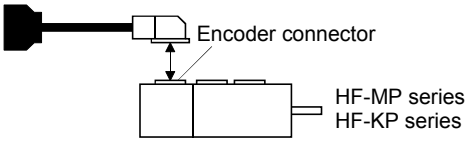
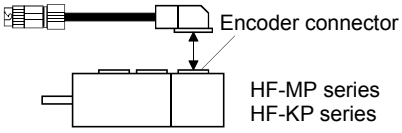
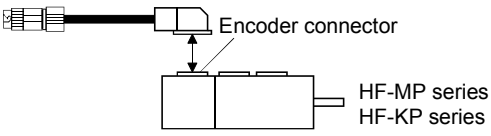


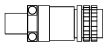
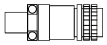


Note. B-axis options are the same as the A-axis options.

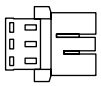
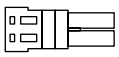
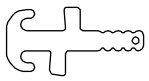
(Note 1) No.	Product	Model	Description	Application
1)	SSCNETⅢ cable	MR-J3BUS□M Cable length: 0.15 to 3m (Refer to section 11.1.5.)	Connector: PF-2D103 (Japan Aviation Electronics Industry, Ltd.) Connector: PF-2D103 (Japan Aviation Electronics Industry, Ltd.)	Inside panel standard cord
2)	SSCNETⅢ cable	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 mini-B 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 EN compliant
9)	Motor power supply cable	MR-PWS1CBL □ M-A1-H Cable length: 2・5・10m		IP65 Load side lead Long bending life EN compliant

(Note 1) No.	Product	Model	Description	Application
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 EN compliant
11)	Motor power supply cable	MR-PWS1CBL ☐ M-A2-H Cable length: 2・5・10m		IP65 Opposite-to-load side lead Long bending life EN compliant
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 EN compliant
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 EN compliant
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 bending 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 bending 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

(Note 1) No.	Product	Model	Description	Application
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 Load side lead Long bending life
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 bending 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		IP20
27)	Encoder cable	MR-EKCBL ☐ M-H Cable length: 20・30・40・50m	For HF-MP・HF-KP series Refer to section 11.1.2 (2) for details.	IP20 Long bending 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

(Note 1) No.	Product	Model	Description	Application
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 bending life
33)	Encoder connector set	MR-J3SCNS	  Refer to section 11.1.2 (5) for details.	IP67
34)	Brake connector set	MR-BKCNS1	Straight plug: CMV1-SP2S-L Socket contact: CMV1-#22BSC-S2-100 (DDK)  For HF-SP series For HF-JP series	IP67
35)	Power supply connector set	MR-PWCNS4	Plug: CE05-6A18-10SD-D-BSS Cable clamp: CE3057-10A-1-D (DDK) Example of applicable cable Applicable wire size: 2 to 3.5mm^2 (AWG1 to AWG12) Cable finish ϕD: ϕ10.5 to 14.1mm  For HF-SP series For HF-JP series	IP67 EN compliant
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: 2 to 3.5mm^2 (AWG14 to AWG12) Cable finish: ϕ9.5 to 13mm  For HC-UP72 For HC-LP52	IP65 EN compliant
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: CMV1-AP2S-L Socket contact: CMV1-#22BSC-S2-100 (DDK)  For HF-SP series For HF-JP series	IP67
39)	Encoder cable	MR-J3ENSCBL □ M-L-S06 Cable length: 2・5・10・20・30m	 For HF-SP/HC-UP/HC-LP/HF-JP 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 bending life (Note 2)

(Note 1) No.	Product	Model	Description	Application
41)	Encoder connector set	MR-J3SCNS-S06	  For HF-SP/HC-UP/HC-LP/HF-JP 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/HF-JP series Refer to section 11.1.2 (5) for details.	IP67 (Note 2)
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: 1.25 to 2.0mm^2 (AWG16 to AWG14) Insulator OD: 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: 1.25 to 2.0mm^2 (AWG16 to AWG14) Insulator OD: 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 set 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: 0.75 to 1.25mm^2 (AWG19 to AWG16) Insulator OD: 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 set when the MR-PWS1CBL□M-□ is not used.  For CNP3A/CNP3B Receptacle housing: F35FDC-04V-K Receptacle contact: BF3F-71GF-P2.0 (Japan Solderless Terminals) Compatible cable example Cable size: 1.25 to 2.0mm^2 (AWG16 to AWG14) Insulator OD: 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
54)	Connector set	MR-J3WCNP123-SP	Items for 1 servo amplifier  CNP1 connector Quantity: 1 Connector: 03JFAT-SAXGFK-43 (Japan Solderless Terminals) Applicable wire size: AWG16 to AWG14  CNP2 connector Quantity: 1 Model: 06JFAT-SAXYGG-F-KK (Japan Solderless Terminals) Applicable wire size: AWG16 to AWG14	For 1 servo amplifier
55)	Connector set	MR-J3WCNP123-SP-10P	 CNP3A/CNP3B connector Quantity: 2 Model: 04JFAT-SAGG-G-KK (Japan Solderless Terminals) Applicable wire size: AWG19 to AWG14  Open tool Quantity: 1 Model: J-FAT-OT-EXL (Japan Solderless Terminals)	For 10 servo amplifier

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.

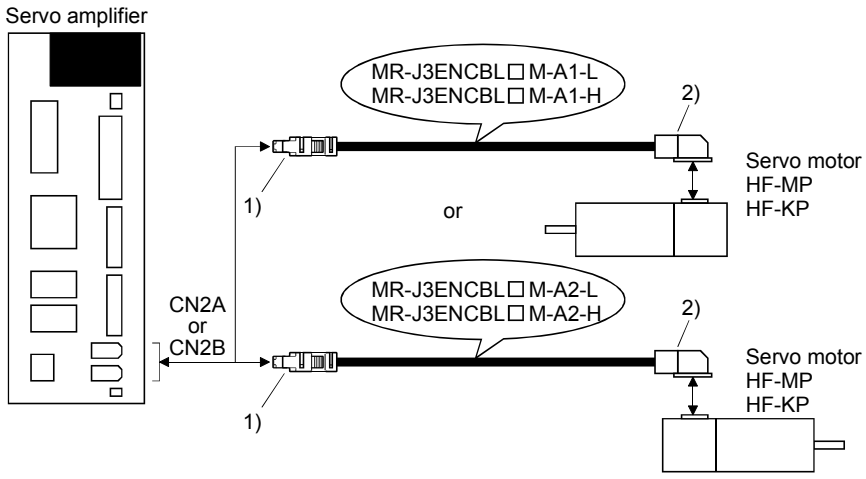
11.1.2 Encoder cable/connector sets

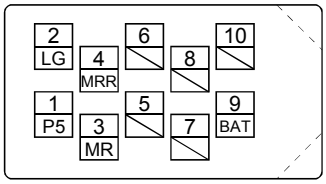
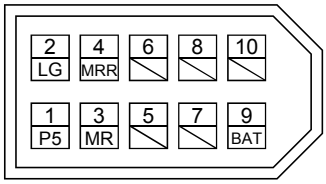
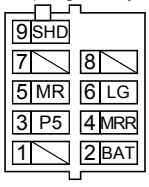
(1) MR-J3ENCBL□M-A1-L/H・MR-J3ENCBL□M-A2-L/H

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.

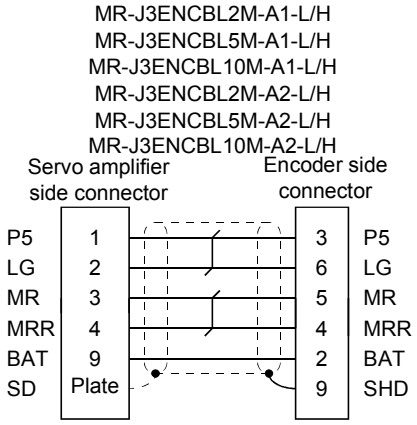
Cable model	Cable length			IP rating	Bending life	Application
	2m	5m	10m			
MR-J3ENCBL□M-A1-L	2	5	10	IP65	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-J3ENCBL□M-A1-H	2	5	10	IP65	Long bending life	
MR-J3ENCBL□M-A2-L	2	5	10	IP65	Standard	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-J3ENCBL□M-A2-H	2	5	10	IP65	Long bending life	

(a) Connection of servo amplifier and servo motor



Cable model	1) For CN2 connector	2) For encoder connector
MR-J3ENCBL□M-A1-L MR-J3ENCBL□M-A1-H MR-J3ENCBL□M-A2-L MR-J3ENCBL□M-A2-H	Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) Connector set: 54599-1019 (Molex) (Note) Signal layout  View seen from wiring side. or (Note) Signal layout  View seen from wiring side. Note. Keep open the pins shown with ⊘. Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.	Connector: 2174053-1 Crimping tool for ground clip: 1596970-1 Crimping tool for receptacle contact: 1596847-1 (TE Connectivity) (Note) Signal layout  View seen from wiring side. Note. Keep open the pin shown with an ⊘.

(b) Cable internal wiring diagram



(2) MR-EKCBL□M-L/H

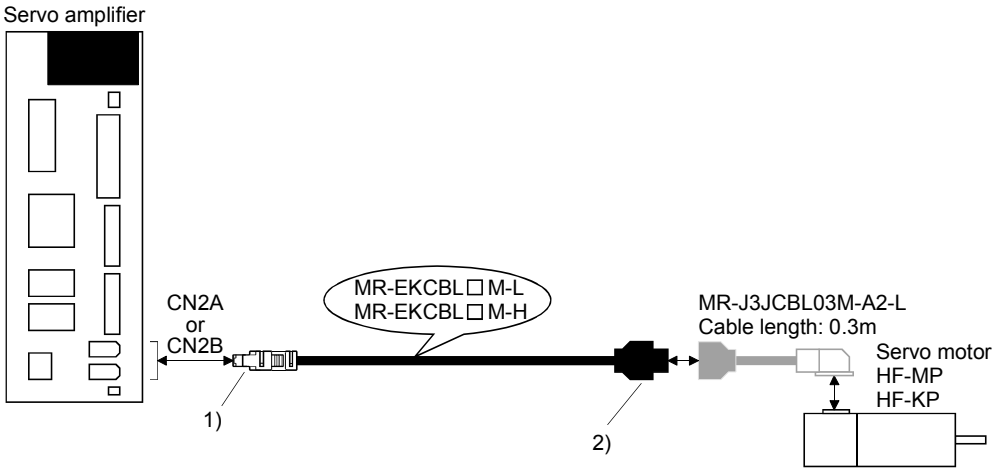
POINT
▪ The following encoder cables are of four-wire type. When using any of these encoder cables, set parameter No.PC04 to "1□□□" to select the four-wire type. MR-EKCBL30M-L MR-EKCBL30M-H MR-EKCBL40M-H MR-EKCBL50M-H

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	Bending life	Application
	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 bending life	

Note. Four-wire type cable.

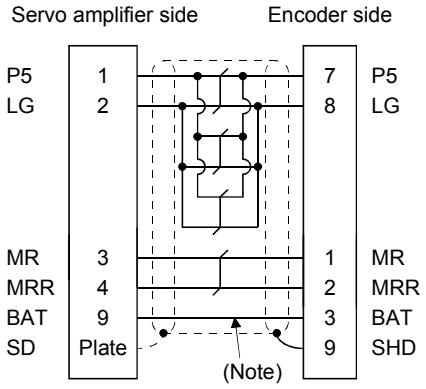
(a) Connection of servo amplifier and servo motor



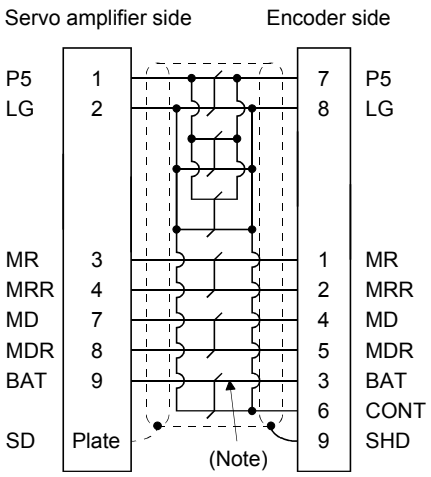
Cable model	1) For CN2 connector	2) For encoder connector
MR-EKCBL☐M-L MR-EKCBL☐M-H	Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) Connector set: 54599-1019 (Molex) (Note) Signal layout 2 LG, 4 MRR, 6, 8 MDR, 10, 1 P5, 3 MR, 5, 7 MD, 9 BAT View seen from wiring side. or (Note) Signal layout 2 LG, 4 MRR, 6, 8 MDR, 10, 1 P5, 3 MR, 5, 7 MD, 9 BAT 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 (TE Connectivity or equivalent) Cable clamp: MTI-0002 (Toa Electric Industry) Signal layout 1 MR, 2 MRR, 3 BAT, 4 MD, 5 MDR, 6 CONT, 7 P5, 8 LG, 9 SHD View seen from wiring side. Note. Keep open the pin shown with an ⍁.

(b) Internal wiring diagram

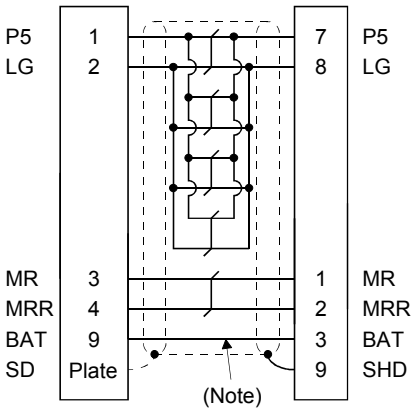
MR-EKCBL20M-L



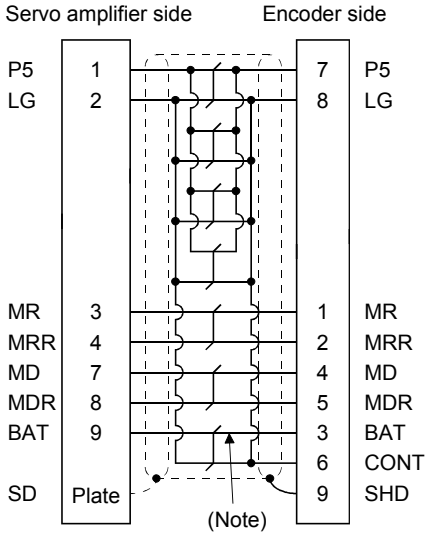
MR-EKCBL30M-L



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 bending life	Applicable wiring diagram	
	Less than 30m	30m to 50m
Standard	MR-EKCBL20M-L	MR-EKCBL30M-L
Long bending 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.

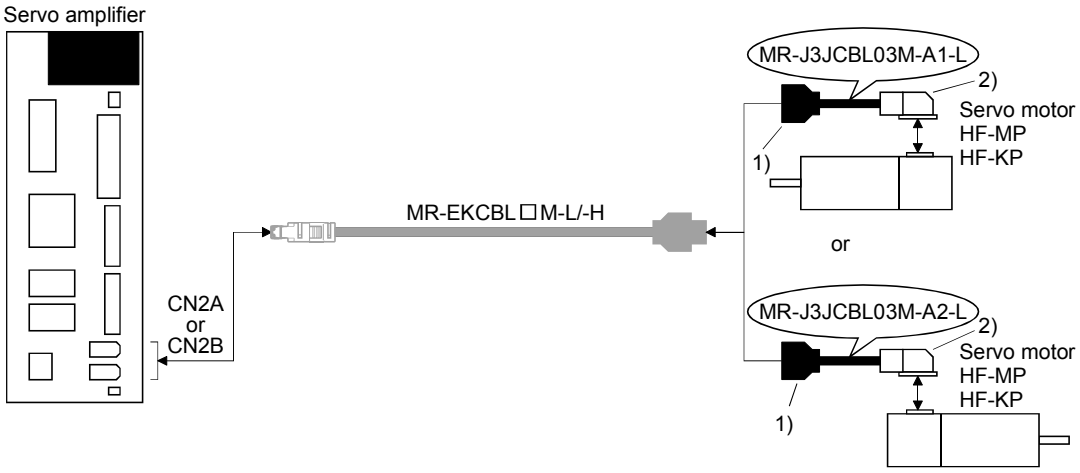
Parts/tool	Description	
Connector set	MR-ECNM	
		
	Servo amplifier side connector Receptacle: 36210-0100PL Shell kit: 536310-3200-008 (3M) Or Connector set: 54599-1019(Molex)	Encoder side connector Housing: 1-172161-9 Connector pin: 170359-1 (Tyco Electronics or equivalent) Cable clamp: MTI-0002 (Toa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

(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.

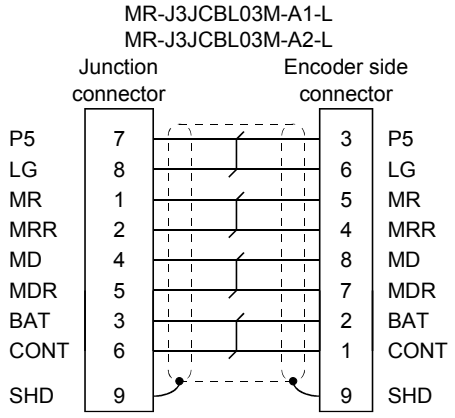
Cable model	Cable length	IP rating	Bending life	Application
MR-J3JCBL03M-A1-L	0.3m	IP20	Standard	For HF-MP・HF-KP servo motor Load side lead Use in combination with MR-EKCBL□M-L/H.
MR-J3JCBL03M-A2-L				For HF-MP・HF-KP servo motor Opposite-to-load side lead Use in combination with MR-EKCBL□M-L/H.

(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 (TE Connectivity) Signal layout 3 2 1 BAT MRR MR 6 5 4 CONT MDR MD 9 8 7 SHD LG P5 View seen from wiring side.	Connector: 2174053-1 Crimping tool for ground clip: 1596970-1 Crimping tool for receptacle contact: 1596847-1 (TE Connectivity) Signal layout 9 SHD 7 MDR 8 MD 5 MR 6 LG 3 P5 4 MRR 1 CONT 2 BAT View seen from wiring
MR-J3JCBL03M-A2-L		

(b) Internal wiring diagram

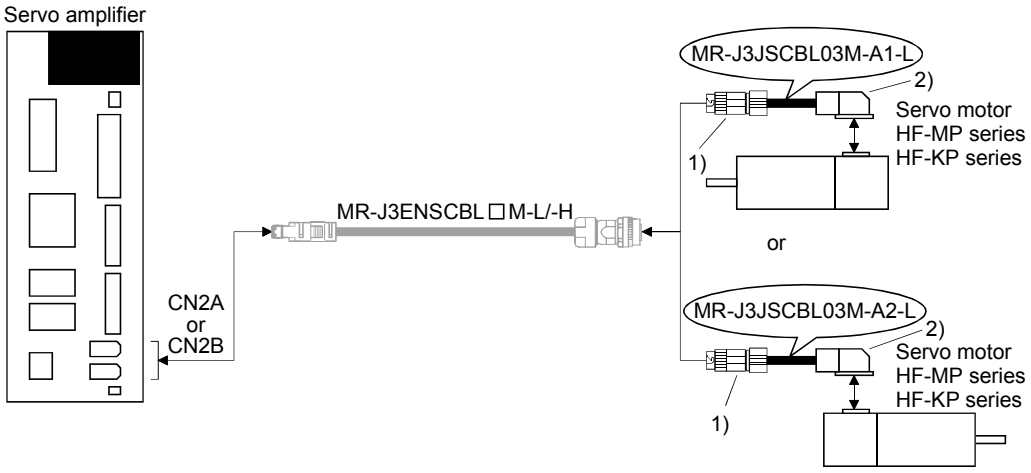


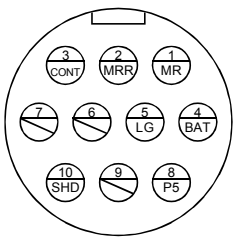
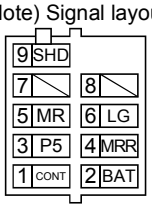
(4) MR-J3JSCBL03M-A1-L・MR-J3JSCBL03M-A2-L

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.

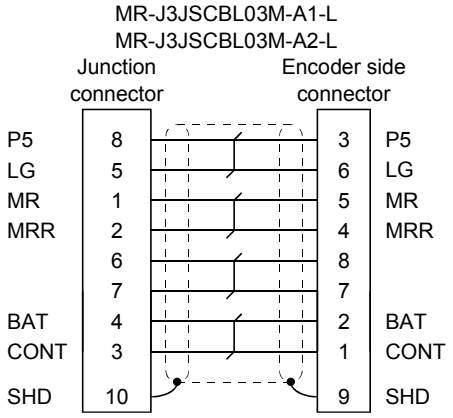
Cable model	Cable length	IP rating	Bending life	Application
MR-J3JSCBL03M-A1-L	0.3m	IP65	Standard	For HF-MP・HF-KP servo motor Load side lead Use in combination with MR-J3ENSCBL□M-L/H.
MR-J3JSCBL03M-A2-L				For HF-MP・HF-KP servo motor Opposite-to-load side lead Use in combination with MR-J3ENSCBL□M-L/H.

(a) Connection of servo amplifier and servo motor



Cable model	1) For CN2 connector	2) For encoder connector
MR-J3JSCBL03M-A1-L MR-J3JSCBL03M-A2-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: 2174053-1 Crimping tool for ground clip: 1596970-1 Crimping tool for receptacle contact: 1596847-1 (TE Connectivity) (Note) Signal layout  View seen from wiring side. Note. Keep open the pin shown with an ▽.

(b) Internal wiring diagram



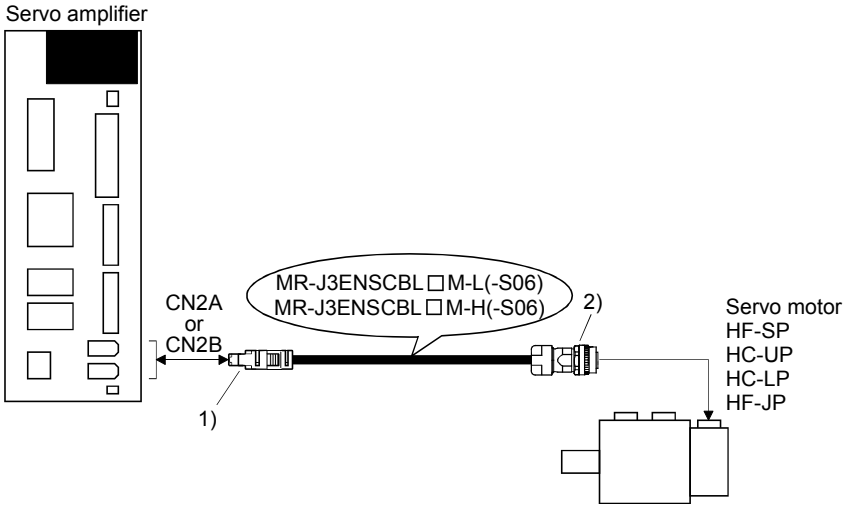
(5) MR-J3ENSCBL□M-L(-S06)・MR-J3ENSCBL□M-H(-S06)

These cables are detector cables for HF-SP・HC-UP・HC-LP・HF-JP 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	Bending 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・HF-JP servo motor
MR- J3ENSCBL □ M-H	2	5	10	20	30	40	50	IP67	Long bending life	
MR-J3ENSCBL □ M-L-S06	2	5	10	20	30			IP67	Standard	For HF-SP・HC-UP・HC-LP・HF-JP servo motor (Note)
MR-J3ENSCBL □ M-H-S06	2	5	10	20	30	40	50	IP67	Long bending 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

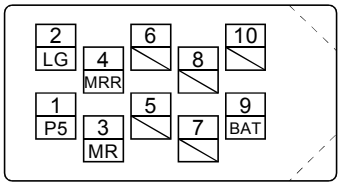


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<tr><td>MR-J3ENSCBL□M-L

MR-J3ENSCBL□M-H

MR-J3ENSCBL□M-L-S06

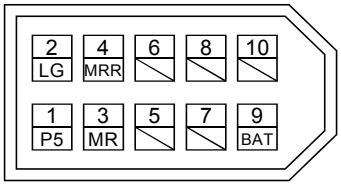
MR-J3ENSCBL□M-H-S06</td><td>Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(3M)

(Note) Signal layout


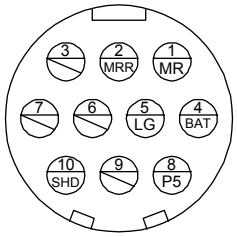
View seen from wiring side.

or

Connector set: 54599-1019 (Molex)

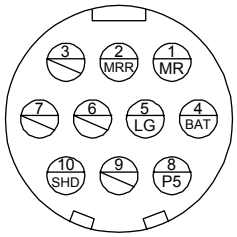
(Note) Signal layout


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.</td><td>
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<tr><th rowspan="2">Cable length</th><th rowspan="2">Bending life</th><th colspan="2">Plug (DDK)</th></tr>
<tr><th>Straight plug</th><th>Socket contact</th></tr>
<tr><td rowspan="2">10m or shorter</td><td>Long bending life</td><td rowspan="3">CMV1-SP10S-M1</td><td>CMV1-#22ASC-C1-100
Applicable wire size: AWG24 to 20
Crimping tool:357J-53162T</td></tr>
<tr><td>Standard</td></tr>
<tr><td rowspan="2">20m or longer</td><td>Long bending life</td><td rowspan="2">CMV1-#22ASC-C2-100
Applicable wire size: AWG28 to 24
Crimping tool:357J-53163T</td></tr>
<tr><td>Standard</td><td>CMV1-SP10S-M2</td></tr>
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View seen from wiring side. (Note)

Note. Keep open the pins shown with ▽.

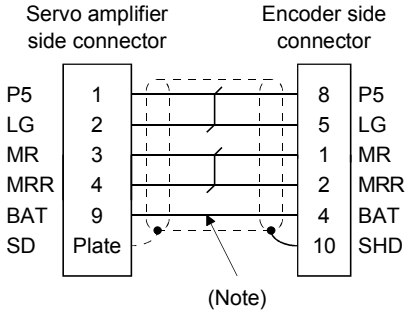
<table>
<tr><th rowspan="2">Cable length</th><th rowspan="2">Bending life</th><th colspan="2">Plug (DDK)</th></tr>
<tr><th>Straight plug</th><th>Socket contact</th></tr>
<tr><td rowspan="2">10m or shorter</td><td>Long bending life</td><td rowspan="4">CM10-SP10S-VP-M</td><td>CM10-#22SC(C1)(D8)-100
Applicable wire size: AWG22 to 20
Crimping tool:357J-50446</td></tr>
<tr><td>Standard</td></tr>
<tr><td rowspan="2">20m or longer</td><td>Long bending life</td><td rowspan="2">CM10-#22SC(C2)(D8)-100
Applicable wire size: AWG28 to 23
Crimping tool:357J-50447</td></tr>
<tr><td>Standard</td></tr>
</table>


View seen from wiring side. (Note)

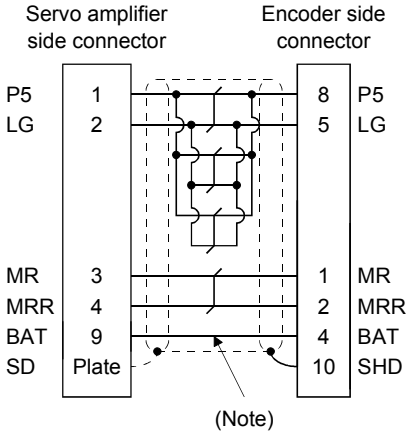
Note. Keep open the pins shown with ▽.
</td></tr>
</table>

(b) Internal wiring diagram

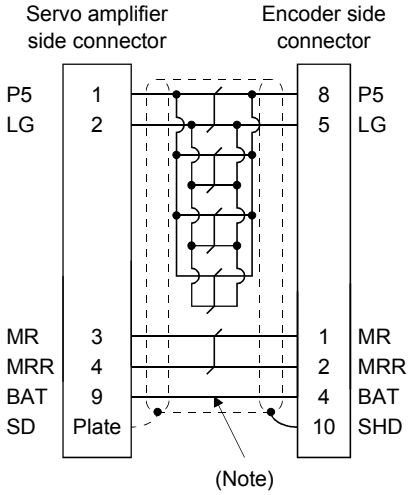
MR-J3ENSCBL2M-L (-S06) /H (-S06)
MR-J3ENSCBL5M-L (-S06) /H (-S06)
MR-J3ENSCBL10M-L (-S06) /H (-S06)



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



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



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

(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 (Note 2)	 Servo amplifier side connector Receptacle: 36210-0100PL Shell kit: 536310-3200-008 (3M) Or Connector set: 54599-1019 (Molex)	 Encoder side connector Straight plug: CMV1-SP10S-M2 Socket contact: CMV1-#22ASC-S1-100 Applicable wire size: AWG20 or less (DDK)
MR-J3SCNS-S06 (Note 1)		 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 (Note 2)		 Encoder side connector Straight plug: CMV1-AP10S-M2 Socket contact: CMV1-#22ASC-S1-100 Applicable wire size: AWG20 or less (DDK)
MR-J3SCNSA-S06 (Note 1)		 Encoder side connector Straight plug: CM10-AP10S-VP-M Socket contact: CM10-#22SC (S1) (D8)-100 Applicable wire size: AWG20 or less (DDK)

Note 1. 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.

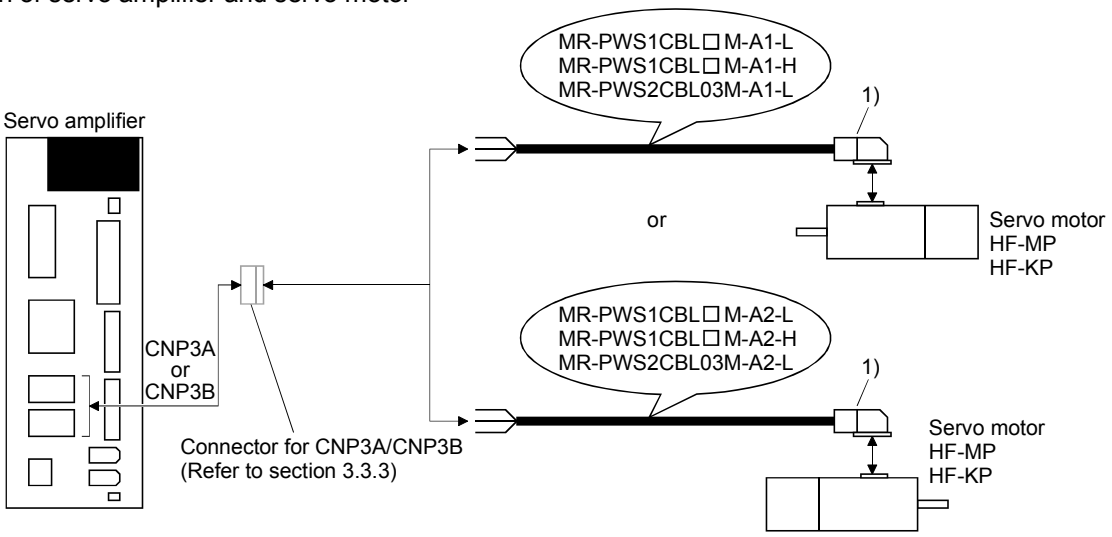
2. Cable clamp and bushing for 5.5 mm to 7.5 mm and 7.0 mm to 9.0 mm of cable outer diameter are included.

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	Bending 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 bending life	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL□M-A2-H		2	5	10	IP65	Long bending life	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-PWS2CBL03M-A1-L	03				IP55	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-PWS2CBL03M-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 MR-PWS1CBL□M-A2-L MR-PWS1CBL□M-A1-H MR-PWS1CBL□M-A2-H	Connector: KN4FT04SJ1-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 1 ⏚ 2 U 3 V 4 W View seen from wiring side.
MR-PWS2CBL03M-A1-L MR-PWS2CBL03M-A2-L	Connector: KN4FT04SJ2-R Hood, socket insulator Bushing, ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT160-3-TMH5B (Japan Aviation Electronics Industry)	

(2) Internal wiring diagram

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



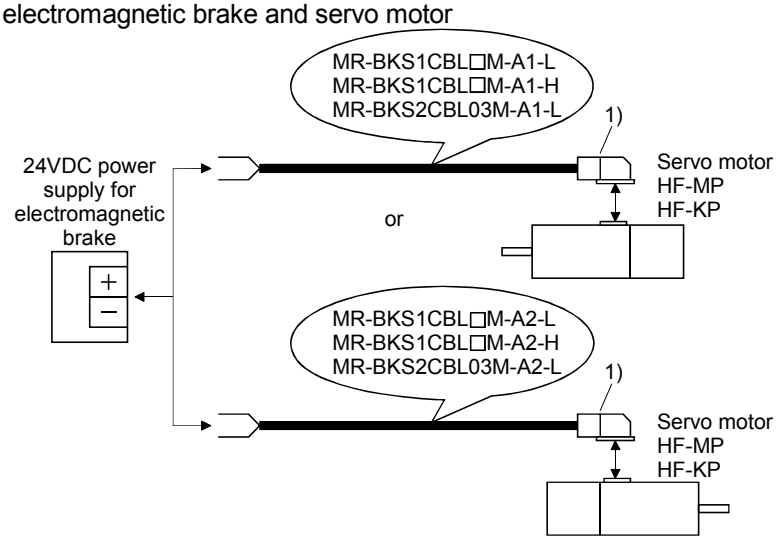
Note. These are not shielded cables.

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.

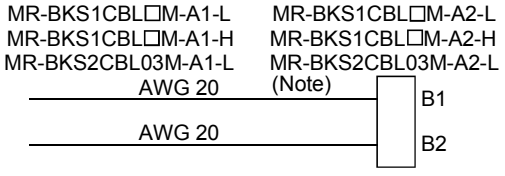
Cable model	Cable length				IP rating	Bending life	Application
	0.3m	2m	5m	10m			
MR-PWS1CBL□M-A1-L		2	5	10	IP65	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL□M-A2-L		2	5	10	IP65	Standard	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-PWS1CBL□M-A1-H		2	5	10	IP65	Long bending life	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL□M-A2-H		2	5	10	IP65	Long bending life	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-PWS2CBL03M-A1-L	03				IP55	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-PWS2CBL03M-A2-L	03				IP55	Standard	For HF-MP・HF-KP servo motor Opposite-to-load side lead

(1) Connection of power supply for electromagnetic brake and servo motor



Cable model	1) For motor brake connector	
MR-BKS1CBL□M-A1-L MR-BKS1CBL□M-A2-L MR-BKS1CBL□M-A1-H MR-BKS1CBL□M-A2-H	Connector: JN4FT02SJ1-R Hood, socket insulator Bushing, ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT160-3-TMH5B (Japan Aviation Electronics Industry)	Signal layout 1 B1 2 B2 View seen from wiring side.
MR-BKS2CBL03M-A1-L MR-BKS2CBL03M-A2-L	Connector: JN4FT02SJ2-R Hood, socket insulator Bushing, ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT160-3-TMH5B (Japan Aviation Electronics Industry)	

(2) Internal wiring diagram



Note. These are not shielded cables.

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.

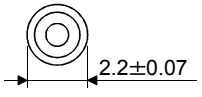
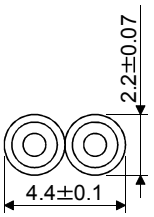
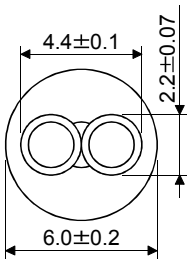
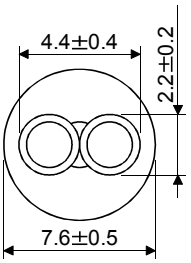
(1) Model explanations

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											Bending 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 bending life	Using long distance cable

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

(2) Specifications

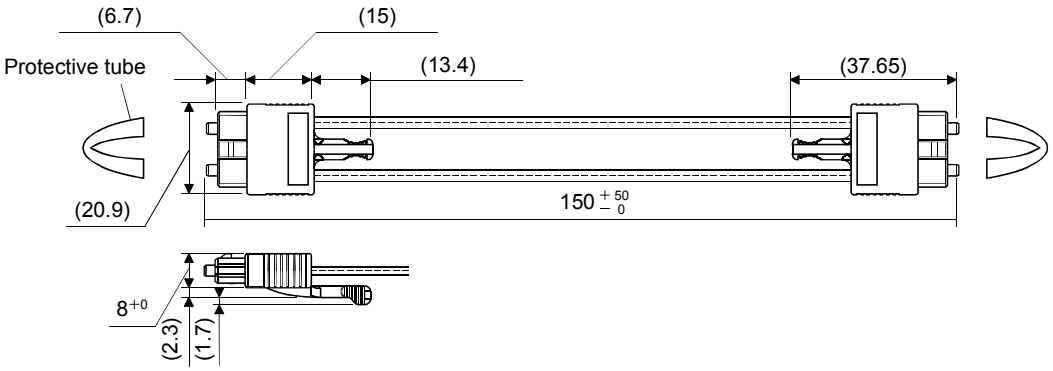
		Description			
SSCNETⅢ cable model		MR-J3BUS□M		MR-J3BUS□M-A	MR-J3BUS□M-B
SSCNETⅢ cable length		0.15m	0.3 to 3m	5 to 20m	30 to 50m
Optical cable (cord)	Minimum bend radius	25mm		Enforced covering cord: 50mm Cord: 25mm	Enforced covering cord: 50mm Cord: 30mm
	Tension strength	70N	140N	420N (Enforced covering 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

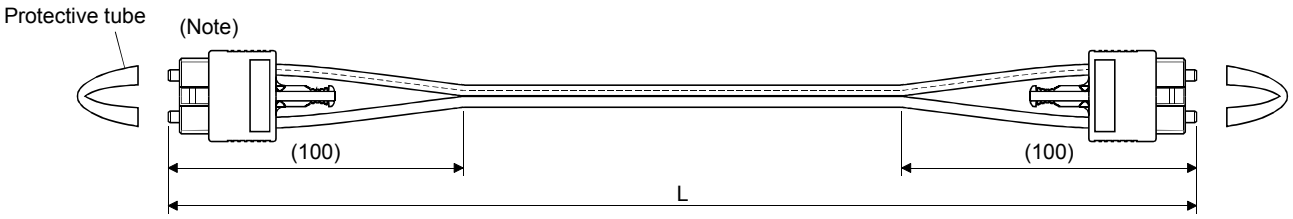
[Unit: mm]



(b) MR-J3BUS03M to MR-J3BUS3M

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

[Unit: mm]



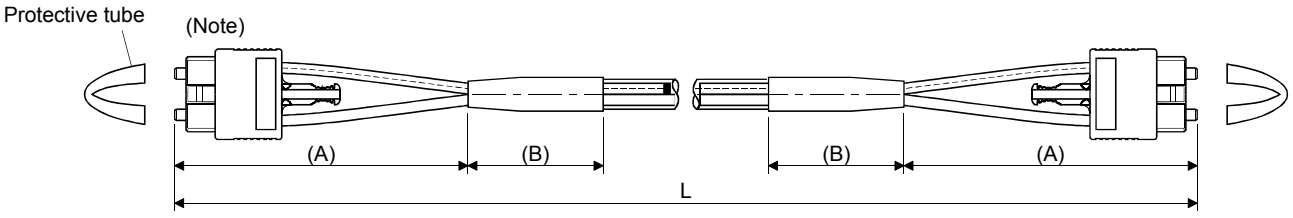
Note. Dimension of connector part is the same as that of MR-J3BUS015M.

(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

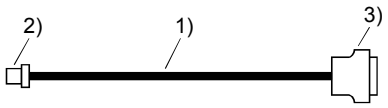
(1) Model explanations

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

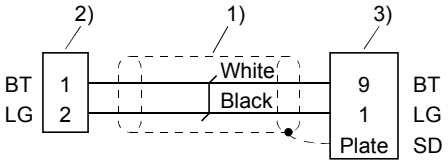
(2) MR-J3BT1CBL□M

(a) Appearance



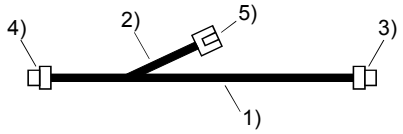
Parts	Description
1) Cable	VSVC 7/0.18 × 2C
2) Connector	Socket: DF3-2S-2C Socket contact: DF3-2428SC(F)C (Hirose Denki)
3) Connector	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or similar product)

(b) Internal wiring diagram



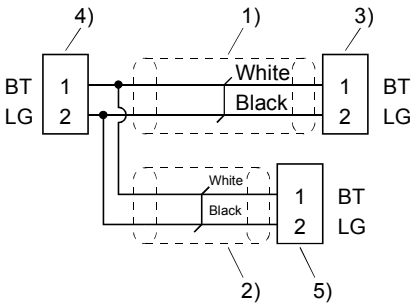
(3) MR-J3BT2CBL□M

(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.

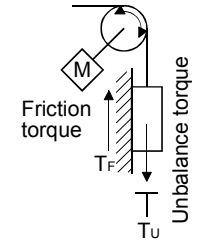
Servo amplifier	Regenerative power [W]			
	Built-in regenerative resistor	MR-RB14 [26Ω]	MR-RB34 [26Ω]	MR-RB3B [20Ω]
MR-J3W-22B	10	100		
MR-J3W-44B				
MR-J3W-77B	100		300	
MR-J3W-1010B				300

(2) Selection of the regenerative option

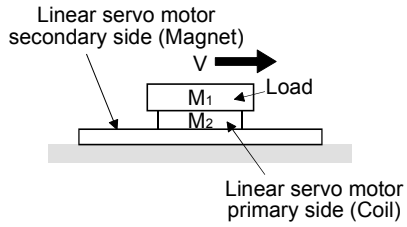
Use the following method when regeneration occurs continuously in vertical motion applications or when it is desired to make an in-depth selection of the regenerative option.

(a) Regenerative energy calculation

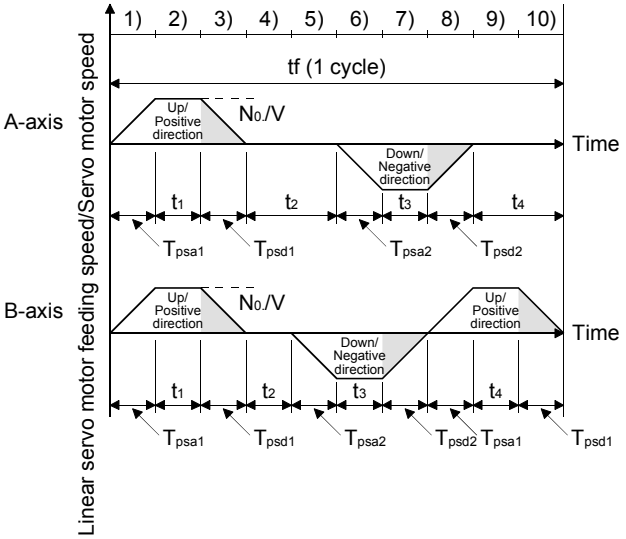
Use the following table to calculate the regenerative energy.



Rotary servo motor



Linear servo motor



Formulas for calculating torque and energy in rotary servo motor 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	$T_4 = T_U$	$E_4 \geq 0$ (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	$T_7 = \frac{-(J_L+J_M)\cdot N_0}{9.55\times10^4}\cdot\frac{1}{T_{psd2}} - T_U + T_F$	$E_7 = \frac{0.1047}{2}\cdot N_0\cdot T_7\cdot T_{psd2}$

Formulas for calculating thrust and energy in linear servo motor operation

Regenerative power	Servo motor thrust [N]	Energy E [J]
1), 8)-B-axis	$F_1 = (M_1+M_2)\cdot V/T_{psa1} + F_t$	$E_1 = V/2\cdot F_1\cdot T_{psa1}$
2), 9)-B-axis	$F_2 = F_t$	$E_2 = V\cdot F_2\cdot t_1$
3), 10)-B-axis	$F_3 = -(M_1+M_2)\cdot V/T_{psd1} + F_t$	$E_3 = V/2\cdot F_3\cdot T_{psd1}$
4), 5)-A-axis, 9), 10)-A-axis	$F_4 = 0$	$E_4 = 0$ (No regeneration)
5)-B-axis, 6)-A-axis	$F_5 = (M_1+M_2)\cdot V/T_{psa2} + F_t$	$E_5 = V/2\cdot F_5\cdot T_{psa2}$
6)-B-axis, 7)-A-axis	$F_6 = F_t$	$E_6 = V\cdot F_6\cdot t_3$
7)-B-axis, 8)-A-axis	$F_7 = -(M_1+M_2)\cdot V/T_{psd2} + F_t$	$E_7 = V/2\cdot F_7\cdot T_{psd2}$

From the calculation results in 1) to 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 MR-J3W-1010B	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.

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

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.

Parameter No.PA02

0	0		

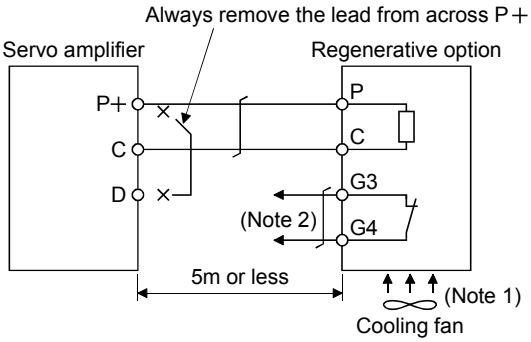
Selection of regenerative option
00: Regenerative option is not used (built-in regenerative resistor is used)
0D: MR-RB14
0E: MR-RB34
10: MR-RB3B

(4) Connection of the regenerative option

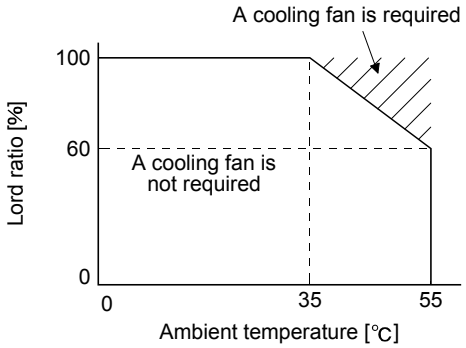
POINT
▪ For the sizes of wires used for wiring, refer to section 11.5.

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 and MR-RB3B, 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.



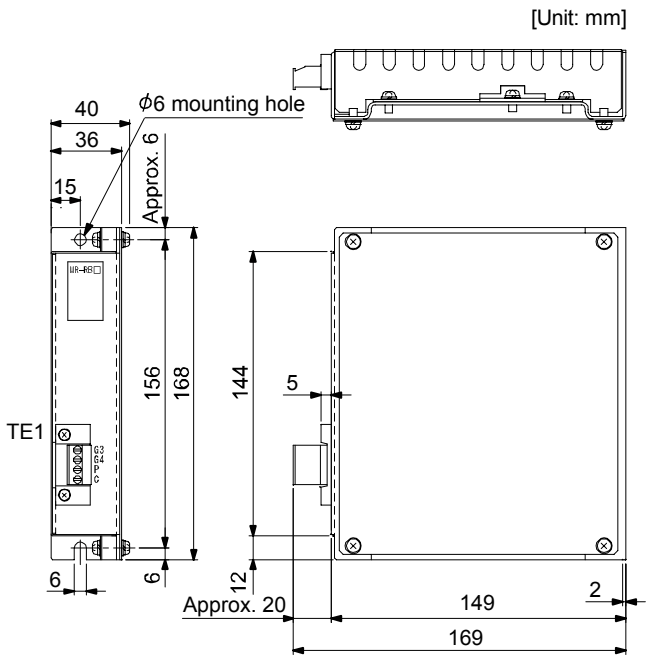
A cooling fan is not required for MR-RB14.

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

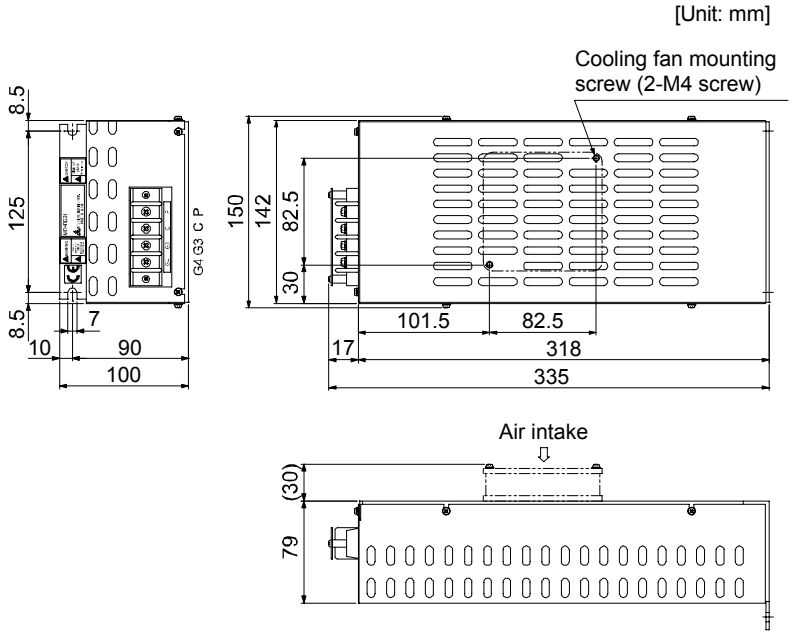
G3
G4
P
C

Applicable wire size: 2 to 2.5mm^2
(AWG24 to 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/MR-RB3B



- 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])

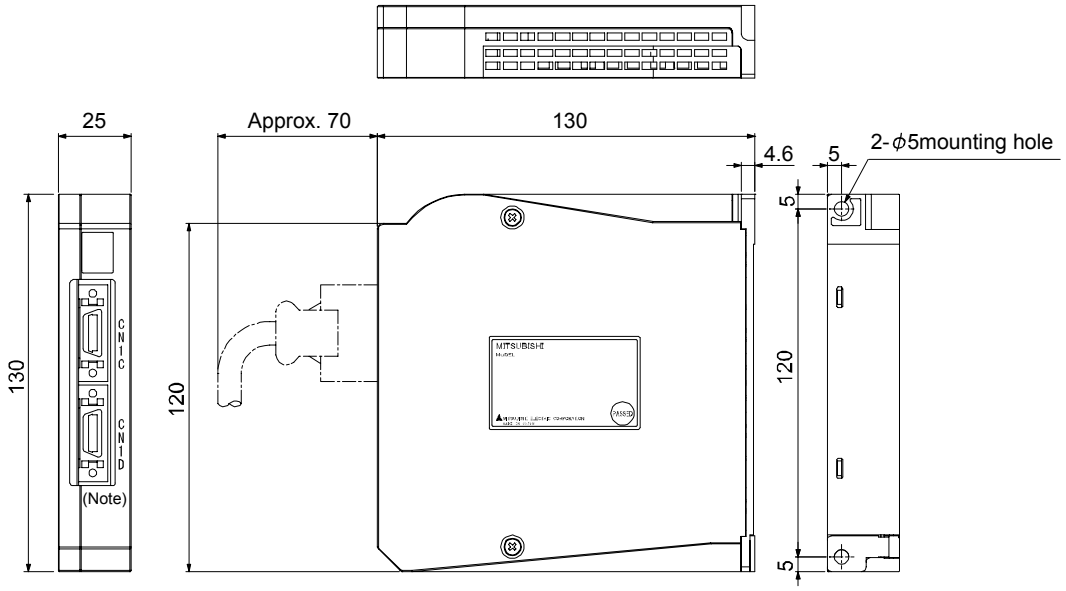
Mass: 2.9 [kg] (6.4 [lb])

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 an MR-BTCASE battery case.

These are used to configure an absolute position detection system. An MR-BTCASE battery case is a case that stores eight MR-BAT batteries by connector connections. An MR-BTCASE battery case can be used by four MR-J3W-B servo amplifiers (eight axes) at maximum. To connect an MR-BTCASE battery case to a servo amplifier, the MR-J3BT1CBL□M battery cable is required. To connect multiple servo amplifiers to an MR-BTCASE battery case, use the MR-J3BT2CBL□M junction battery cable. When using an 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

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Compatibility with a servo amplifier</td><td>
<table>
<tr><th>MR Configurator
Servo motor</th><th>MRZJW3-SETUP221
software version</th></tr>
<tr><td>Rotary servo motor</td><td rowspan="2">C1 or later</td></tr>
<tr><td>Linear servo motor</td></tr>
<tr><td>Direct drive motor</td><td>C3 or later</td></tr>
</table>
</td></tr>
<tr><td>Monitor</td><td>Display, high speed monitor, Multiple axis graph trend graph
Minimum resolution changes with the processing speed of the personal computer.</td></tr>
<tr><td>Alarm</td><td>Display, history, amplifier data</td></tr>
<tr><td>Diagnostic</td><td>Digital I/O, no motor rotation, total power-on time, amplifier software version info, motor information, tuning data, absolute encoder data, Axis name setting.</td></tr>
<tr><td>Parameters</td><td>Parameter list, turning, change list, detailed information</td></tr>
<tr><td>Test operation</td><td>Jog operation, positioning operation, Do forced output, program operation.</td></tr>
<tr><td>Advanced function (Note)</td><td>Machine analyzer, gain search, machine simulation, robust disturbance compensation, Advanced gain search</td></tr>
<tr><td>File operation</td><td>Data read, save, delete, print</td></tr>
<tr><td>Others</td><td>Automatic demo, help display</td></tr>
</table>

Note. The advanced gain search is supported by MR Configurator with software version C2 or later.

(2) System configuration

(a) Components

To use this software, the following components are required in addition to the servo amplifier and servo motor.

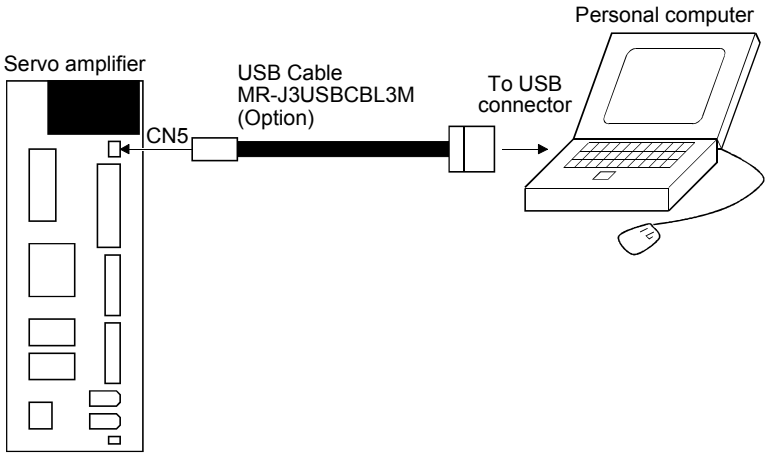
Equipment		(Note 1) Description
(Note 2, 3, 4, 5) Personal computer	OS	Microsoft® Windows® 7 Ultimate [Service Pack none/1] Microsoft® Windows® 7 Enterprise [Service Pack none/1] Microsoft® Windows® 7 Professional [Service Pack none/1] Microsoft® Windows® 7 Home Premium [Service Pack none/1] Microsoft® Windows® 7 Starter [Service Pack none/1] Microsoft® Windows Vista® Home Basic [Service Pack none/1/2] Microsoft® Windows Vista® Home Premium [Service Pack none/1/2] Microsoft® Windows Vista® Business [Service Pack none/1/2] Microsoft® Windows Vista® Ultimate [Service Pack none/1/2] Microsoft® Windows Vista® Enterprise [Service Pack none/1/2] Microsoft® Windows® XP Professional [Service Pack 2/3] Microsoft® Windows® XP Home Edition [Service Pack 2/3] Microsoft® Windows® 2000 Professional [Service Pack 4]
	CPU	Desktop PC: Intel® Celeron® processor 2.8GHz or more. Laptop PC: Intel® Pentium® M processor 1.7GHz or more.
	Memory	512 MB or more (for 32-bit OS) and 1 GB or more (for 64-bit OS)
	Hard Disk	1GB or more of free space
	Communication interface	USB port
Browser	Windows® Internet Explorer® 4.0 or more (Note 1)	
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. Microsoft, Windows, Internet Explorer and Windows Vista are registered trademarks of Microsoft Corporation in the United States and other countries.
Celeron and Pentium are the registered trademarks of Intel Corporation.

2. On some personal computers, MR Configurator2 may not run properly.
3. When Microsoft® Windows® 7, Microsoft® Windows Vista® , or Microsoft® Windows® XP is used, the following functions cannot be used.
   - Windows Program Compatibility mode
   - Fast User Switching
   - Remote Desktop
   - Large Fonts Mode (Display property)
   - DPI settings other than 96DPI (Display property)

   For 64-bit operating system, this software is compatible with Windows® 7.
4. When Windows® 7 is used, the following functions cannot be used.
   - Windows XP Mode
   - Windows touch
5. When using this software with Windows Vista® and Windows® 7, log in as a user having USER authority or higher.

(b) Connection with servo amplifier



(3) MR Configurator

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

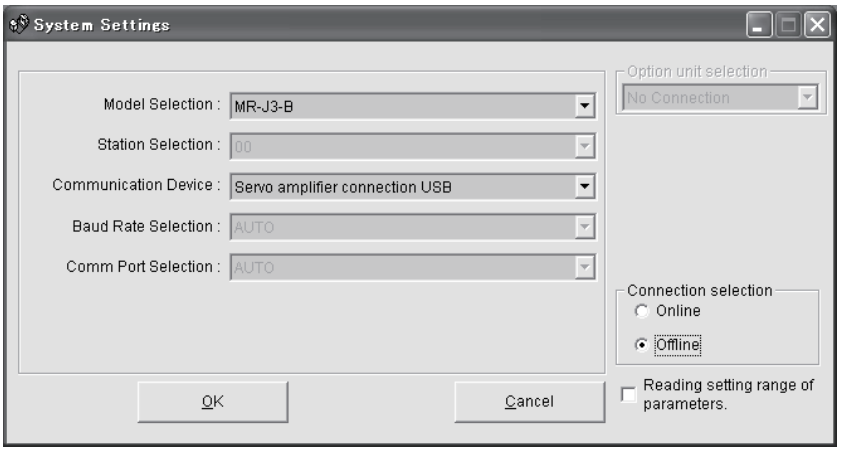
(a) Specification and setting

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". With the software whose version is C3 or later, this setting is not required.
	B-axis	Servo amplifier: Set parameter No.PC15 to "1". MR Configurator: Select the station number "1". With the software whose version is C3 or later, this setting is not required.
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.)

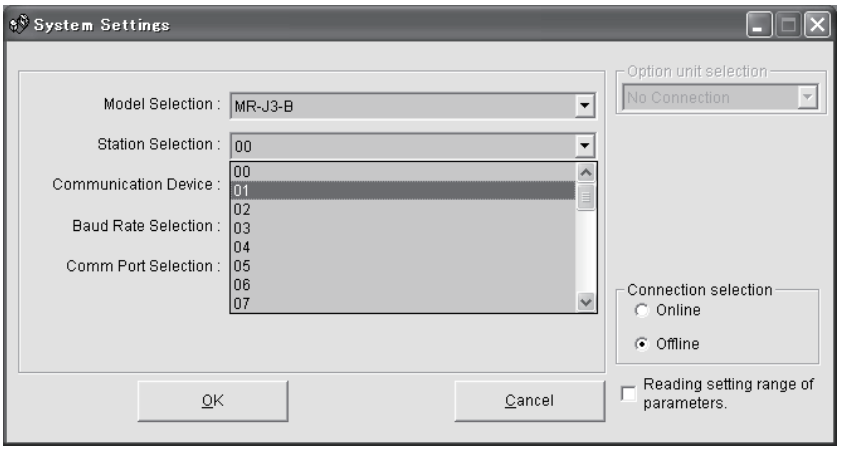
(b) Selecting an axis to communicate

Follow the following procedure to switch the communicating axis.

Step 1: Display the System Settings.



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



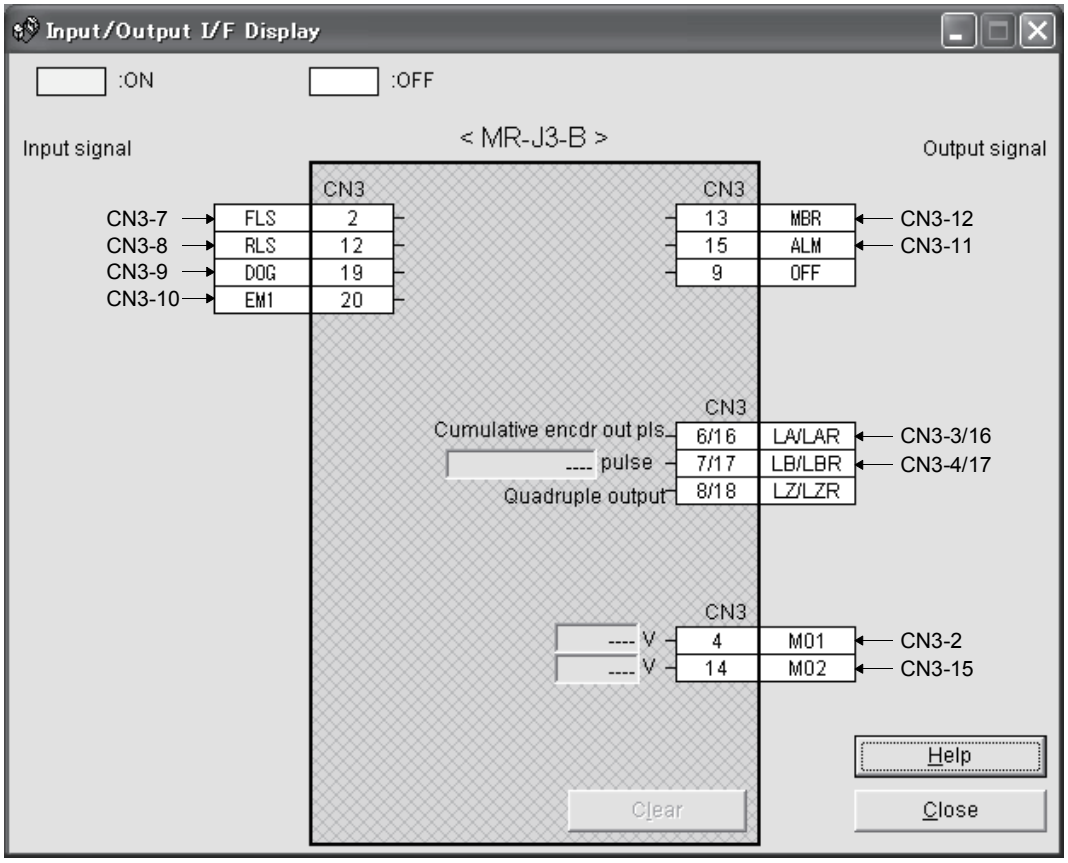
Step 3: Select the station "00" for the A-axis setting and the station "01" for the B-axis setting in the Station Selection.

(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.

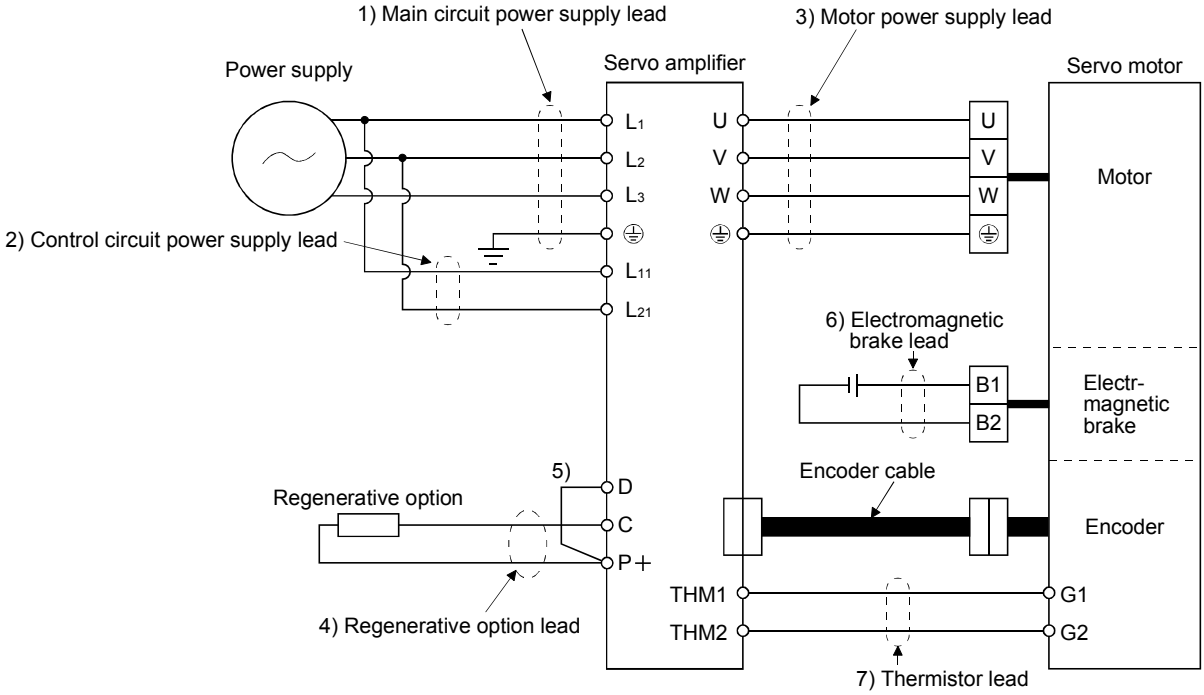


11.5 Selection example of wires

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							
MR-J3W-77B							
MR-J3W-1010B							

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

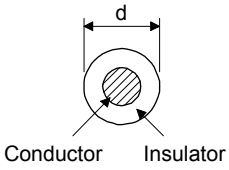
When fabricating a cable, use the wire models given in the following table or equivalent.

Table 11.2 Wires for option cables

Type	Model	Length [m]	Core size [mm^2]	Number of Cores	Characteristics of one core			(Note 2) 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	1.18	7.1	(Note 3) VSVP 7/0.26 (AWG#22 or equivalent)-3P KB-1655-2 (Bando Densen)
	MR-J3ENCBL_M-A2-L								
	MR-J3ENCBL_M-A1-H	2 to 10	AWG22	6 (3 pairs)	70/0.08	56 or less	1.17	7.1	(Note 3) TPE・SVP 70/0.08 (AWG#22 or equivalent)-3P KB-2237-2 (Bando Densen)
	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	T/2464-1061/IIA-SB 4P×26AWG (Taiyo Cabletec)
	MR-J3JCBL03M-A2-L								
	MR-EKCBL_M-L	2 to 10	AWG28	4 (2 pairs)	7/0.127	232 or less	1.18	7.0	(Note 3) 20276 composite 6-core shielded cable Ban-gi-shi-16395-1 (Bando Densen)
			AWG22	2	17/0.16	28.7 or less	1.50		
		20・30	AWG23	12 (6 pairs)	12/0.18	63.6 or less	1.2	8.2±0.3	(Note 3) 20276 VSVPAWG#23×6P KB-0492 (Bando Densen)
	MR-EKCBL_M-H	2 to 10	0.2 mm^2	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	(Note 3) A14B2339 6P (Junkosha)
		20	AWG24	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	(Note 3) TPE・SVP 40/0.08 (AWG#24 or equivalent)-6P KB-1928-2 (Bando Densen)
		30 to 50	AWG24	14 (7 pairs)	40/0.08	105 or less	0.88	8.0	(Note 3) TPE・SVP 40/0.08 (AWG#24 or equivalent)-7P KB-1929-2 (Bando Densen)
	MR-J3JSCBL03M-A1-L	0.3	AWG26	8 (4 pairs)	7/0.16	146 or less	1.0	7.1±0.3	(Note 3) VSVP 7/0.16 (AWG#26 or equivalent)-4P Ban-gi-shi-16822 (Bando Densen)
	MR-J3JSCBL03M-A2-L								
	MR-J3ENSCBL_M-L	2 to 10	AWG22	6 (3 pairs)	7/0.26	53 or less	1.18	7.1	(Note 3) VSVP 7/0.26 (AWG#22 or equivalent)-3P KB-1655-2 (Bando Densen)
		20/30	AWG23	12 (6 pairs)	12/0.18	63.3 or less	1.2	8.2±0.3	(Note 3) 20276 VSVPAWG#23×6P KB-0492 (Bando Densen)
	MR-J3ENSCBL_M-H	2 to 10	AWG22	6 (3 pairs)	70/0.08	56 or less	1.17	7.1	(Note 3) TPE・SVP 70/0.08 (AWG#22 or equivalent)-3P KB-2237-2 (Bando Densen)
		20 to 50	AWG24	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	(Note 3) TPE・SVP 40/0.08 (AWG#24 or equivalent)-6P KB-1928-2 (Bando Densen)

Type	Model	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)		
Motor power supply cable	MR-PWS1CBL_M-A1-L	2 to 10	AWG18	4	34/0.18	21.8 or less	1.71	6.2±0.3	(Note 4) HRZFEV-A (CL3) AWG18 4 cores (Dyden)
	MR-PWS1CBL_M-A2-L	2 to 10							
	MR-PWS1CBL_M-A1-H	2 to 10	AWG19 (0.75 mm^2)	4	150/0.08	29.1 or less	1.63	5.7±0.5	(Note 4) RMFES-A (CL3X) AWG19 4 cores (Dyden)
	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, 5) J11B2330 UL10125 (Junkosha)
	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 (Dyden)
	MR-BKS1CBL_M-A2-L	2 to 10							
	MR-BKS1CBL_M-A1-H	2 to 10	AWG20	2	110/0.08	39.0 or less	1.37	4.5±0.3	(Note 4) RMFES-A (CL3X) AWG20 2 cores (Dyden)
	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, 5) J11B2331 UL10125 (Junkosha)
	MR-BKS2CBL03M-A2-L	0.3							

Note 1. The following shows the detail of d.



2. Standard OD. Max. OD is about 10% greater.
3. Purchase from Toa Electric Industry Co. Ltd., Nagoya Branch
4. Purchase from Taisei Co., Ltd.
5. These models consist with solid wires. Specify the color, separately.

11.6 No-fuse breakers, fuses, magnetic contactors

Always use one molded-case circuit breaker and one magnetic contactor with one servo amplifier. When using a fuse instead of the molded-case circuit breaker, use the one having the specifications given in this section. When using two different types of motors in combination from a rotary servo motor, a linear servo motor or a direct drive motor, select a molded-case circuit breaker, a fuse or a magnetic contactor temporarily assuming that the same type of the motors are used for both axes. After selecting for the two types, use the larger molded-case circuit breaker, fuse or magnetic contactor.

Total output of rotary servo motor	Total continuous thrust of linear servo motor	Total output of direct drive motor	Molded-case circuit breaker			Fuse			(Note 2) Magnetic contactor
			Current		Voltage AC [V]	(Note 1) Class	Current [A]	Voltage AC [V]	
			Not using power factor improving AC reactor	Using power factor improving AC reactor					
300W or less			30A frame 5A	30A frame 5A	240	K5	15	300	S-N10
From over 300W to 600W	120N or less	100W or less	30A frame 10A	30A frame 10A			20		
From over 600W to 1kW	From over 120N to 240N	From over 100W to 250W	30A frame 15A	30A frame 10A			20		
From over 1kW to 2.0kW	From over 240N to 480N	From over 250W to 838W	30A frame 20A	30A frame 15A			30		S-N18

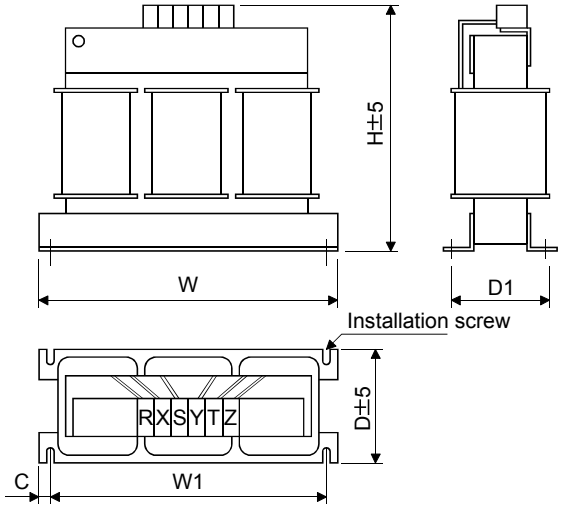
Note 1. Refer to appendix 4(8) to use the servo amplifier as a UL/CSA compliant product.

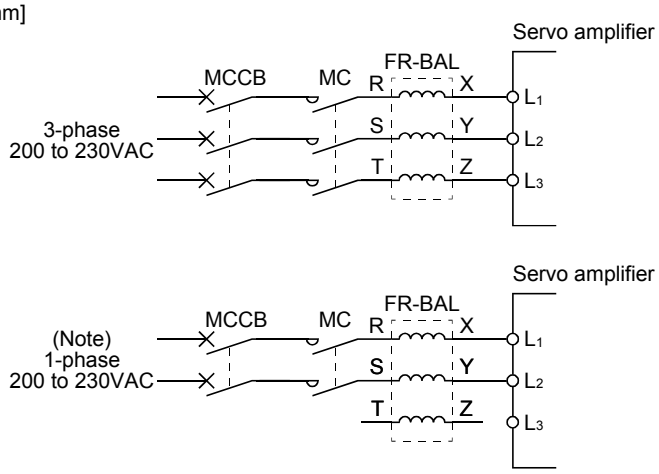
2. Be sure to use a magnetic contactor with an operation delay time of 80ms or less. The operation delay time is the time interval between current being applied to the coil until closure of contacts.

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%.
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.
When using two different types of motors in combination from a rotary servo motor, a linear servo motor or a direct drive motor, select a power factor improving AC reactor temporarily assuming that the same type of the motors are used for both axes. After selecting for the two types, use the larger power factor improving AC reactor.

[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.

Total output of rotary servo motor	Total continuous thrust of linear servo motor	Total output of direct drive motor	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	100W 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	From over 100W to 150W	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	From over 150W to 250W	FR-BAL-2.2K	160	145	140	91	75	7.5	M4	M3.5	5.6 (12.35)
From over 1kW to 2.0kW	From over 240N to 480N	From over 250W to 838W	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).

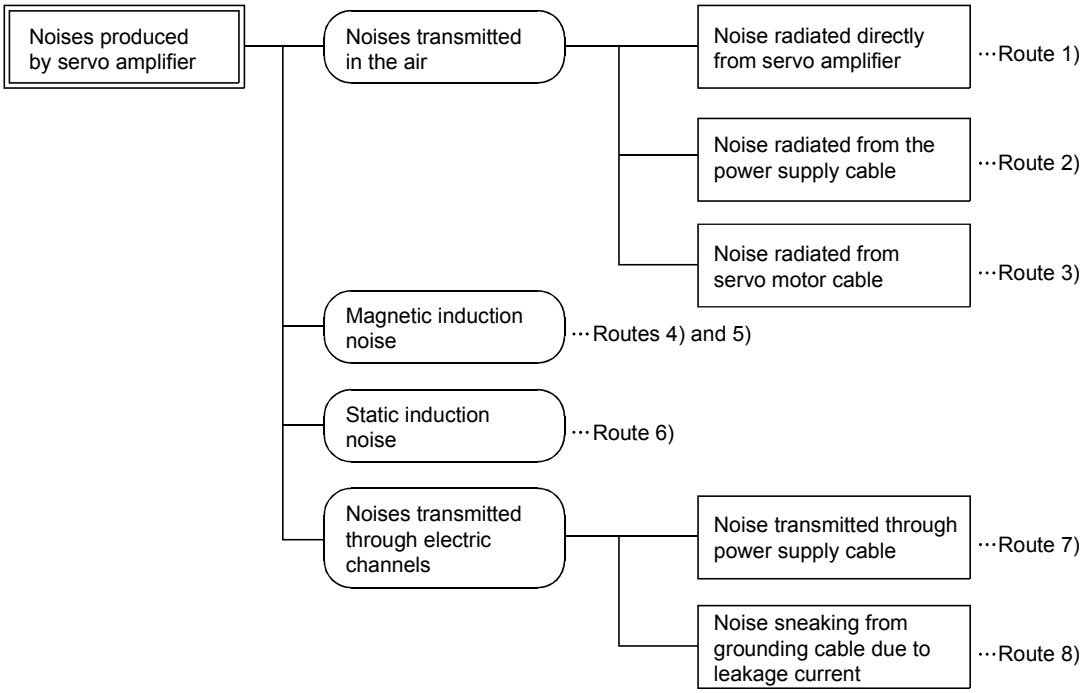
(b) Reduction techniques for external noises that cause the servo amplifier to malfunction

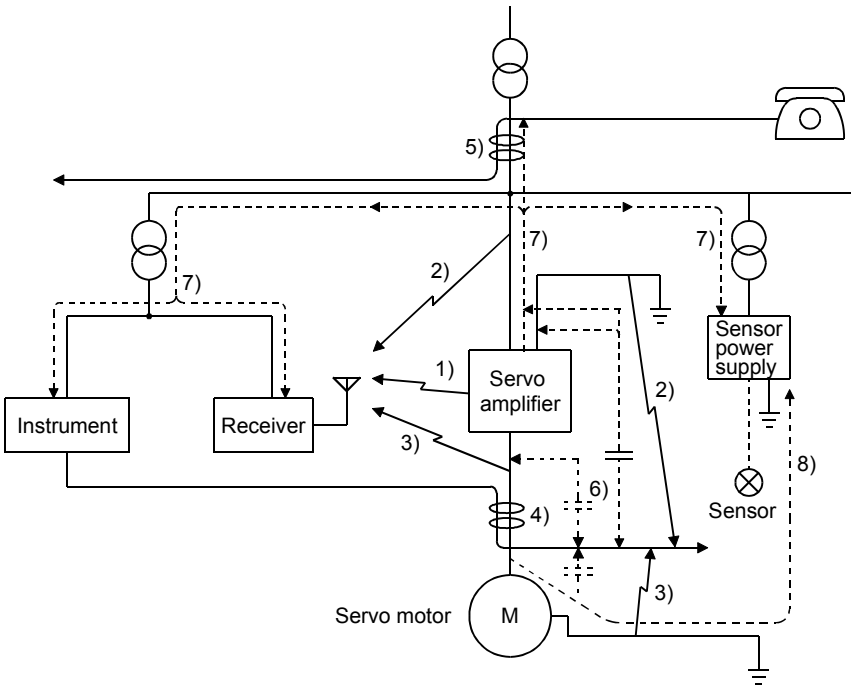
If there are noise sources (such as a magnetic contactor, an electromagnetic brake, and many relays which make a large amount of noise) near the servo amplifier and the servo amplifier may malfunction, the following countermeasures are required.

- 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.

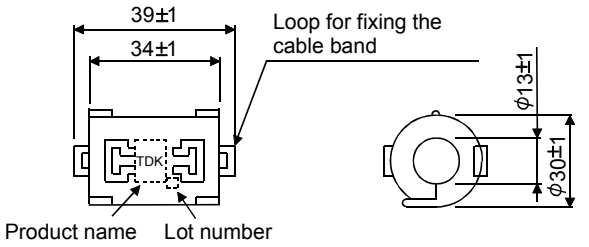
(2) Noise reduction products

(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

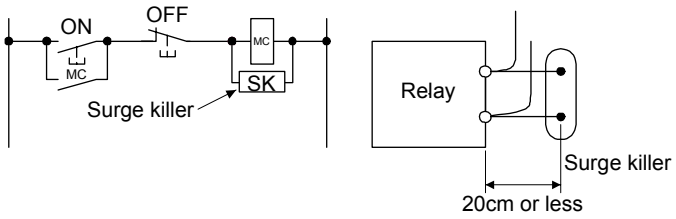
[Unit: mm]



Outline drawing (ZCAT3035-1330)

(b) Surge killer

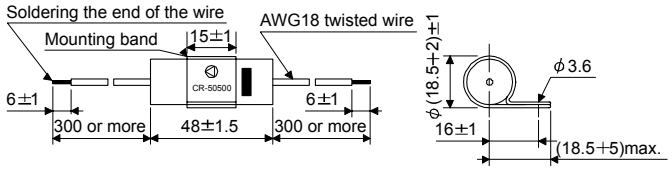
The recommended surge killer for installation to an AC relay, AC valve or the like near the servo amplifier is shown below. Use this product or equivalent.



(Ex.) CR-50500 (OKAYA Electric industries Co., Ltd.)

Rated voltage AC[V]	C [μF±20%]	R [Ω±30%]	Test voltage AC[V]
250	0.5	50 (1/2W)	Between terminals: 625VAC, 50/60Hz 60s Between terminal and case: 2000VAC 50/60Hz 60s

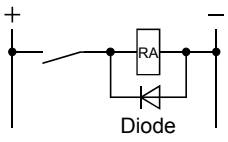
Outline drawing [Unit: mm]



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

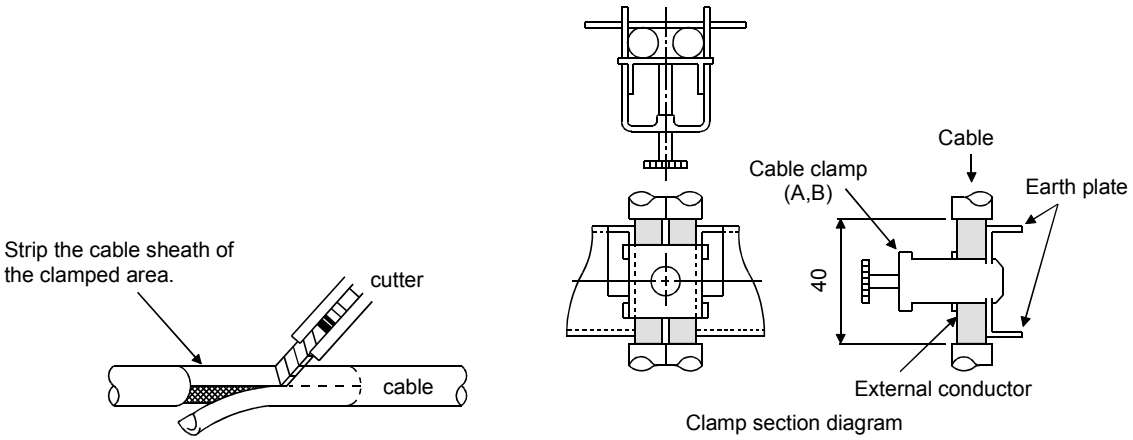


(c) Cable clamp fitting AERSBAN-□SET

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.

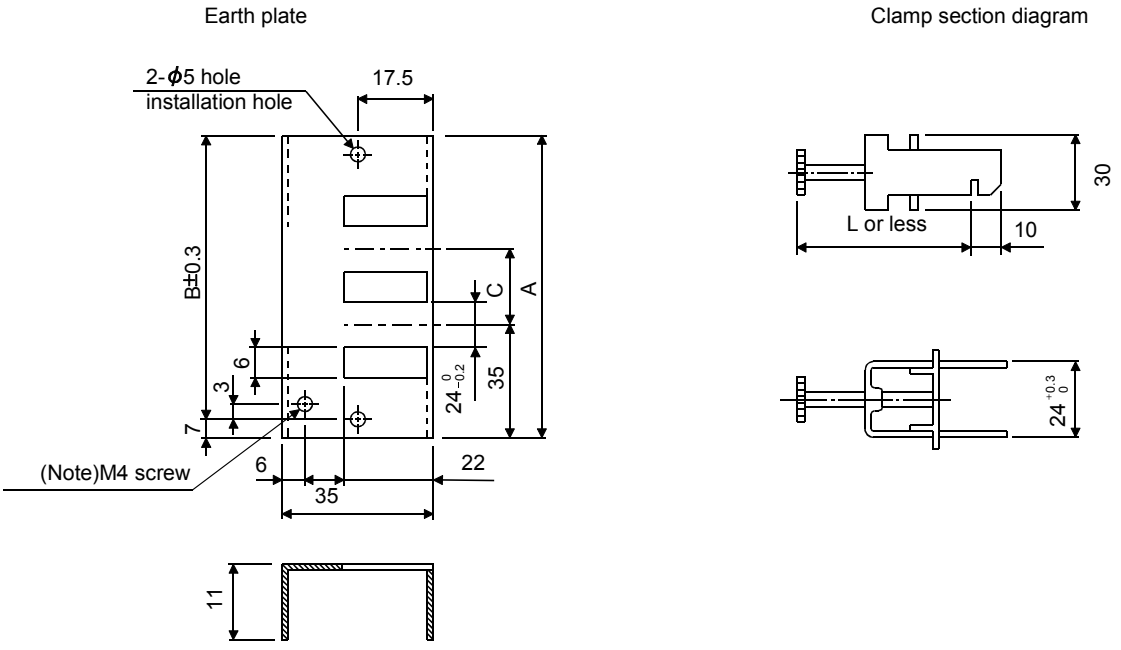
The clamp comes as a set with the earth plate.

[Unit: mm]



・Outline drawing

[Unit: mm]



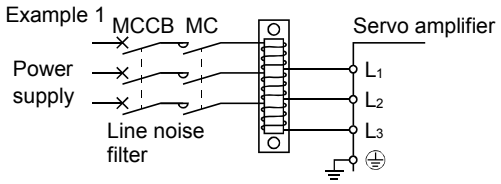
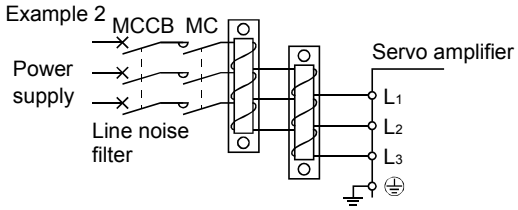
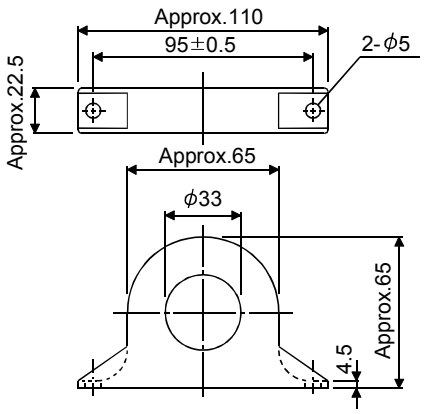
Note. Screw hole for grounding. Connect it to the earth plate of the control box.

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

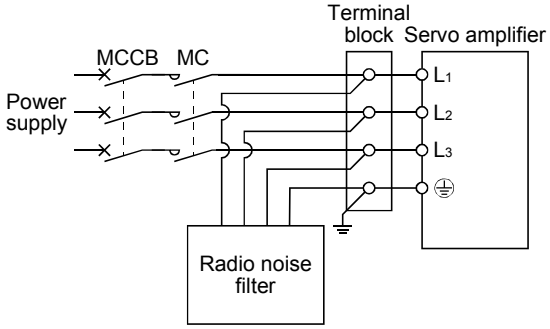
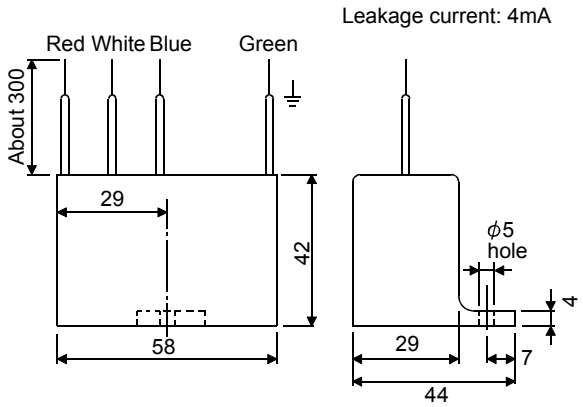
(d) Line noise filter (FR-BSF01)

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.

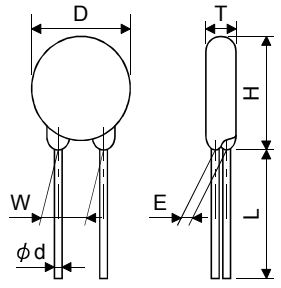
Connection diagram	Outline drawing (Unit: mm)
Make the connection cables as short as possible. Grounding is always required. When using the FR-BIF with a single-phase power supply, always insulate the wires that are not used for wiring. 	

(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 Earth-leakage current breaker

(1) Selection method

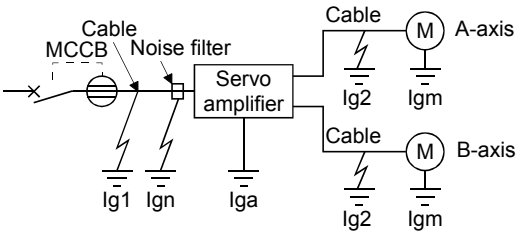
High-frequency chopper currents controlled by pulse width modulation flow in the AC servo circuits. Leakage currents containing harmonic contents are larger than those of the motor which is run with a commercial power supply.

Select an earth-leakage current breaker according to the following formula, and ground the servo amplifier, servo motor, etc. securely.

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≥

$$10 \cdot \{Ig1 + Ign + Iga + K \cdot (Ig2\ (A\text{-axis}) + Igm\ (A\text{-axis}) + Ig2\ (B\text{-axis}) + Igm\ (B\text{-axis}))\}\ [mA] \cdots (11.1)$$



Earth-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 earth-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.)

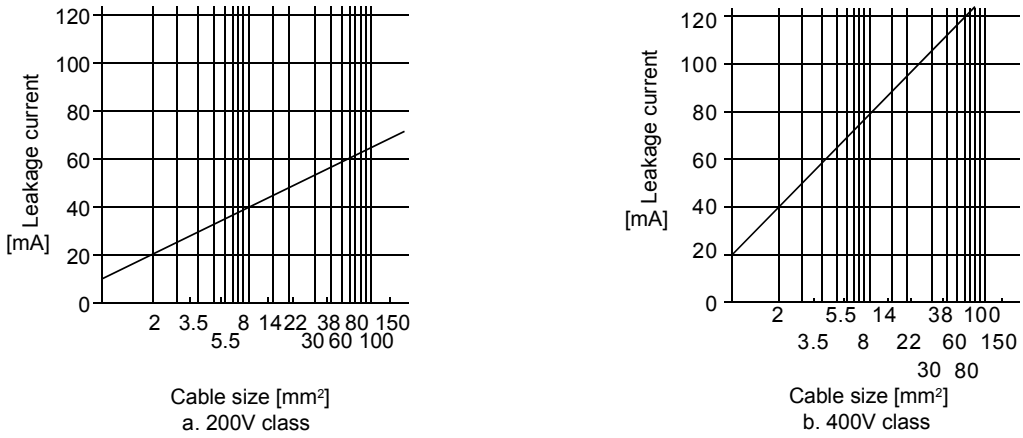


Fig. 11.1 Leakage current example (Ig1, Ig2) for CV cable run in metal conduit

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

Servo motor power [kW]	Leakage current [mA]
0.05 to 1	0.1

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

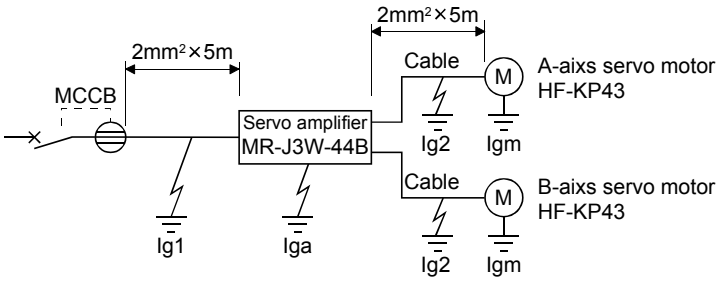
Servo amplifier	Leakage current [mA]
MR-J3W-22B MR-J3W-44B	0.1
MR-J3W-77B MR-J3W-1010B	0.15

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 MR-J3W-1010B	15

(2) Selection example

Indicated below is an example of selecting an earth-leakage current breaker under the following conditions.



Use an earth-leakage current breaker 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 an earth-leakage current breaker having the rated sensitivity current (Ig) of 6.0 [mA] or more. An earth-leakage current breaker having Ig of 15 [mA] is used with the NV-SP/SW/CP/CW/HW series.

11.11 EMC filter (recommended)

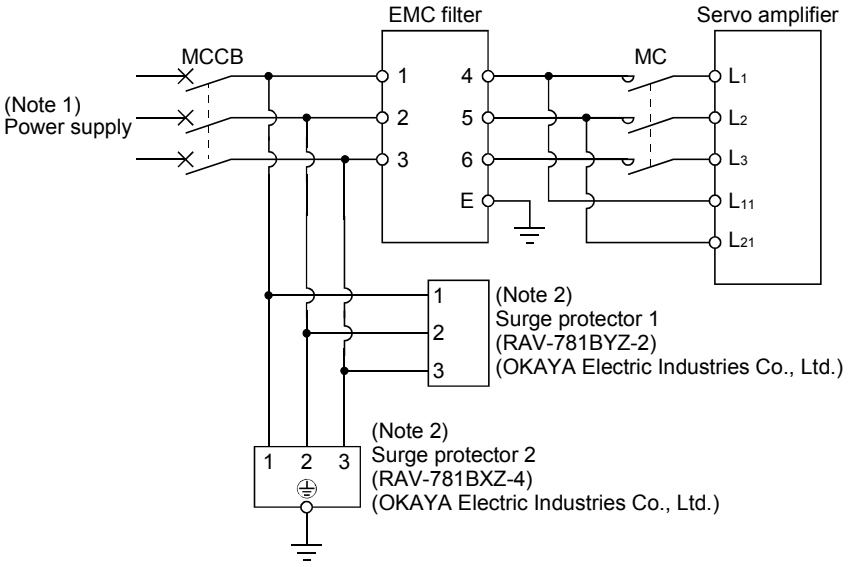
For compliance with the EMC directive of the EN, it is recommended to use the following filter. Some EMC filters are large in leakage current.

(1) Combination with the servo amplifier

Servo amplifier	Recommended filter (Soshin Electric)				Mass [kg]([lb])
	Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	
MR-J3W-22B MR-J3W-44B	(Note) HF3010A-UN	10	250	5	3.5 (7.72)
MR-J3W-77B MR-J3W-1010B	(Note) HF3030A-UN	30			5.5 (12.13)

Note. A surge protector is separately required to use any of these EMC filters.

(2) Connection example



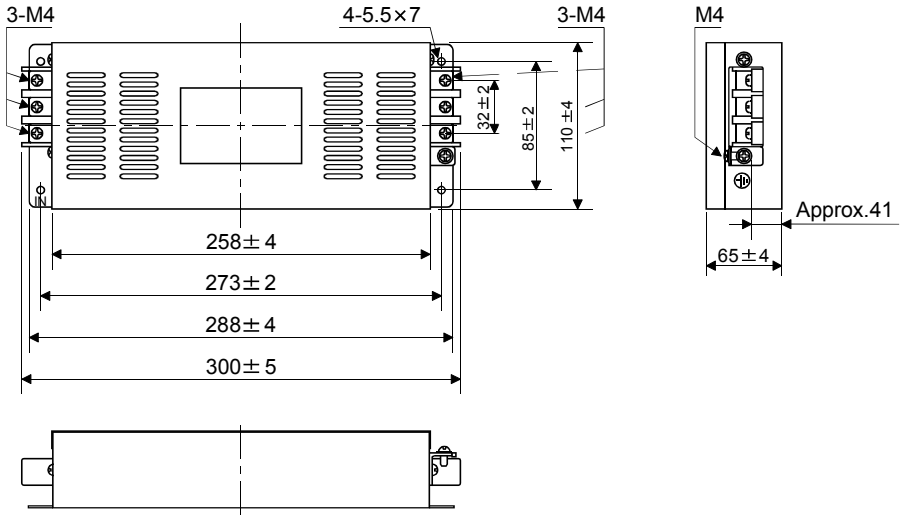
Note 1. For 1-phase 200V to 230VAC power supply, connect the power supply to L_1, L_2 and leave L_3 open. Refer to section 1.3 for the power supply specification.
2. The example is when a surge protector is connected.

(3) Outline drawing

(a) EMC filter

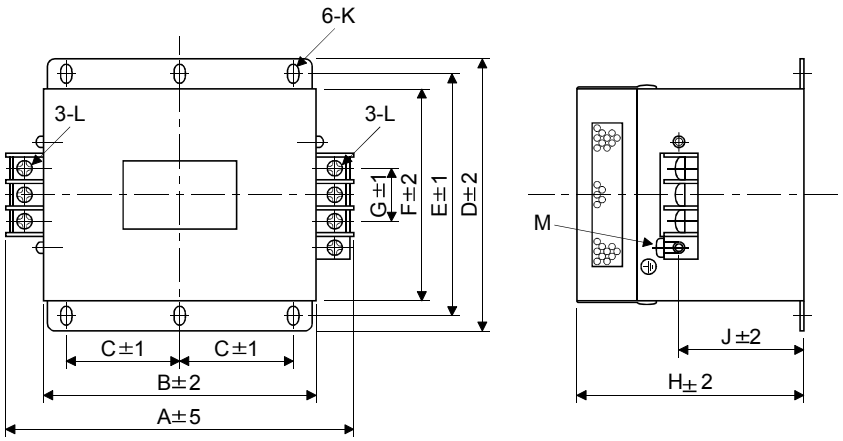
HF3010A-UN

[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

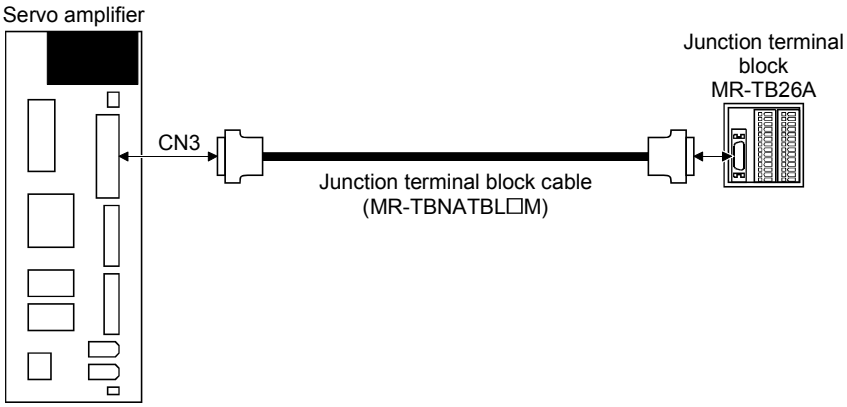
(1) Usage

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 CN3 connector of a servo amplifier. The terminal symbol S is for the shield.



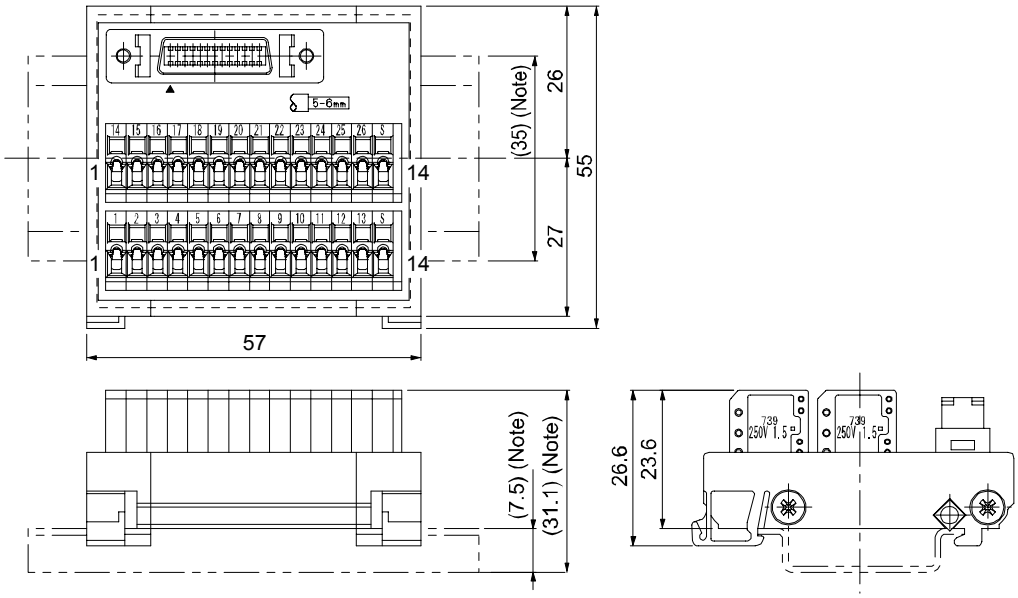
Ground the junction terminal block cable using the S terminal of the junction terminal block.

(2) Specifications

Item \ Junction terminal block		MR-TB26A
Rating		AC/DC32V 0.5A
Usable cables	Twisted wire	0.08 to 1.5mm^2 (AWG28 to 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]



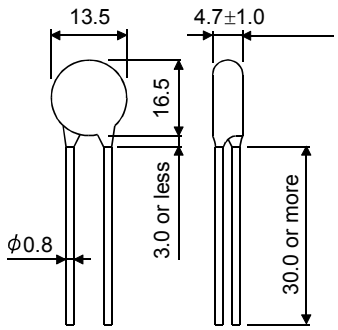
Note. Values in parenthesis are the sizes when installed with a 35mm DIN rail.

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

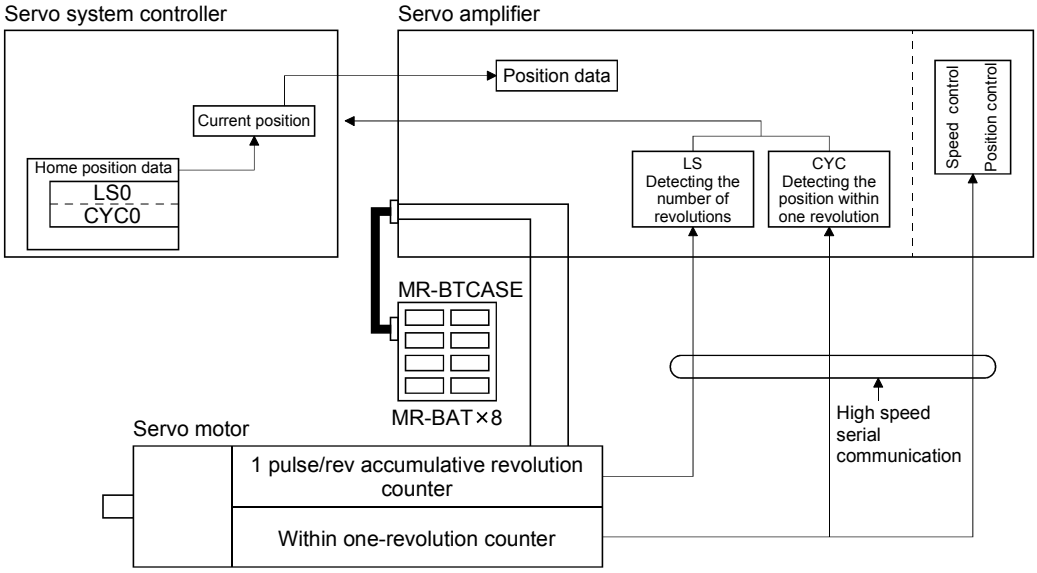
- If an absolute position erase alarm (25.1) or absolute position counter warning (E3.☐) has occurred, always perform home position setting again. Not doing so can cause runaway. Not doing so may cause unexpected operation.

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, HC-LP and HF-JP. 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 circuit power OFF, the absolute position data is lost.

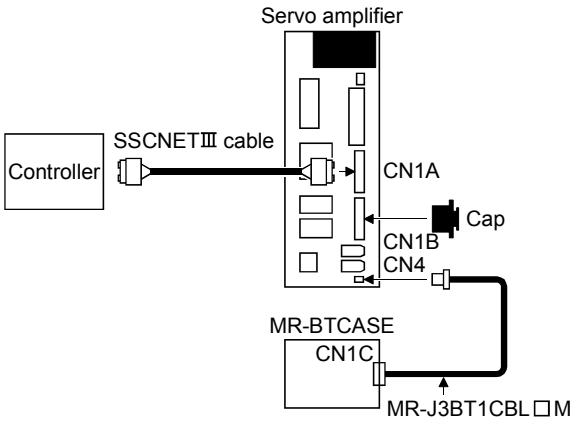
(1) Specification list

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

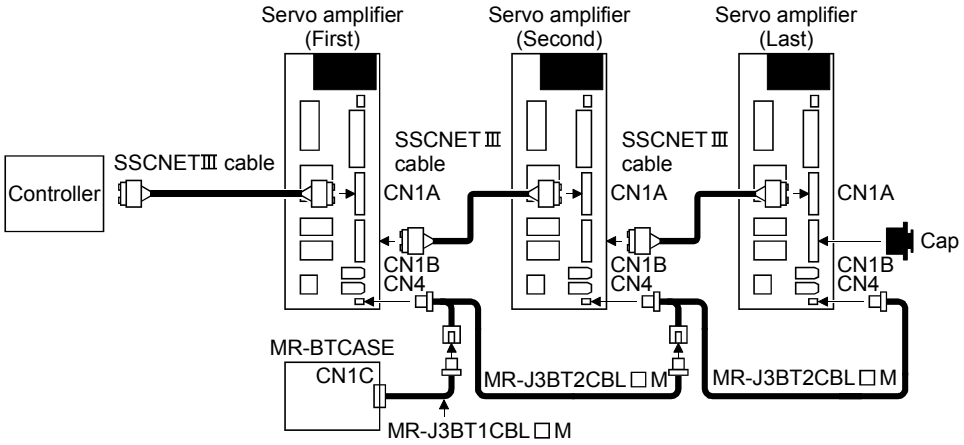
Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like.
2. Time to hold data by a battery with power off. Replace battery within 3 years since the operation start whether power is kept on/off. If the battery is used out of specification, the 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

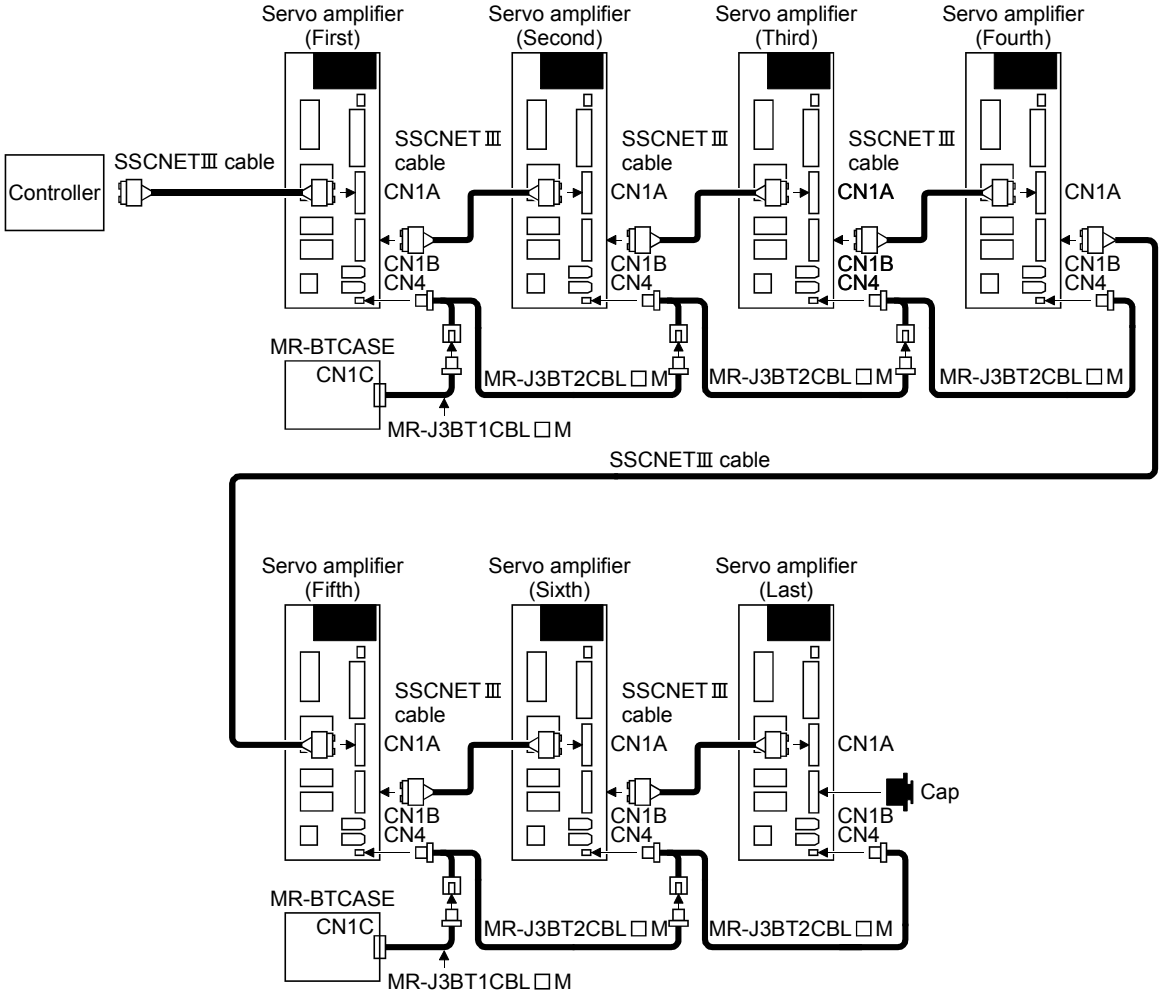
(a) When using one servo amplifier



(b) When using two to four servo amplifiers

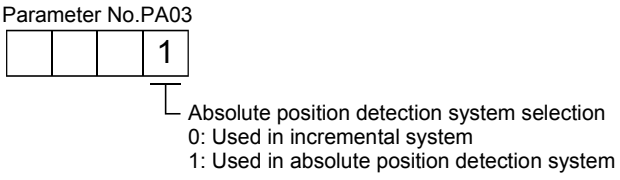


(c) When using five or more servo amplifiers



(3) Parameter setting

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



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.

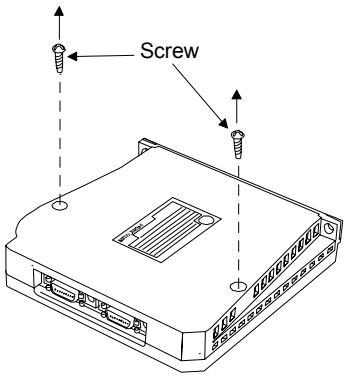
> **POINT**
> - Always install eight MR-BAT batteries to an MR-BTCASE battery case.

12.3.1 Required items

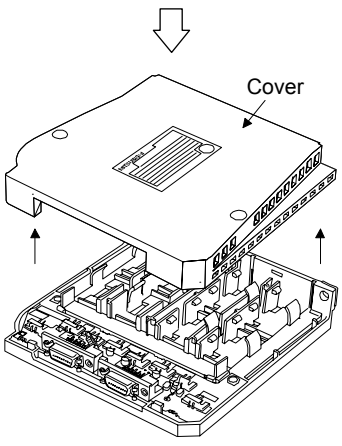
Product	Model	Use	Remarks
Battery case	MR-BTCASE	1	MR-BTCASE is a case that holds eight MR-BAT batteries and connect them to the connector.
Battery	MR-BAT	8	Lithium battery (primary battery, nominal＋3.6V)

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.

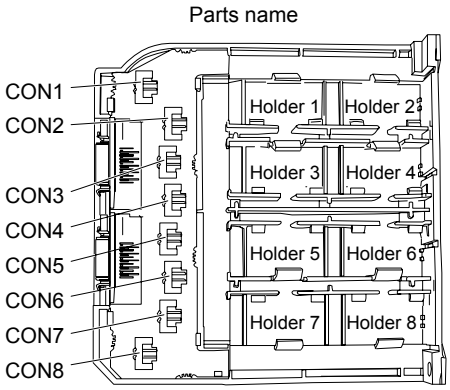


Remove the two screws using a Phillips screwdriver.

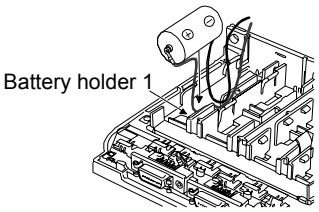


Remove the cover.

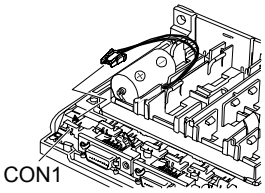
Parts name



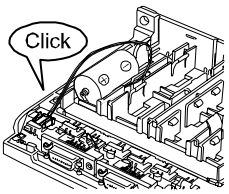
(2) Installation of MR-BAT



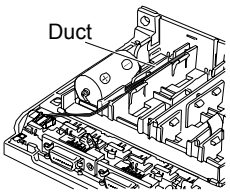
Securely insert MR-BAT to the battery holder 1.



Push the MR-BAT connector into CON1.

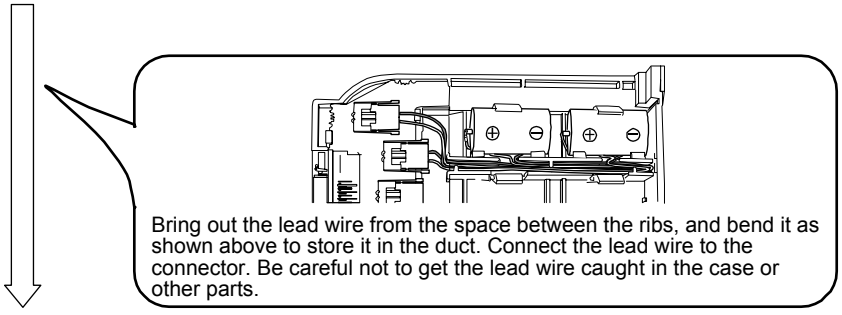


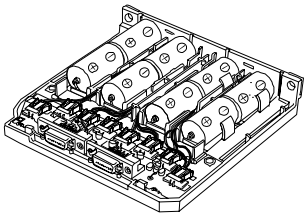
Confirm the click sound at this point.
The connector has to be connected in the right direction.
If the connector is pushed forcefully in the wrong direction, the connector will break.



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

Install other seven MR-BATs in the same manner.

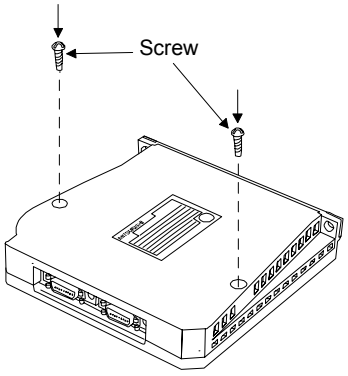




(3) Assembly of the case

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.



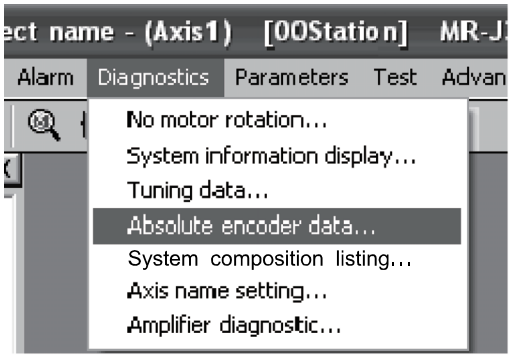
12.3.3 Battery transportation

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

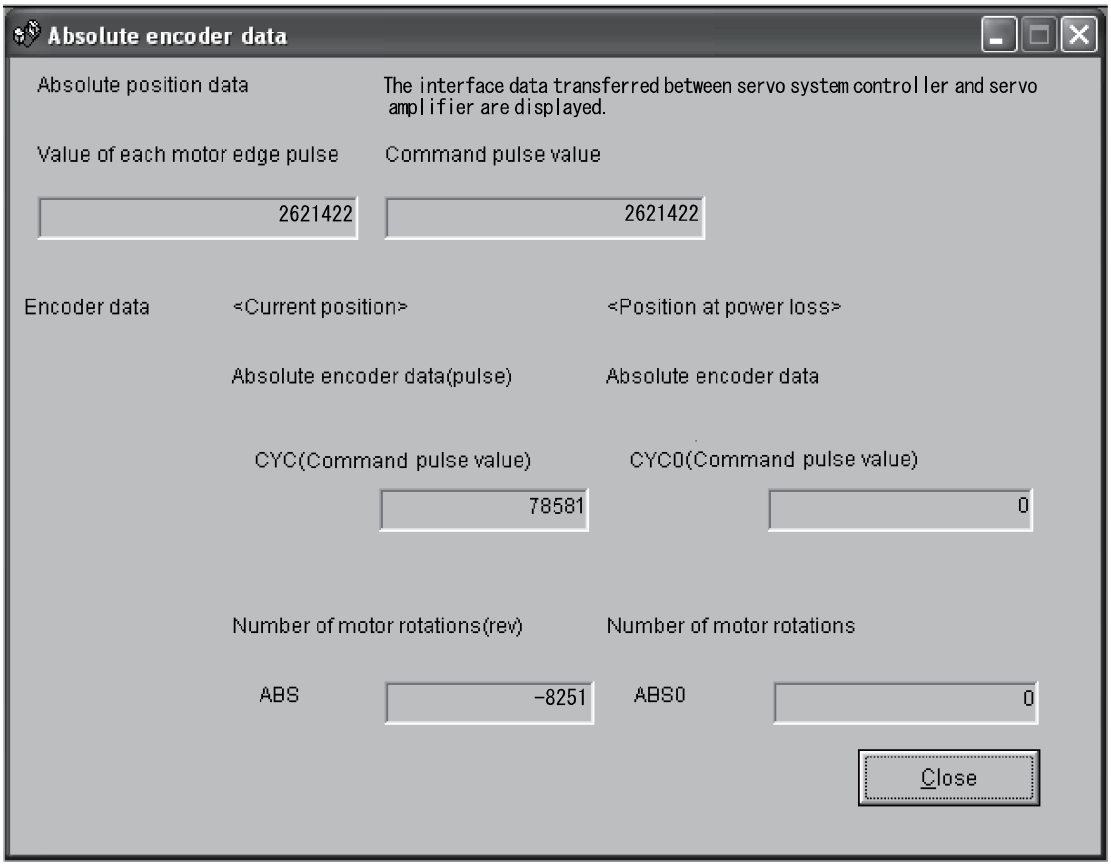
12.4 Confirmation of absolute position detection data

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.



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

13. USING A LINEAR SERVO MOTOR

⚠ WARNING	・When using the linear servo motor, read the following descriptions in the SSCNETⅢ Interface Linear Servo MR-J3-□B-RJ004 INSTRUCTION MANUAL (SH(NA)030054). ● Safety Instructions ● ● Handling of Linear Servo Motor ● 2. LINEAR SERVO MOTOR 9. CHARACTERISTICS

13.1 Functions and configuration

13.1.1 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 13.5.2 (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 13.5.2.)
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.□)

Classification	Item		Differences		Remarks
			Linear servo motor	Rotating servo motor	
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.☐) ・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	
MR Configurator MRZJW3-SETUP221E (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	

13.1.2 Combinations of Servo Amplifiers and Linear Servo Motors

(1) LM-H2 series

Linear servo motor		Servo amplifier					
Primary side(coil)	Secondary side(magnet)	MR-J3W-44B		MR-J3W-77B		MR-J3W-1010B	
		A-axis	B-axis	A-axis	B-axis	A-axis	B-axis
LM-H2P1A-06M-4SS0	LM-H2S10-288-4SS0 LM-H2S10-384-4SS0 LM-H2S10-480-4SS0 LM-H2S10-768-4SS0	○		○(Note)		○(Note)	
LM-H2P2A-12M-1SS0	LM-H2S20-288-1SS0 LM-H2S20-384-1SS0	○		○(Note)		○(Note)	
LM-H2P2B-24M-1SS0	LM-H2S20-480-1SS0 LM-H2S20-768-1SS0			○		○	
LM-H2P3A-24M-1SS0	LM-H2S30-288-1SS0 LM-H2S30-384-1SS0 LM-H2S30-480-1SS0 LM-H2S30-768-1SS0			○		○	

Note. With the servo amplifier whose software version is B2 or earlier, this linear servo motor can be used by setting parameter No.Po04 to "☐☐1☐". With the servo amplifier whose software version is B3 or later, no parameter setting is required.

(2) LM-U2 series

Linear servo motor		Servo amplifier							
Primary side(coil)	Secondary(magnet)	MR-J3W-22B		MR-J3W-44B		MR-J3W-77B		MR-J3W-1010B	
		A-axis	B-axis	A-axis	B-axis	A-axis	B-axis	A-axis	B-axis
LM-U2PAB-05M-0SS0	LM-U2SA0-240-0SS0	○		○					
LM-U2PAD-10M-0SS0	LM-U2SA0-300-0SS0			○		○(Note)		○(Note)	
LM-U2PAF-15M-0SS0	LM-U2SA0-420-0SS0			○		○(Note)		○(Note)	
LM-U2PBB-07M-1SS0	LM-U2SB0-240-1SS0	○		○					
LM-U2PBD-15M-1SS0	LM-U2SB0-300-1SS0					○		○	
LM-U2PBF-22M-1SS0	LM-U2SB0-420-1SS0					○		○	

Note. With the servo amplifier whose software version is B2 or earlier, this linear servo motor can be used by setting parameter No.Po04 to "□□1□". With the servo amplifier whose software version is B3 or later, no parameter setting is required.

(3) LM-K2 series

Linear servo motor		Servo amplifier					
Primary side(coil)	Secondary side(magnet)	MR-J3W-44B		MR-J3W-77B		MR-J3W-1010B	
		A-axis	B-axis	A-axis	B-axis	A-axis	B-axis
LM-K2P1A-01M-2SS1	LM-K2S10-288-2SS1 LM-K2S10-384-2SS1 LM-K2S10-480-2SS1 LM-K2S10-768-2SS1	○(Note 2)		○(Note 1, 2)		○(Note 1, 2)	
LM-K2P2A-02M-1SS1	LM-K2S20-288-1SS1 LM-K2S20-384-1SS1 LM-K2S20-480-1SS1 LM-K2S20-768-1SS1			○(Note 2)		○(Note 2)	

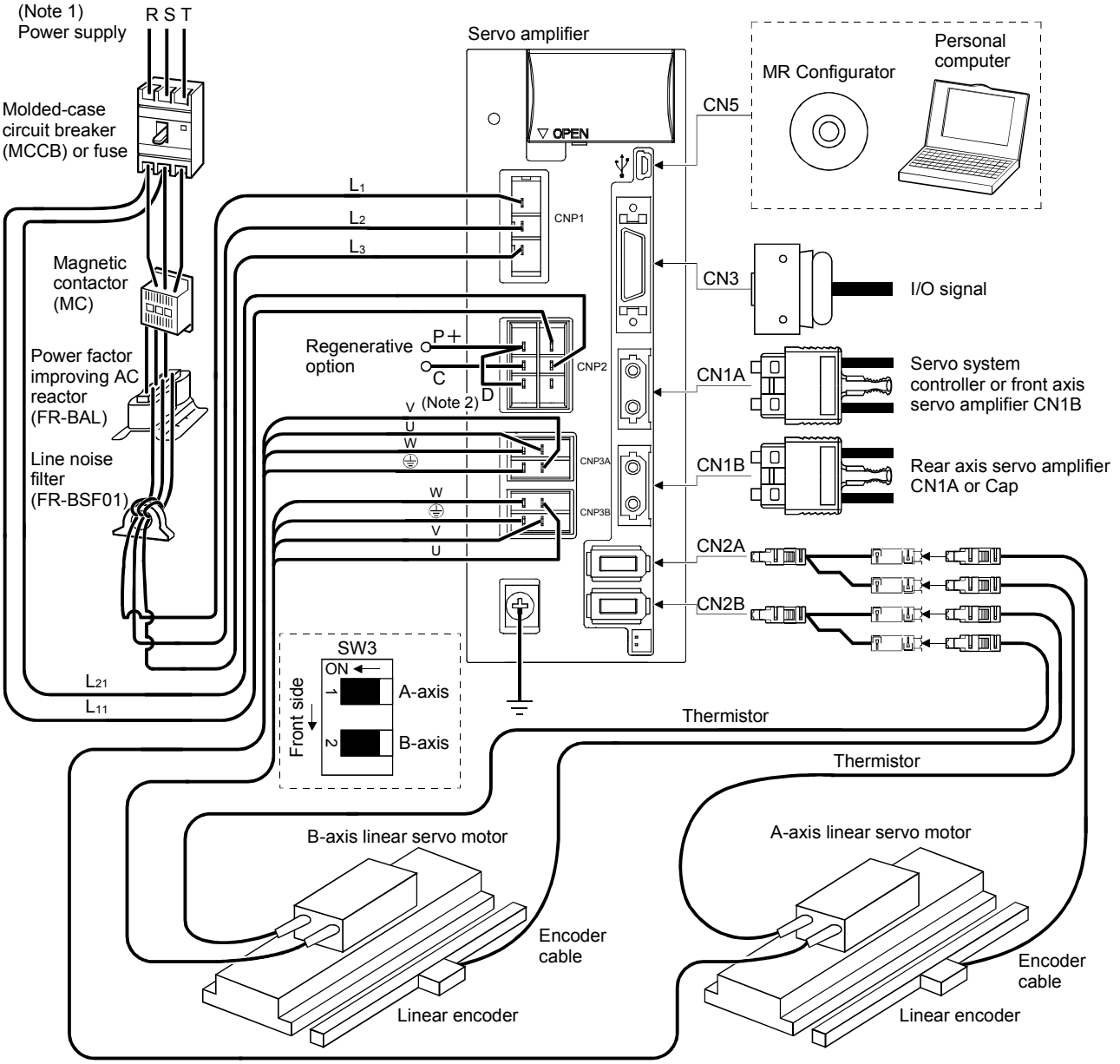
Note 1. With the servo amplifier whose software version is B2 or earlier, this linear servo motor can be used by setting parameter No.Po04 to "□□1□". With the servo amplifier whose software version is B3 or later, no parameter setting is required.

2. This linear servo motor can be used with the servo amplifier whose software version is B2 or later.

13.1.3 Configuration including auxiliary equipment

CAUTION	・Connecting a linear servo motor for different axis to the CNP3A or CNP3B connector may cause a malfunction.

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.



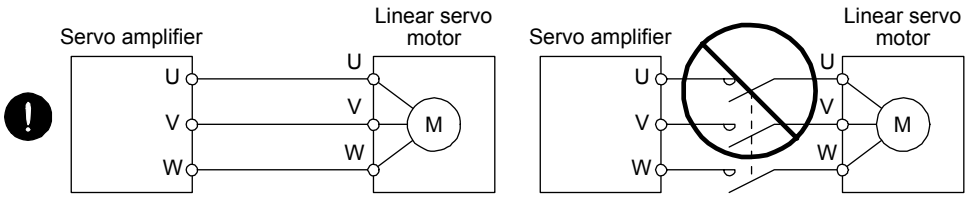
Note 1. For 1-phase 200V to 230VAC, connect the power supply to L_1・L_2 and leave L_3 open. Refer to section 1.3 for the power supply specification.

2. Make sure to connect the P+ terminal to the D terminal. When using the regenerative option, refer to section 11.2.

13.2 Connection of servo amplifier and linear servo motor

CAUTION

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



13.2.1 Connection instructions

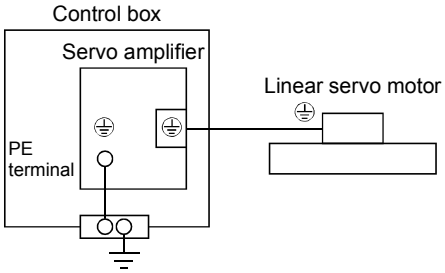
WARNING

- To avoid an electric shock, insulate the connections of the power supply terminals.

CAUTION

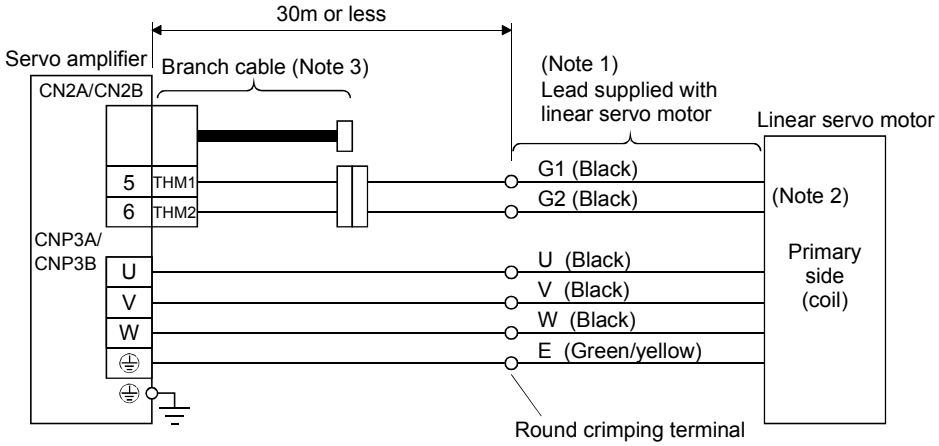
- Connect the wires to the correct phase terminals (U, V, W) of the servo amplifier and linear servo motor. Otherwise, the linear servo motor does not operate properly.
- Do not connect AC power supply directly to the linear servo motor. Otherwise, a fault may occur.

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.



13.2.2 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.
The following shows the lead length.
LM-H2: 0.4m
LM-U2: 0.4m
LM-K2: 0.5m
2. No polarity for the thermistors (G1 and G2)
3. Make the branch cable using the MR-J3THMCN2 connector set.

13.3 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.

13.3.1 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	Magnescale Co., Ltd. (Note 5)	SR77	0.05μm/ 0.01μm	3.3m/s	2040mm	2 wire type	○
			SR87			3040mm		
		Mitutoyo Corporation	AT343A	0.05μm	2.0m/s	3000mm	2 wire type	
			AT543A-SC		2.5m/s	2200mm		
			AT545A-SC	20μm/4096 (Approximately 0.005μm)	2.5m/s	2200mm		
			ST741A	0.5μm	4.0m/s	6000mm		
			ST742A					
			ST743A	0.1μm				
			ST744A					
		Heidenhain Corporation	LC 493M (Note 3)	0.05μm	3.0m/s	2040mm	4 wire type	
				0.01μm				
			LC 193M (Note 3)	0.05μm		4240mm		
				0.01μm				
	Incremental type	Magnescale Co., Ltd. (Note 5)	SR75	0.05μm	3.3m/s	2040mm	2 wire type	×
				0.01μm				
			SR85	0.05μm		3040mm		
				0.01μm				
			SL710 +PL101-R/RH +MJ830 or MJ831 (Note 2)	0.2μm (Note 1)	6.4m/s	100000mm		
		Renishaw Inc.	RGH26P	5μm	4.0m/s	70000mm	2 wire type	
			RGH26Q	1μm	3.2m/s			
			RGH26R	0.5μm	1.6m/s			
		Heidenhain Corporation	LIDA 485 +EIB 392M (Note 4)	20μm/16384 (Approximately 1.22μm)	4.0m/s	30040mm	4 wire type	
			LIDA 487 +EIB 392M (Note 4)			6040mm		
A/B/Z-phase differential output	Incremental type	Not specified		Permissible 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.

3. Changed from LC 491M and LC 192M, respectively. For details, please contact Heidenhain Corporation.

4. Changed from APE391M. For details, please contact Heidenhain Corporation.

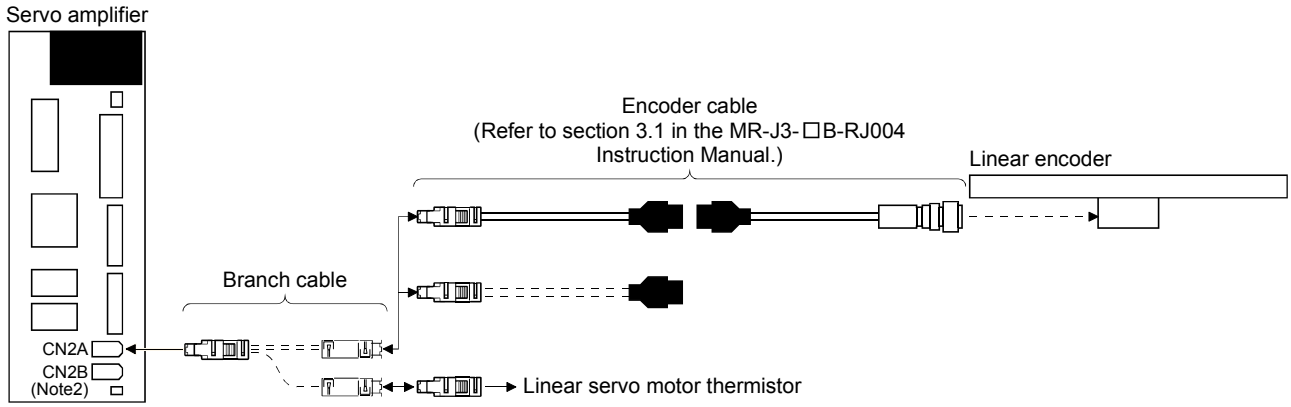
5. Former company name: Sony Manufacturing Systems Corporation (The company name was changed at the end of March 2010.)

13.3.2 Linear encoder and branch cable

The CN2A/CN2B connector has the thermistor signal pins for the linear servo motor. To output the thermistor signal, create a branch cable.

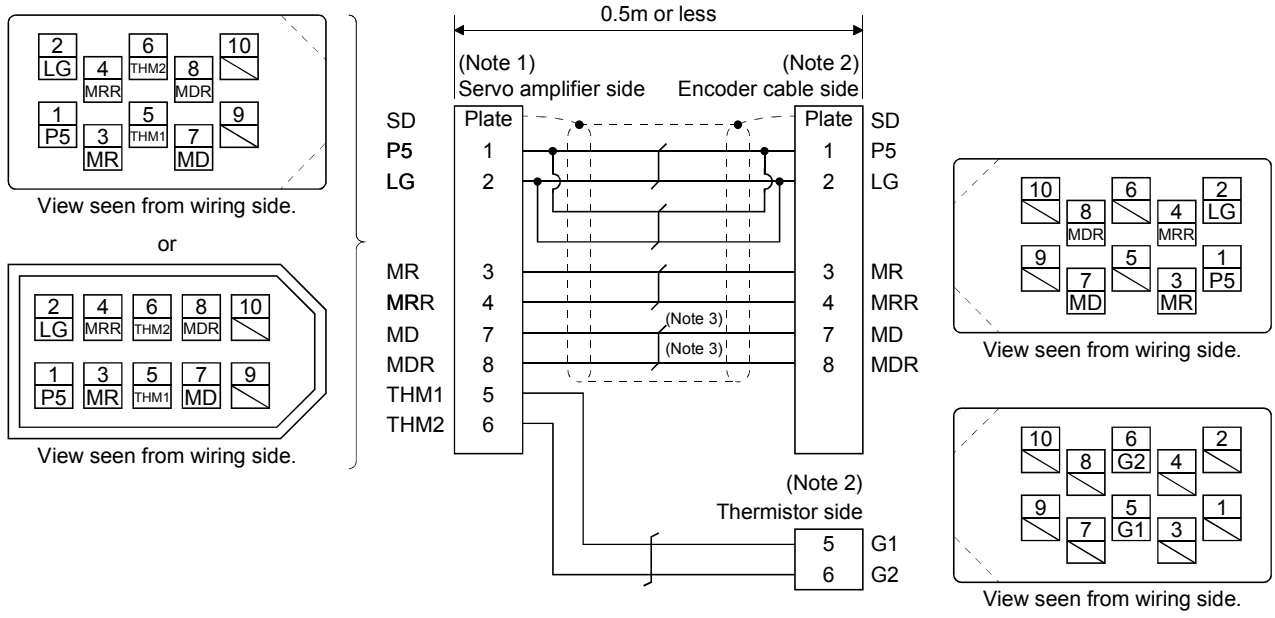
(1) Configuration diagram

The following shows the configuration diagram of the servo amplifier and the linear encoder. The configuration of the encoder cable differs according to the linear encoder. For the encoder cable, refer to section 3.1 in the MR-J3-□B-RJ004 Instruction Manual.



(2) 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)

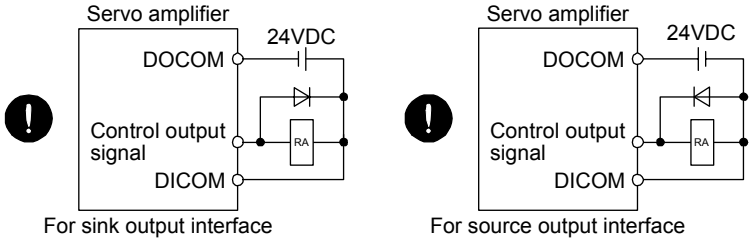
3. If the linear encoder is the two-wire type, the wiring is not required for MD and MDR.

13.4 Signals and wiring

WARNING

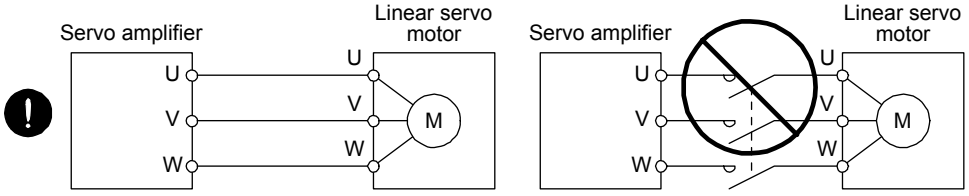
- Any person who is involved in wiring should be fully competent to do the work.
- Before wiring or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Otherwise, an electric shock may occur. In addition, always confirm from the front of the servo amplifier, 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.

- Wire the equipment correctly and securely. Otherwise, the linear 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.



CAUTION

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



CAUTION

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

13.4.1 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

13.4.2 Power supply system circuit connection example

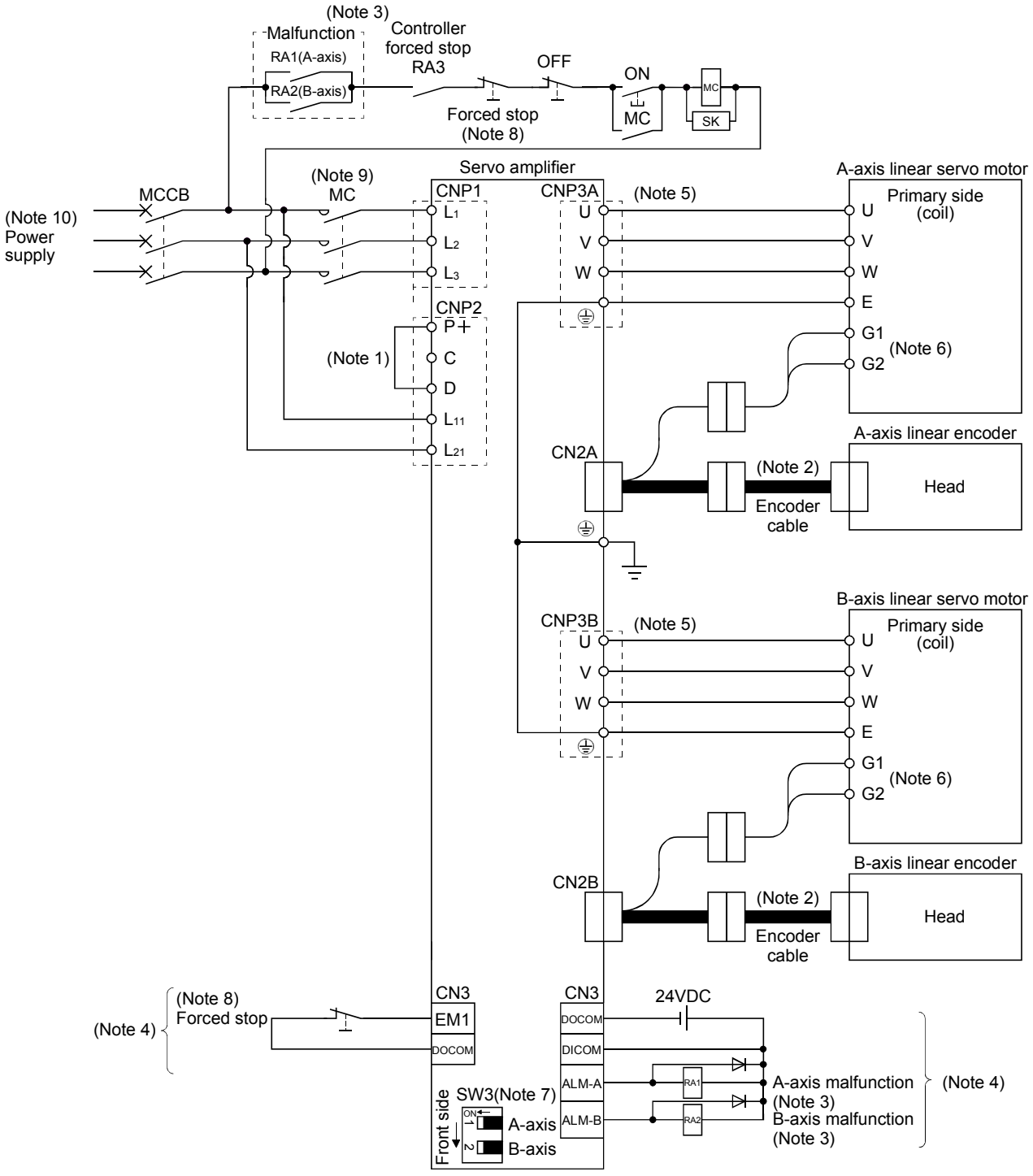
CAUTION

- Always connect a magnetic contactor between the power supply and the main circuit power supply (L1, L2, and L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.
- 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.
- Check the servo amplifier model, and then input proper voltage to the servo amplifier power supply. If input voltage exceeds the upper limit, the servo amplifier will break down.
- Connecting a linear servo motor for different axis to the CNP3A or CNP3B connector may cause a malfunction.

POINT

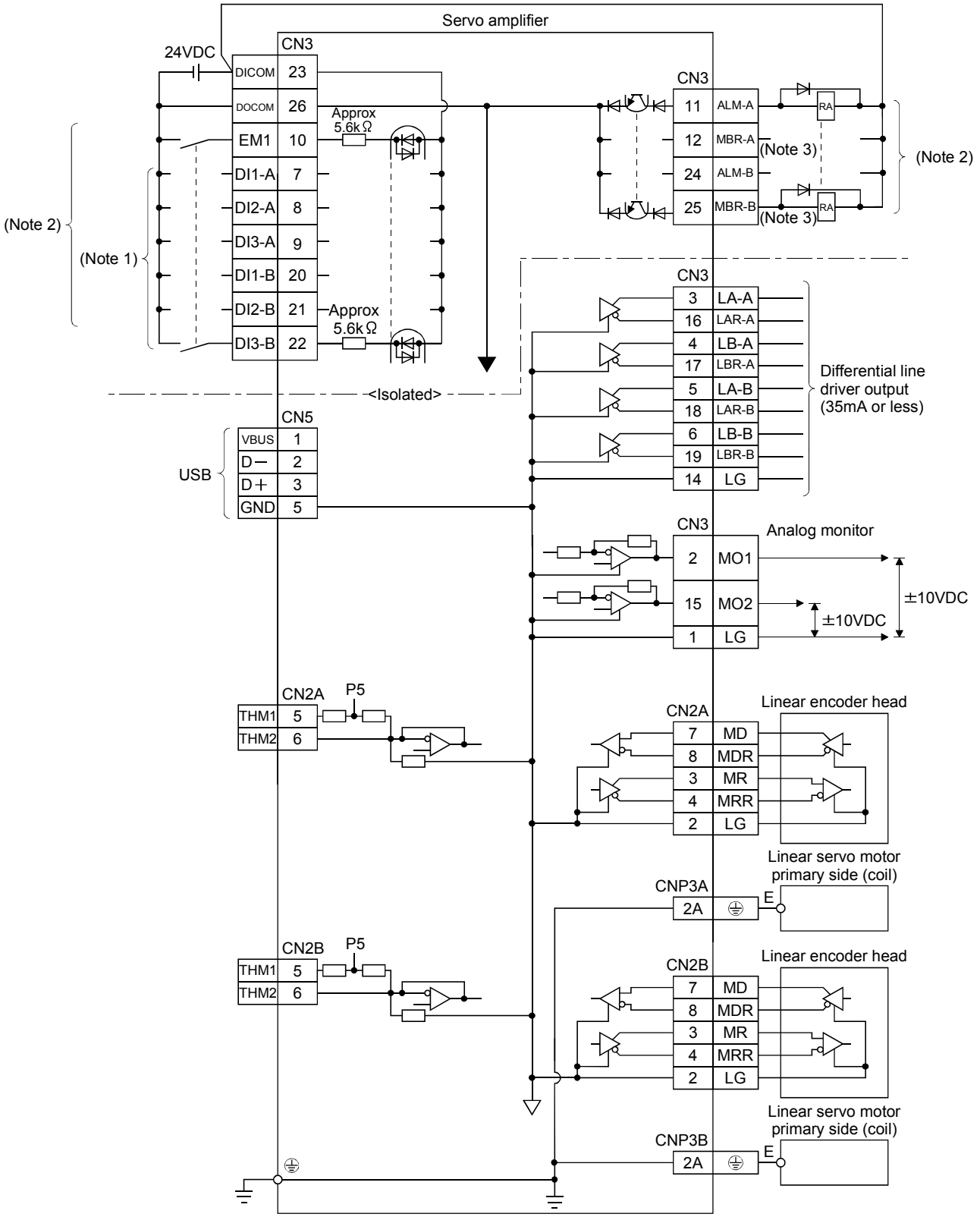
- Even if alarm has occurred, do not switch off the control circuit power supply. When the control circuit power supply has been switched off, optical module does not operate, and optical transmission of SSCNETⅢ communication is interrupted. Therefore, the servo amplifier on the rear axis displays "AA" 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 molded-case circuit breaker (MCCB) must be used with the input cables of the main circuit power supply.


(Note 3)
Malfunction
RA1(A-axis)
RA2(B-axis)
Controller forced stop
RA3
OFF
ON
MC
SK
Forced stop
(Note 8)
Servo amplifier
MCCB
(Note 9)
MC
CNP1
CNP3A
(Note 5)
A-axis linear servo motor
Primary side
(coil)
(Note 10)
Power
supply
L1
L2
L3
U
V
W
E
G1
G2
(Note 6)
CNP2
P+
C
D
L11
L21
(Note 1)
A-axis linear encoder
CN2A
(Note 2)
Encoder
cable
Head
B-axis linear servo motor
CNP3B
(Note 5)
B-axis linear encoder
CN2B
(Note 4)
(Note 8)
Forced stop
CN3
EM1
DOCOM
DICOM
ALM-A
ALM-B
24VDC
RA1
RA2
A-axis malfunction
(Note 3)
B-axis malfunction
(Note 3)
(Note 4)
Front side
SW3(Note 7)
ON
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 malfunction (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.

13.4.3 Internal connection diagram



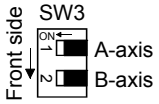
Note 1. Signal can be assigned for these pins with the controller setting.
For contents of signals, refer to the instruction manual of the controller.
2. For the sink I/O interface. For the source I/O interface, refer to section 3.7.3.
3. When using a linear servo motor, use MBR (Electromagnetic brake interlock) for an external brake mechanism.

13.5 Operation and functions

13.5.1 Startup

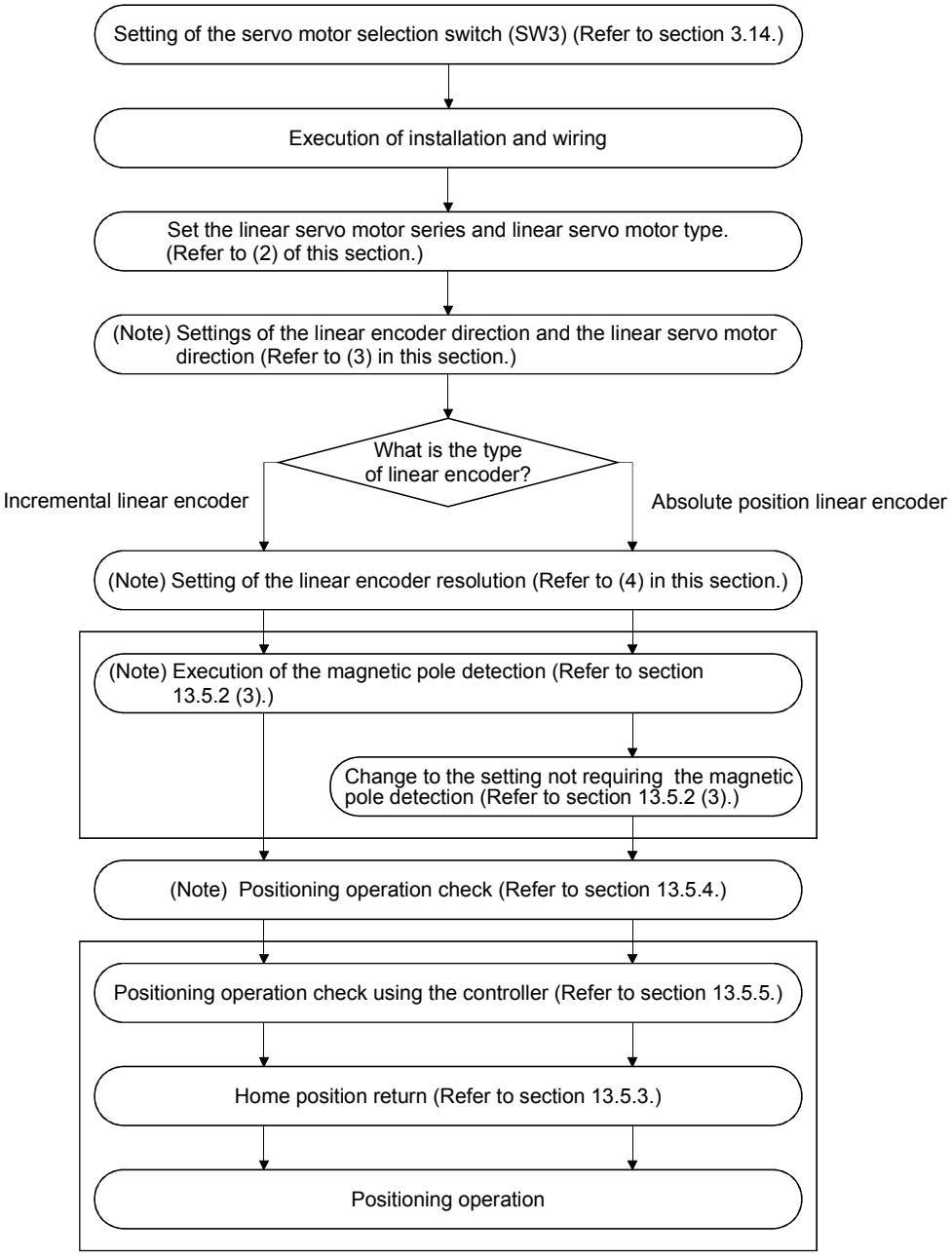
POINT

- To use a linear servo motor, turn SW3 on.



(1) Startup procedure

Start up the linear servo referring to the following procedure.

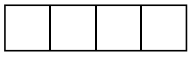


Note. MR Configurator is used.

(2) Set the linear servo motor series and linear servo motor type.
To use the linear servo motor, set the linear servo motor series and linear servo motor type with parameter No. PA17 (Linear servo motor series setting) and No. PA18 (Linear servo motor type setting). (Refer to section 13.6.2.)

(3) 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.

Parameter No.PC27

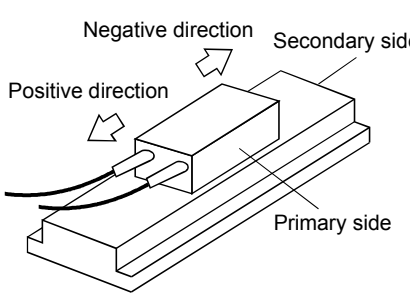


Encoder pulse count polarity selection
0: Linear servo motor positive direction and linear encoder increase direction
1: Linear servo motor positive direction and linear encoder decrease direction

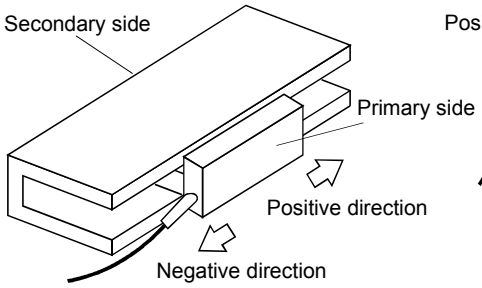
(a) Parameter setting method
1) Confirm the positive direction of linear servo motor the relationship of the moving direction of linear servo motor to commands is determined by the setting of the parameter No.PA14 as follows.

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

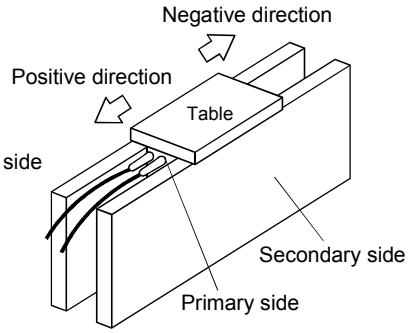
The positive/negative directions of the linear servo motor are as shown below.



LM-H2 series



LM-U2 series



LM-K2 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.

(4) 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.

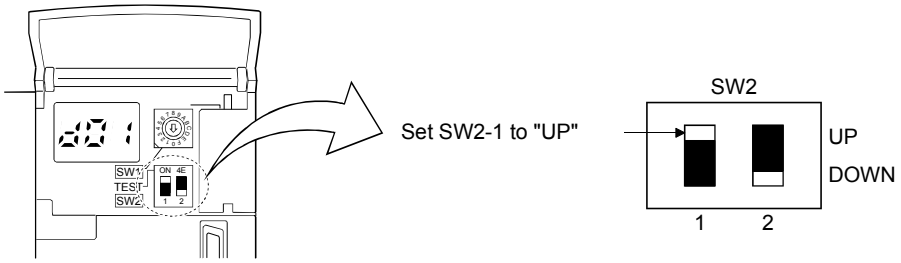
13.5.2 Magnetic pole detection

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

POINT
・When the test operation mode is selected by using the test operation select switch (SW2-1), the SSCNETⅢ communication for the servo amplifier in the test operation mode and the following servo amplifiers is blocked.

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.

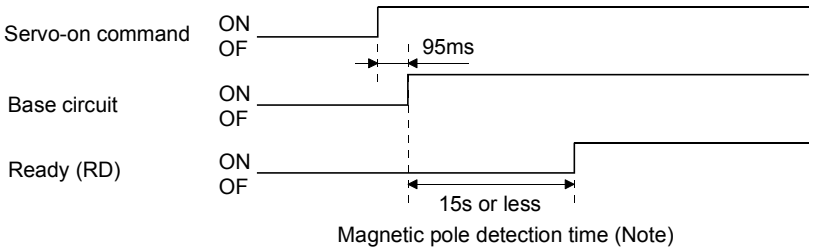
1) When using the incremental linear encoder (Refer to (2) (a) in this section)

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

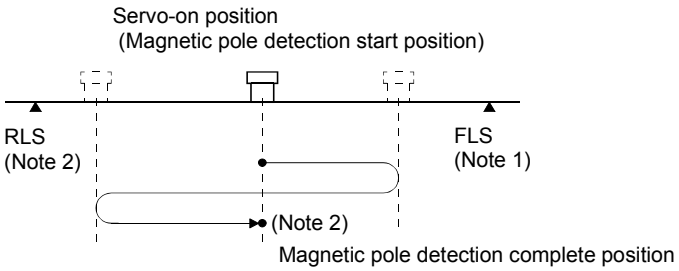
For the incremental linear encoder, the magnetic pole detection is required every time the power is turned on. By turning ON the servo-on command from the controller after the power-on, the magnetic pole detection is automatically carried out. Therefore, there is no need to set the parameter (first digit 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)

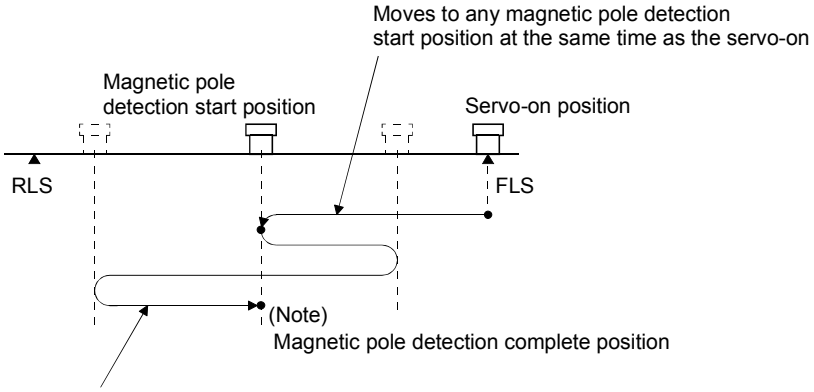


Note 1. When the stroke limit (FLS or RLS) turns OFF during the magnetic pole detection, the operation of magnetic pole detection is carried on to the opposite direction. When both FLS and RLS are OFF, the magnetic pole detection error (27.☐) occurs.

2. The following shows the pitch against magnetic pole.

Linear servo motor series	LM-H2	LM-U2 (Medium thrust)	LM-K2
Pitch against magnetic pole [mm]	48	30	48

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.



Returns to the magnetic pole detection start position after several reciprocating operation, and changes to the servo lock status after the completion of magnetic pole detection. At this time, there may be a gap, approximately a quarter of the pitch against magnetic pole, from the start position.

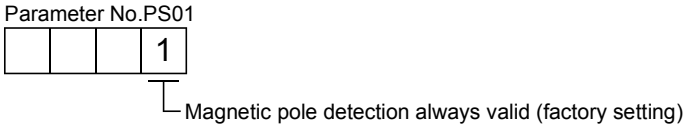
Note. For the pitch against magnetic pole, refer to (2) (a) 2) Note 2 in this section.

(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.

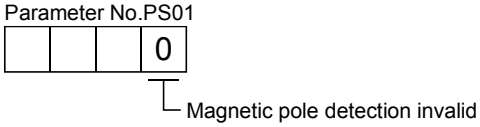
Carry out the magnetic pole detection referring the following procedure.

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

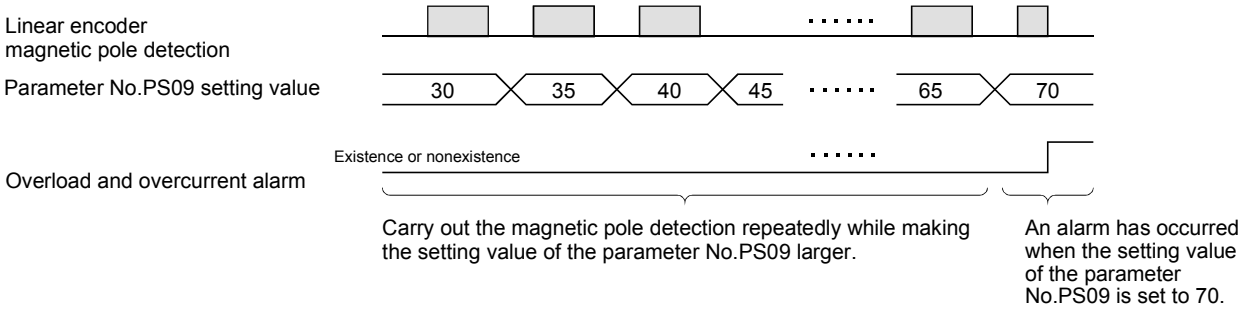
(b) Setting procedure

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

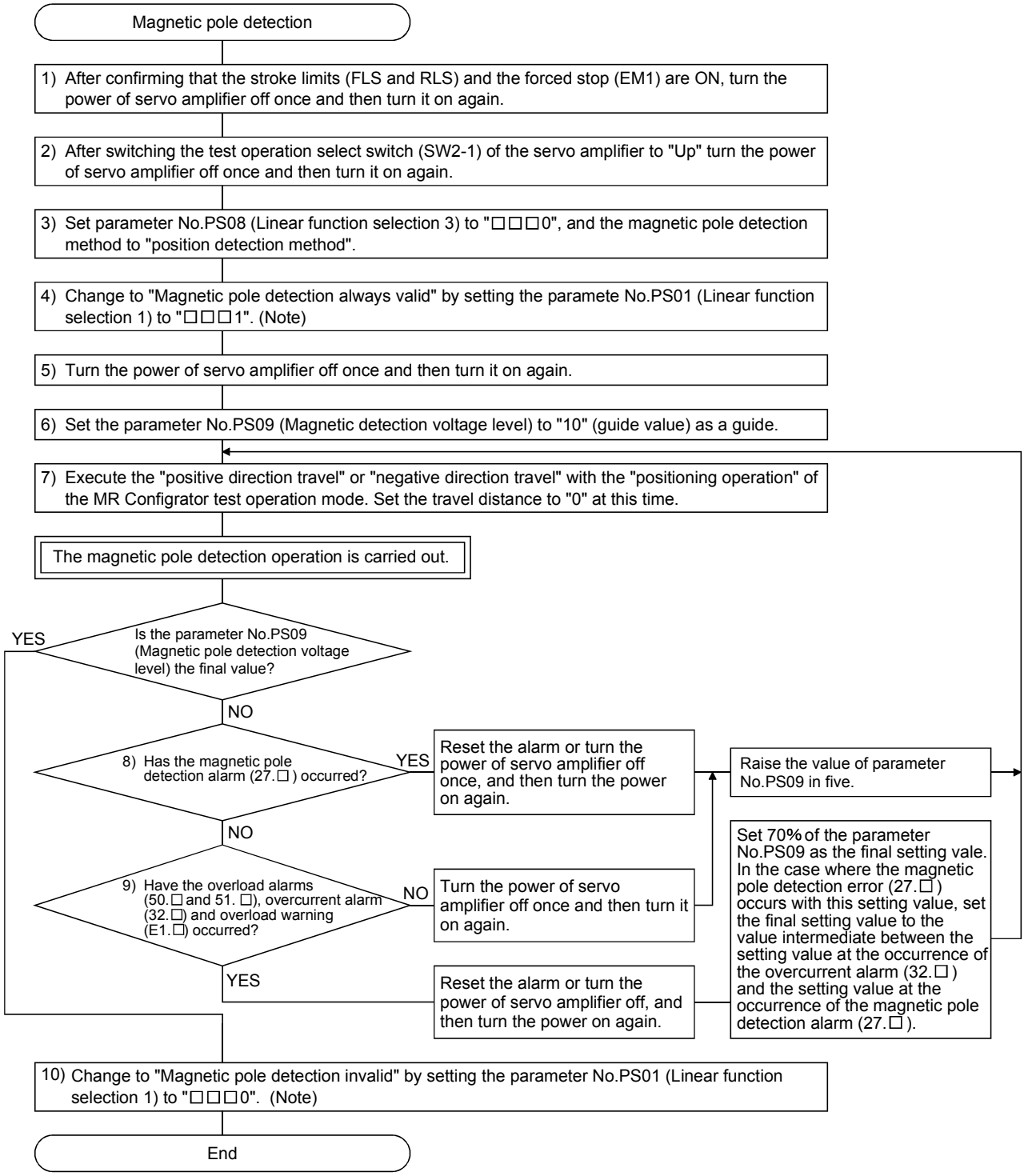


Here, the final setting value of the parameter No.PS09 is set to 49 (the setting value at the occurrence of the overload and overcurrent alarm = 70 × 0.7).

(4) Magnetic pole detection method using MR Configurator

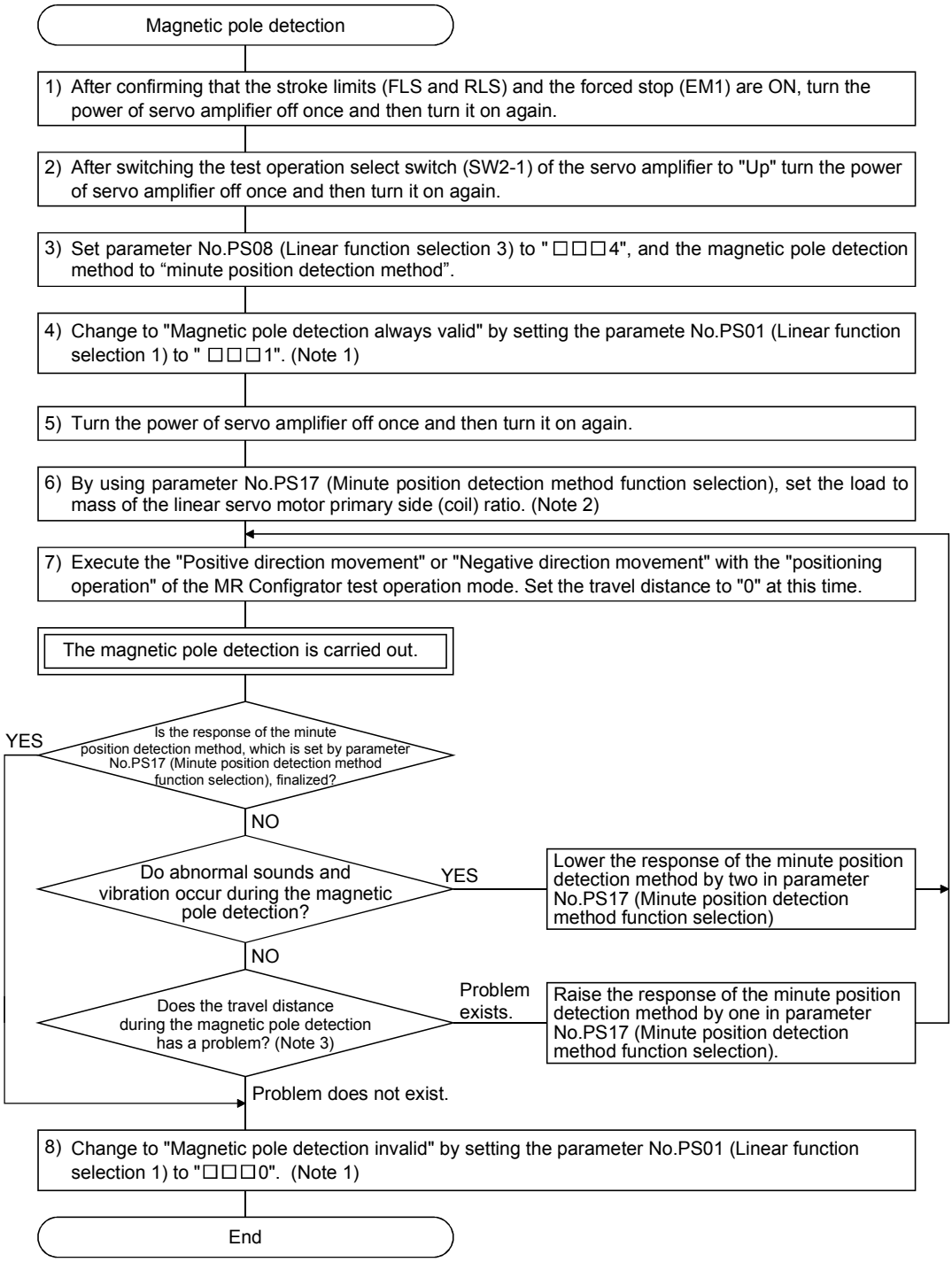
The following shows the procedure of the magnetic pole detection using MR Configurator.

(a) Magnetic pole detection of the positioning detection method.



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



Note 1. When using the incremental system, parameter No.PS01 setting is not required.

2. When the load to mass of the linear servo motor primary side (coil) ratio 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.

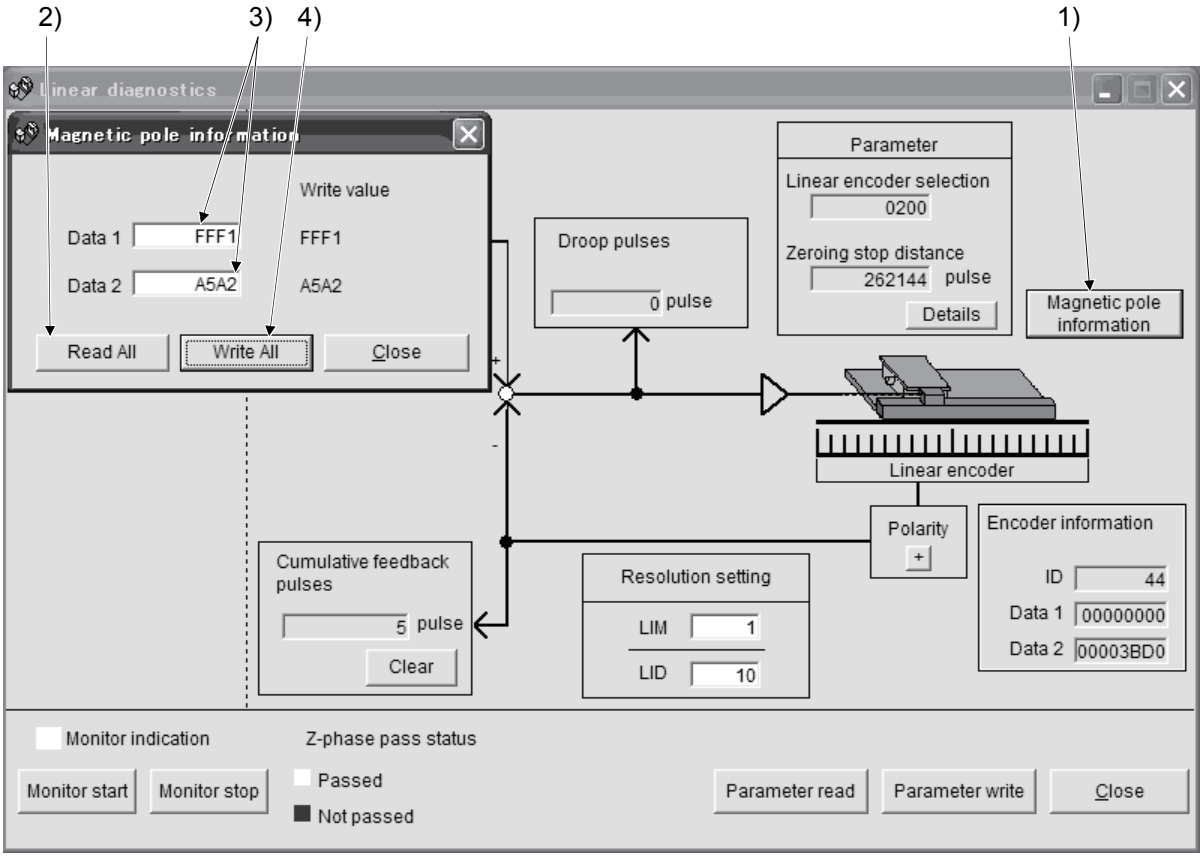
b) Confirm that the personal computer is connected to the servo amplifier, and select "Diagnostic" and then "Linear diagnostic".

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.


2)
3)
4)
1)
Linear diagnostics
Magnetic pole information
Write value
Data 1
FFF1
FFF1
Data 2
A5A2
A5A2
Read All
Write All
Close
Droop pulses
0 pulse
Parameter
Linear encoder selection
0200
Zeroing stop distance
262144 pulse
Details
Magnetic pole information
Linear encoder
Polarity
+
Encoder information
ID 44
Data 1 00000000
Data 2 00003BD0
Cumulative feedback pulses
5 pulse
Clear
Resolution setting
LIM 1
LID 10
Monitor indication
Z-phase pass status
Passed
Not passed
Monitor start
Monitor stop
Parameter read
Parameter write
Close

13.5.3 Home position return

POINT

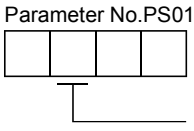
- The incremental linear encoder and the absolute position linear encoder have different home position reference positions at the home position return.

(1) Incremental linear encoder

CAUTION

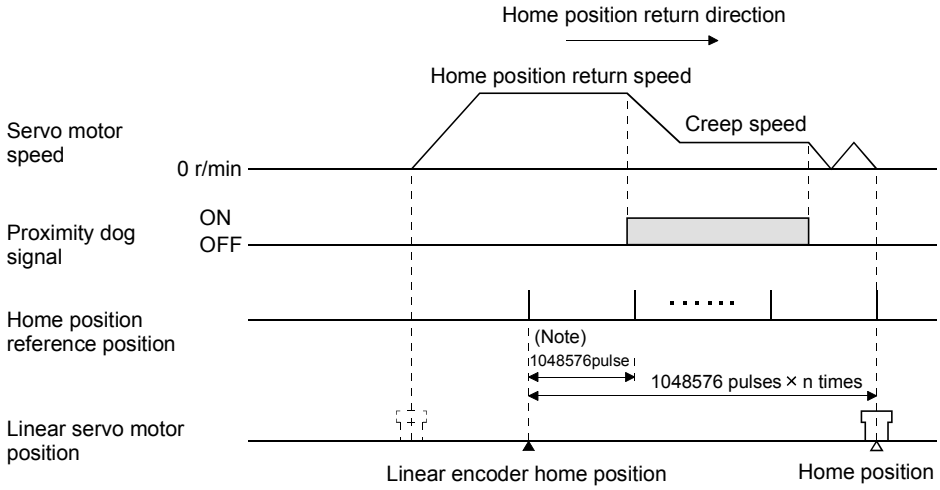
- If the resolution or stop interval (the third digit of the parameter No.PS01) of the linear encoder is too large, it is very dangerous since it may crash into the stroke end.

(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.



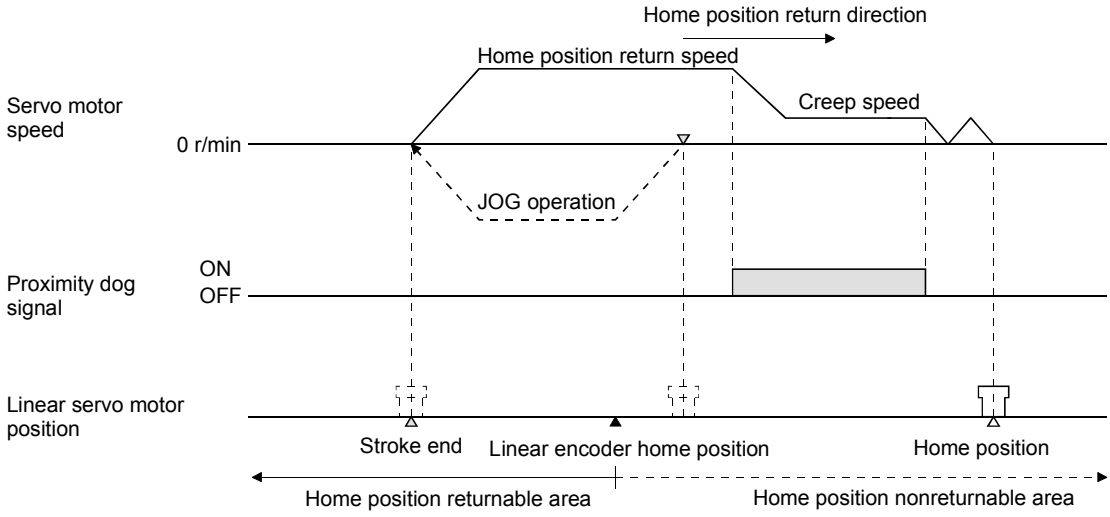
Setting value	Stop interval [pulse]
0	8192
1	131072
2	262144
3	1048576
4	4194304
5	16777216
6	67108864

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.



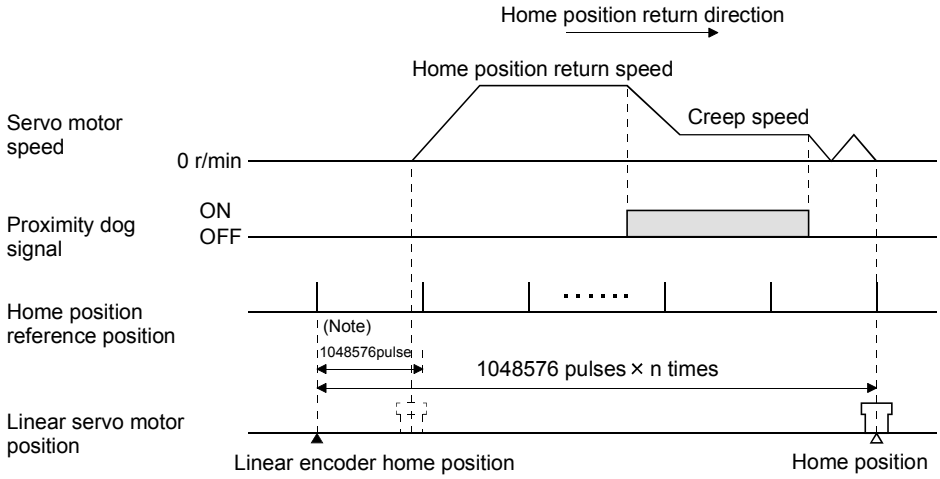
POINT

- 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.

13.5.4 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.
・When the test operation mode is selected by using the test operation select switch (SW2-1), the SSCNETⅢ communication for the servo amplifier in the test operation mode and the following servo amplifiers is blocked.

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.

(1) Test operation mode

(a) 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	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

2) 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.

(b) 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.

(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.

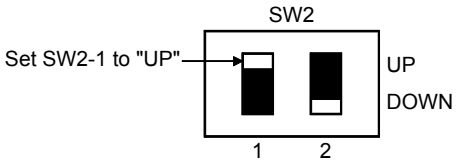
Exercise control on the program operation screen of the MR Configurator. For full information, refer to the MR Configurator Installation Guide.

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

(2) Operation procedure

1) Switch power off.

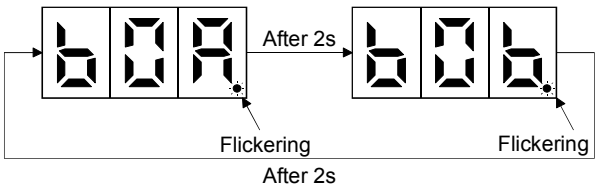
2) Set SW2-1 to "UP".



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.

13.5.5 Operation from the controller

When establishing the absolute position detection system, the absolute position linear encoder is required.
An 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□/LD77MH□

(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

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 QD74MH□/QD75MH□/ LD77MH□
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		
	PA01	**STY	Control mode (Note 2)	0000h	0004h	0004h
	PC01	ERZ	Error excessive alarm level	100	Set as necessary.	Set as necessary.
	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	0		
	PS06	LB2	Linear servo motor control speed deviation error detection level	0		
	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		This parameter is not used. (Note 2)	500		
	PS17	LTSTS	Minute position detection method function selection Each	0000h		
	PS18	IDLV	Minute position detection method identification signal amplitude	0000h		
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.

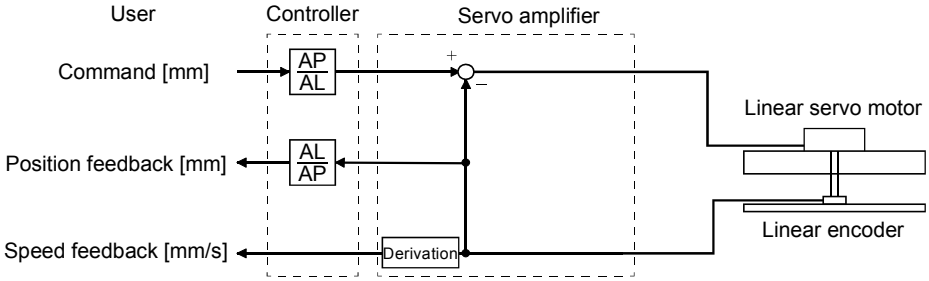
2. For the QD75 MH□, make sure to set the factory setting.

3. GX Configurator-QP(SW2D5C-QD75P) of Ver.2.29F or later supports the MR-J3-□B linear.

4. Note that the following.

- When a servo amplifier parameter (servo parameter) is changed, the controller automatically reads the servo parameter and stores the new servo parameter in the buffer memory of the QD74MH□, QD75MH or LD77MH. However, the new servo parameter is not reflected in the flash memory.
- Right after the servo parameter is changed, if the QD74MH□, QD75MH or LD77MH is turned off or reset, or if the control circuit power supply of the servo amplifier is turned off, the new servo parameter may not be reflected in the buffer memory. In this case, change the servo parameter again.

(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

$$\frac{\text{Number of pulses (AP) [pulse]}}{\text{Travel distance (AL) [}\mu\text{m]}} = \frac{1}{0.05} = \frac{20}{1}$$

13.5.6 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.

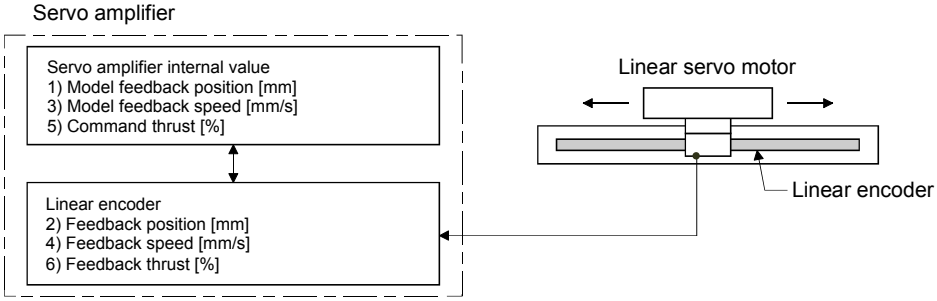
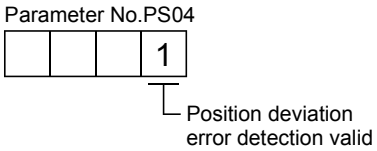


Figure 13.1 Summary of linear servo control error detection function

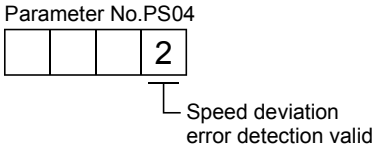
(a) Position deviation error detection
Set the parameter No.PS04 to "□□□1" to make the position deviation error detection enabled.



If there is a deviation larger than the setting value (1 to 1000mm) 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

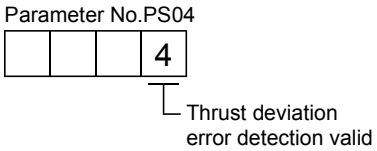
Set the parameter No.PS04 to "□□□2" to make the speed deviation error detection enabled.



If there is a deviation larger than the setting value (1 to 5000mm/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

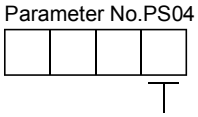
Set the parameter No.PS04 to "□□□4" to make the thrust deviation error detection enabled.



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 to mass of the linear servo motor primary side (coil) ratio.

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 to mass of the linear servo motor primary side (coil) ratio 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.

13.5.7 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 an 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.

13.6 Parameters

⚠ CAUTION	・Never adjust or change the parameter values extremely as it will make operation instable. ・When the fixed values are indicated for any digits of a parameter, never change the values of the digits.

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.

13.6.1 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					

13.6.2 Basic setting parameters (No.PA□□)

(1) Parameter list

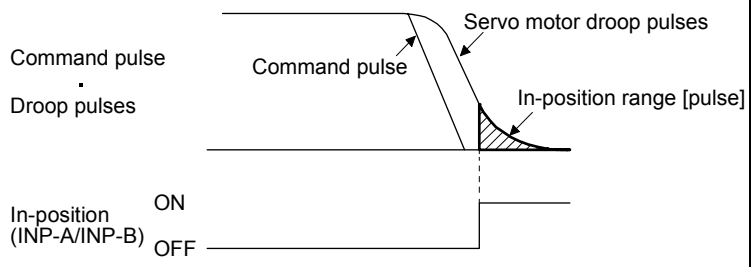
POINT

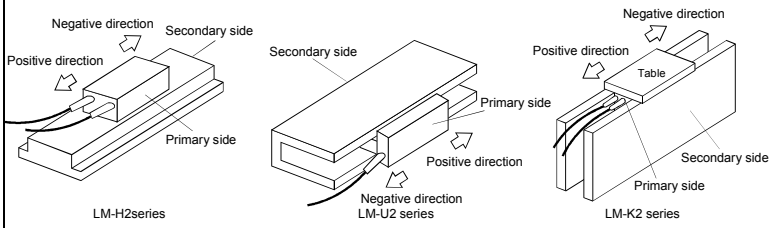
- The parameter whose symbol preceded by * can be validated with the following conditions.
  * : Turn off the power and then on again, or reset the controller after setting the parameter.
  **: Turn off the power and then on again after setting the parameter.

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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		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 6: Direct drive 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.

</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/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.
$\text{Output pulse} = \frac{\text{Travel distance of linear encoder}}{\text{Set value}}$ [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/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 × $\frac{\text{Set value of parameter No.PA15}}{\text{Set value of parameter No.PA16}}$ [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 rowspan="2"></td><td rowspan="2">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>00B3h</td><td>1101h</td></tr>
<tr><td>LM-H2P2A-12M-1SS0</td><td>00B3h</td><td>2101h</td></tr>
<tr><td>LM-H2P2B-24M-1SS0</td><td>00B3h</td><td>2201h</td></tr>
<tr><td>LM-H2P3A-24M-1SS0</td><td>00B3h</td><td>3101h</td></tr>
<tr><td rowspan="6">LM-U2</td><td>LM-U2PAB-05M-0SS0</td><td>00B4h</td><td>A201h</td></tr>
<tr><td>LM-U2PBB-07M-1SS0</td><td>00B4h</td><td>B201h</td></tr>
<tr><td>LM-U2PAD-10M-0SS0</td><td>00B4h</td><td>A401h</td></tr>
<tr><td>LM-U2PAF-15M-0SS0</td><td>00B4h</td><td>A601h</td></tr>
<tr><td>LM-U2PBD-15M-1SS0</td><td>00B4h</td><td>B401h</td></tr>
<tr><td>LM-U2PBF-22M-1SS0</td><td>00B4h</td><td>2601h</td></tr>
<tr><td rowspan="2">LM-K2</td><td>LM-K2P1A-01M-2SS1</td><td>00B8h</td><td>1101h</td></tr>
<tr><td>LM-K2P2A-02M-1SS1</td><td>00B8h</td><td>2101h</td></tr>
</table></td><td>Each axis</td><td>0000h</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>

13.6.3 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.

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		This parameter is not used. Do not change the value.		0		
PB04	FFC	Feed forward gain	Each axis	0	%	Section 5.2.2
PB05		This parameter is not used. Do not change the value.		500		
PB06	GD2	Load to mass of the linear servo motor primary side (coil) ratio	Each axis	7.0	Multi-plier (×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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		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 to mass of the linear servo motor primary side (coil) ratio	Each axis	7.0	Multi-plier (×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		This parameter is not used. Do not change the value.		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 to mass of the linear servo motor primary side (coil) ratio Used to set the load to mass of the linear servo motor primary side (coil) ratio. When auto tuning mode 1 and interpolation mode are selected, the result of auto tuning is automatically used. In this case, it varies between 0.0 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)	0.0 to 300.0
PB29	GD2B	Gain changing - load to mass of the linear servo motor primary side (coil) ratio Used to set the load to mass of the linear servo motor primary side (coil) 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	Multi-plier (×1)	0.0 to 300.0

13.6.4 Extension setting parameters (No.PC□□)

(1) Parameter list

POINT

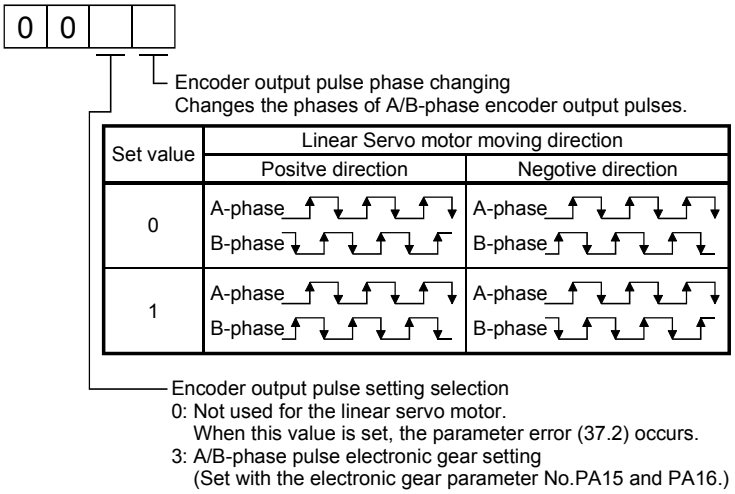
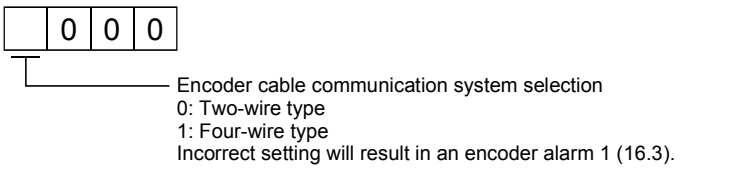
- The parameter whose symbol preceded by * can be validated with the following conditions.
  * : Turn off the power and then on again, or reset the controller after setting the parameter.
  **: Turn off the power and then on again after setting the parameter.

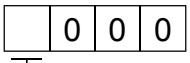
No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PC01	ERZ	Error excessive alarm level	Each axis	0	mm	This section (2)
PC02	MBR	Electromagnetic brake sequence output	Each axis	0	ms	Section 5.3.2
PC03	*ENRS	Encoder output pulses selection	Each axis	0010h		This section (2)
PC04	**COP1	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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		0000h		
PC17	**COP4	Function selection C-4	Each axis	0000h		Section 5.3.2
PC18		This parameter is not used. Do not change the value.		0000h		
PC19				0000h		
PC20				0000h		
PC21	*BPS	Alarm history clear	Each axis	0000h		Section 5.3.2
PC22		This parameter is not used. Do not change the value.		0000h		
PC23				0000h		
PC24				0000h		
PC25				0000h		
PC26				0000h		

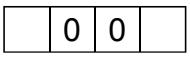
No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PC27	**COP9	Function selection C-9	Each axis	0000h		This section (2)
PC28		This parameter is not used. Do not change the value.		0000h		
PC29				0000h		
PC30				0000h		
PC31				0000h		
PC32				0000h		

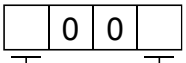
Note 1. Each axis: Set a value for each of the A-axis and the B-axis.
Common: Common parameters for the A-axis and the B-axis. Set same values for the A-axis and the B-axis. If different values are set, the last set value becomes valid.
2. Valid for the A-axis and the B-axis.

(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.  	Each axis	0010h		Refer to name and function column.
PC04	**COP1	Function selection C-1 Select the encoder cable communication system selection.  	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.


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.


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)</td></tr><tr><td>7</td><td>Droop pulses (±10V/1000 pulses)</td></tr><tr><td>8</td><td>Droop pulses (±10V/10000 pulses)</td></tr><tr><td>9</td><td>Droop pulses (±10V/100000 pulses)</td></tr><tr><td>D</td><td>Bus voltage (±8V/400V)</td></tr></table>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.


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>This parameter is not used. Do not change the value.
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. 0 0 0 [ ] 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

POINT
▪ A voltage of analog monitor output may be irregular at power-on.

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

(a) Setting

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

Parameter No.PC09

[ ] 0 0 [ ]

- [ ] (last digit): Analog monitor (MO1) output selection (Signal output to across MO1-LG)
- [ ] (first digit): Analog monitor 1 (MO1) output axis selection
  0: A-axis
  1: B-axis

Parameter No.PC10

[ ] 0 0 [ ]

- [ ] (last digit): Analog monitor (MO2) output selection (Signal output to across MO2-LG)
- [ ] (first digit): Analog monitor 2 (MO2) output axis selection
  0: A-axis
  1: B-axis

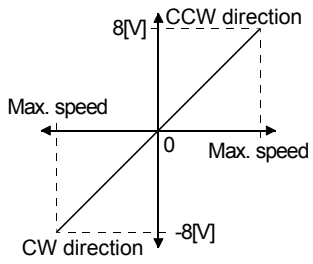
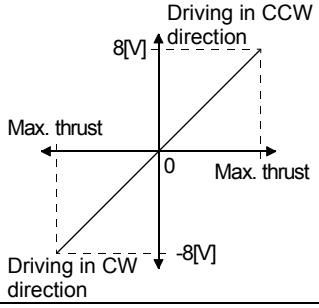
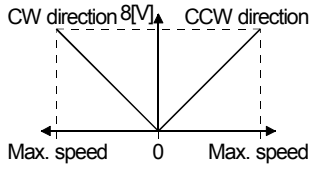
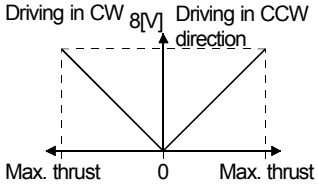
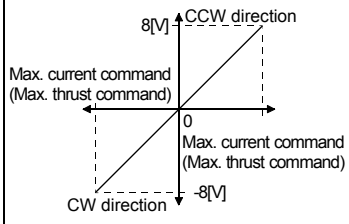
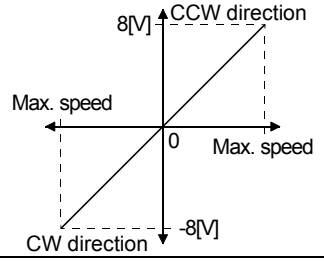
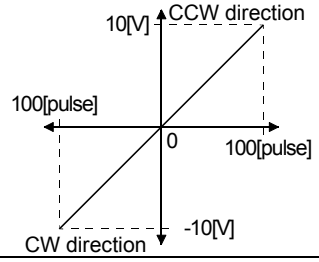
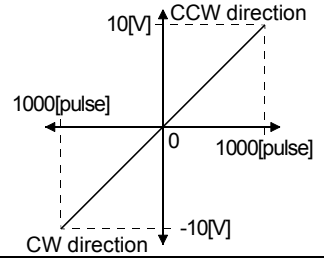
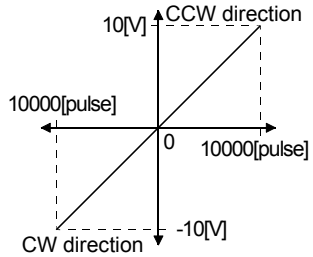
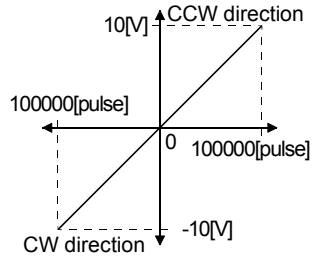
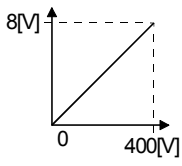
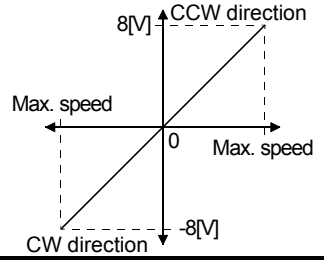
Parameters No.PC11 and PC12 can be used to set the offset voltages to the analog output voltages. The setting range is between −999 and 999mV.

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

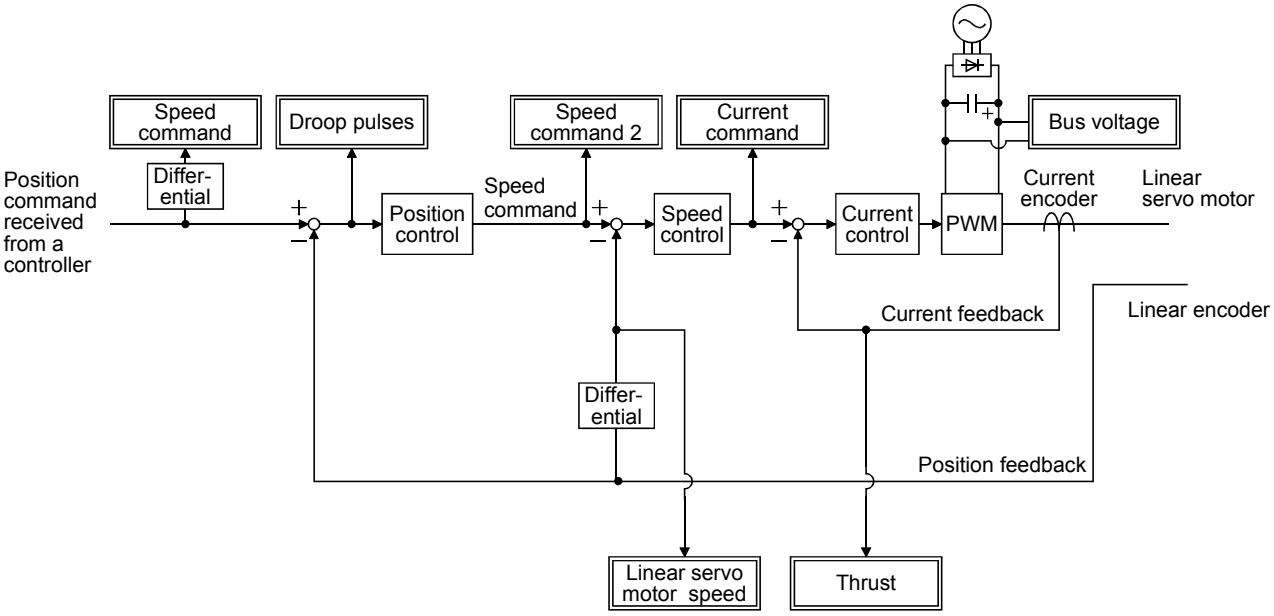
The servo amplifier is factory-set to output the linear servo motor speed to analog monitor 1 (MO1) and the torque to analog monitor (MO2). The setting can be changed as listed below by changing the parameter No.PC09 and PC10 value.

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 (Note 2)	
6	Droop pulses (Note 1, 2, 3) (±10V/100 pulses)		7	Droop pulses (Note 1, 2, 3) (±10V/1000 pulses)	
8	Droop pulses (Note 1, 2, 3) (±10V/10000 pulses)		9	Droop pulses (Note 1, 2, 3) (±10V/100000 pulses)	
D	Bus voltage		E	Speed command (Note 2, 4)	

Note 1. Encoder pulse unit.
2. Cannot be used in the torque loop mode.
3. Cannot be used in the speed loop mode.
4. This setting can be used with the servo amplifier whose software version is B3 or later and with MR Configurator whose software version is C5 or later.

(c) Analog monitor block diagram



13.6.5 I/O setting parameters (No.PD□□)

(1) Parameter list

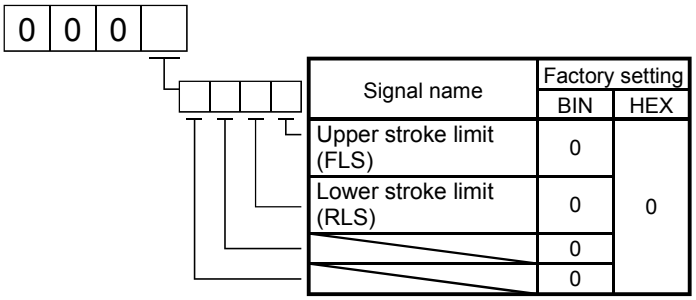
POINT

- 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.

No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PD01		This parameter is not used. Do not change the value.		0000h		
PD02	*DIA2	Input signal automatic ON selection	Each axis	0000h		This section (2)
PD03		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		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		This parameter is not used. Do not change the value.		0000h		
PD11				0004h		
PD12				0000h		
PD13				0000h		
PD14	*DOP3	Function selection D-3	Each axis	0000h		Section 5.4.2
PD15		This parameter is not used. Do not change the value.		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

No.	Symbol	Name	Setting	Factory setting	Unit	Setting range
PD02	*DIA2	Input signal automatic ON selection Select the input devices to be automatically turned ON.  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.	Each axis	0000h		Refer to name and function column.

Signal name	Factory setting BIN	Factory setting HEX
Upper stroke limit (FLS)	0	0
Lower stroke limit (RLS)	0	
	0	
	0	

13.6.6 Special setting parameters (No.PS□□)

(1) Parameter list

POINT

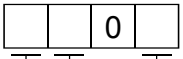
- The parameter whose symbol preceded by * can be validated with the following conditions.
  * : Turn off the power and then on again, or reset the controller after setting the parameter.
  **: Turn off the power and then on again after setting the parameter.

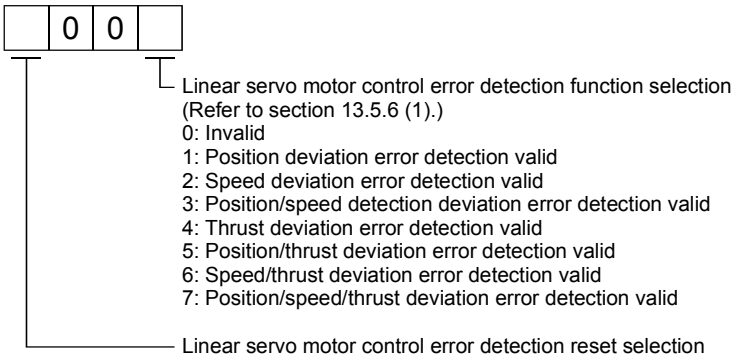
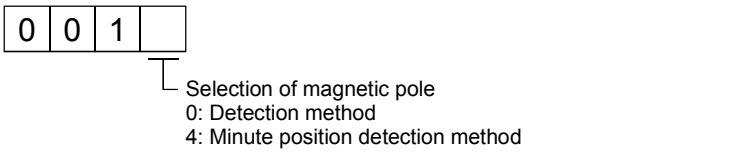
No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PS01	**LIT1	Linear function selection 1	Each axis	0301h		This section (2)
PS02	**LIM	Linear encoder resolution setting Numerator	Each axis	1000		
PS03	**LID	Linear encoder resolution setting Denominator	Each axis	1000		
PS04	*LIT2	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	%	

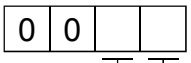
No.	Symbol	Name	Setting (Note 1)	Factory setting (Note 2)	Unit	Reference
PS08	*LIT3	Linear function selection 3	Each axis	0010h		This section (2)
PS09	LPWM	Magnetic pole detection voltage level	Each axis	30	%	
PS10		This parameter is not used. Do not change the value.		5		
PS11				100		
PS12				500		
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		This parameter is not used. Do not change the value.		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 13.5.2.)

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 13.5.1 (4).)
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.  	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 13.5.6 (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 13.5.6 (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 13.5.6 (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 13.5.2 (6).)  	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 13.5.2 (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 rowspan="7"></td><td rowspan="7">This parameter is not used. Do not change the value.</td><td rowspan="7"></td><td>5</td><td rowspan="7"></td><td rowspan="7"></td></tr>
<tr><td>PS11</td><td>100</td></tr>
<tr><td>PS12</td><td>500</td></tr>
<tr><td>PS13</td><td>0000h</td></tr>
<tr><td>PS14</td><td>0</td></tr>
<tr><td>PS15</td><td>0000h</td></tr>
<tr><td>PS16</td><td>0000h</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 13.5.2.)


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 rowspan="6"></td><td>9</td><td rowspan="6"></td></tr><tr><td>2</td><td>A</td></tr><tr><td>3</td><td>B</td></tr><tr><td>4</td><td>C</td></tr><tr><td>5</td><td>D</td></tr><tr><td>6</td><td>E</td></tr><tr><td>7</td><td>Medium response</td><td>F</td><td>High response</td></tr></table>
Selecting the load to mass of the linear servo motor primary side (coil) ratio, 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 13.5.2.)</td><td>Each axis</td><td>0000h</td><td>%</td><td>0000h to 006Fh</td></tr>
<tr><td>PS19</td><td rowspan="8"></td><td rowspan="8">This parameter is not used. Do not change the value.</td><td rowspan="8"></td><td>0000h</td><td rowspan="8"></td><td rowspan="8"></td></tr>
<tr><td>PS20</td><td>0000h</td></tr>
<tr><td>PS21</td><td>0000h</td></tr>
<tr><td>PS22</td><td>0000h</td></tr>
<tr><td>PS23</td><td>0000h</td></tr>
<tr><td>PS24</td><td>0000h</td></tr>
<tr><td>PS25</td><td>0000h</td></tr>
<tr><td>PS26</td><td>0000h</td></tr>
</table>

No.	Symbol	Name	Setting	Factory setting	Unit	Setting range
PS27		This parameter is not used. Do not change the value.		0000h		
PS28				0000h		
PS29				0000h		
PS30				0000h		
PS31				0000h		
PS32				0000h		

13.6.7 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.

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 data (MR Configurator)	Common	0000h		
Po03	SGRD	Axis selection for graphing digtal data (MR Configurator)	Common	0000h		
Po04	**OOP2	Function selection O-2	Common	0000h		
Po05		This parameter is not used. Do not change the value.		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.

13.7 Troubleshooting

POINT

- When an alarm with "Each axis" indicated in the "Stop method" column 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.

13.7.1 Alarms and warning list

When an error occurs during operation, the corresponding alarm or warning is displayed.
If any alarm has occurred, refer to section 13.7.2 and section 8.3; if any warning has occurred, refer to section 13.7.3 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□□□."

13.7.2 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.☐)
  ・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 13.7.1.

When an alarm occurs, the malfunction (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.

<table>
<tr><td colspan="2">Alarm No.10</td><td colspan="2">Name: Undervoltage</td><td colspan="2">Stop method: All axes stop</td></tr>
<tr><td colspan="2">Alarm description</td><td colspan="4">・Voltage of the control circuit power has dropped.
・Voltage of the main circuit power has dropped.</td></tr>
<tr><td>Display</td><td>Name</td><td>Cause</td><td>Checkpoint</td><td>Finding</td><td>Action</td></tr>
<tr><td>10.1</td><td>Voltage drop in the control circuit power</td><td colspan="4" rowspan="2">Same as for the rotary servo motor.
Refer to section 8.3.</td></tr>
<tr><td>10.2</td><td>Voltage drop in the main circuit power</td></tr>
</table>

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□" Direct drive motor: "□□6□"	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 Direct drive 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.	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.			
		(3)	Replace the servo amplifier.			
16.3	Encoder receive data error 3	(1)	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 (2).
		(2)	The encoder cable is unplugged.	Check if the encoder cable is connected properly.	Not connected properly.	Connect properly.
					Connected properly.	Check (3).
		(3)	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 (4).
		(4)	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 (5).
		(5)	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 (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.	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.	Check for noise, and other factors.	Problem found.	Take countermeasure according to the cause.
					No problem found.	Check (3).
		(3)	Encoder is faulty.	Replace the servo motor and check the reproducibility of the error.	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.			
		(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.			
		(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□" Direct drive motor: "□□6□"	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.	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.			
		(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.	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.	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 the linear encoder and check the reproducibility of the error.	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.			
		(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.			
		(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 the linear encoder and check the reproducibility of the error.	Error is not reproduced.	Replace the linear encoder.
					Reproduced.	Check (2).
		(2)	Fault is generated from the surrounding environment.	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.	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 13.7.4.	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.	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 13.7.4.	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.	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 13.7.4.	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.	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 13.7.4.	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.	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 13.7.4.	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.	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 13.7.4.	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.	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 13.7.4.	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.	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 13.7.4.	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.			
45.5	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
46.2	Linear servo motor thermal sensor error	(1)	The ambient temperature of the linear servo motor is over 40℃.	Check the ambient temperature of the linear servo motor.	The ambient temperature is over 40℃.	Reduce the ambient temperature of the servo motor.
					The ambient temperature is 40℃ or less.	Check 2).
		(2)	The linear servo motor is overloaded.	Check the effective load ratio with MR Configurator.	The effective load ratio is large.	Reduce the load or check the operation pattern.
					The effective load ratio is small.	Check 3).
		(3)	Thermal sensor fault in the linear servo motor	Check the linear servo motor temperature at alarm occurrence.	The linear servo motor temperature is low.	Replace the linear servo motor.
46.3	Thermistor cable disconnection error	(1)	The thermistor cable is disconnected.	Check if the thermistor cable is connected	Not connected.	Connect the cable.
					Connected.	Check 2).
		(2)	The thermistor cable is disconnected.	Check the thermistor cable.	Disconnected.	Repair the lead.
					Is not disconnected.	Replace the linear 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				
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 phases.	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 with MR Configurator.		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 phases.		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 phases.	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 pulses 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				

13.7.3 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				

Alarm No.96		Name: Home position setting warning		Stop method: Axes can operate (detected by the corresponding axis).	
Alarm description		・Home positioning cannot be made.			
Display	Name	Cause	Checkpoint	Finding	Action
96.1	INP error at home positioning	Same as for the rotary servo motor. Refer to section 8.4.			
96.2	Command input error at home positioning				

Alarm 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	Same as for the rotary servo motor. Refer to section 8.4.			

Alarm No.E1		Name: Overload warning 1		Stop method: Axes can operate (detected at the corresponding axis)	
Alarm description		・There is a possibility that overload alarm (50.□, 51.□) may occur.			
Display	Name	Cause	Checkpoint	Finding	Action
E1.1	Thermal overload warning 1 during operation	Same as for the rotary servo motor. Refer to section 8.4.			
E1.2	Thermal overload warning 2 during operation				
E1.3	Thermal overload warning 3 during operation				
E1.4	Thermal overload warning 4 during operation				
E1.5	Thermal overload warning 1 during a stop				
E1.6	Thermal overload warning 2 during a stop				
E1.7	Thermal overload warning 3 during a stop				
E1.8	Thermal overload warning 4 during a stop				

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 alarm level of the linear servo motor overheat (46.2).	Examine checkpoints described in the alarm display "46.2".		

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				
E9.3	Ready-on signal on at main circuit off				

Alarm No.EB		Name: The other axis fault warning		Stop method: All axes stop (warning detected at both axes)	
Alarm 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	Same as for the rotary servo motor. Refer to section 8.4.			

Alarm No.EC		Name: Overload warning 2		Stop method: Axes can operate (detected at the corresponding axis)	
Alarm 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	Same as for the rotary servo motor. Refer to section 8.4.			

Alarm No.ED		Name: Output watt excess warning		Stop method: Axes can operate (detected at the corresponding axis)	
Alarm 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	Same as for the rotary servo motor. Refer to section 8.4.			

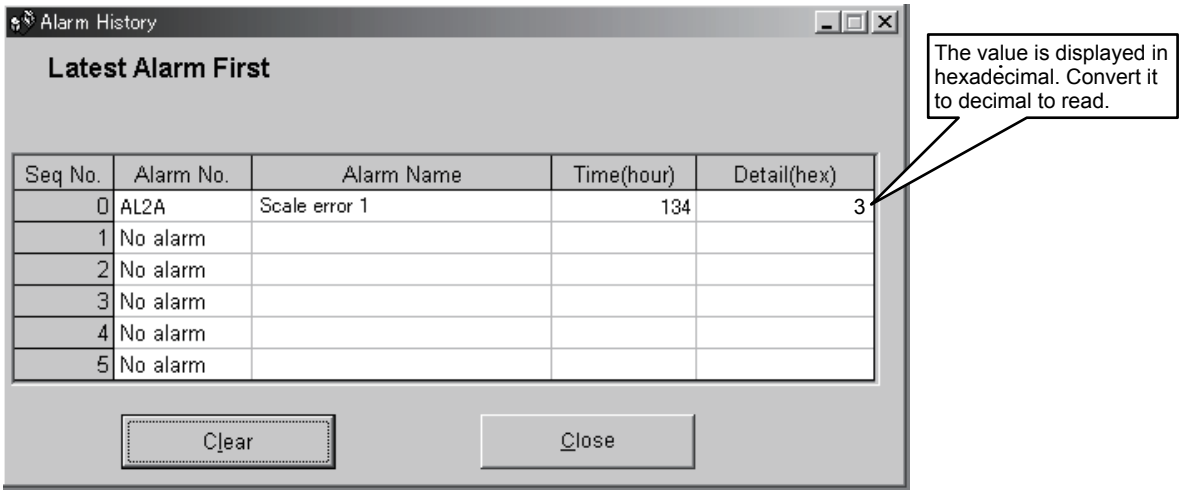
13.7.4 Detailed explanation of linear encoder error 1 (2A.☐)

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.



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.

14. USING A DIRECT DRIVE MOTOR

⚠ CAUTION	▪ The drive motor is available for servo amplifiers of which software version is B3 or above. ▪ When using the direct drive motor, read the following items of SSCNETⅢ interface Direct Drive Servo MR-J3-□B-RJ080W Instruction Manual (SH(NA)030079). ● Safety Instructions ● 2. DIRECT DRIVE MOTOR 8. CHARACTERISTICS (except Overload protection characteristics and Dynamic brake characteristics)

14.1 Functions and configuration

14.1.1 Summary

The fields of semiconductor/LCD manufacturing systems, mounters, and others have strong demands for high accuracy and high efficiency. Therefore, the number of systems using a direct drive motor for a drive axis has been increasing. The direct drive servo system includes the following features.

(1) Performance

(a) The direct drive servo system ensures the high-rigidity and the high-torque. A high-resolution encoder enables the high-accuracy control.

(b) The high-resolution encoder contributes to the high-accuracy indexing.

(c) Since transmission mechanism is no longer required, no backlash occurs. In addition, the settling time is reduced, and the high-frequency operation is enabled.

(d) Since transmission mechanism is no longer required, the direct drive motor does not deteriorate with time.

(2) Mechanism

(a) The motor's low profile design contributes to compact moving part of the machine and a low center of gravity for enhanced equipment stability.

(b) The motor has an inner rotor with hollow shaft which enables cables and pipes to be passed through.

(c) Lubrication and the maintenance due to abrasion are not required.

The following shows the differences between the direct drive motor and the rotary servo motor.

Category	Item	Differences		Remarks
		Direct drive motor	Rotary servo motor	
External I/O signal	Stroke limit input signal (FLS, RLS)	Required (for magnetic pole detection)	Not required	Automatically turns on in the parameter setting.
Motor pole adjustment	Magnetic pole detection	Required	Not required (default setting)	Automatically executed at the first servo-on after the power is turned on. For the absolute position detection system, you can disable the magnetic pole detection with parameter No.PS01. (Refer to (2) (b) of 14.4.2.)
Absolute position detection system	Absolute position encoder battery unit (MR-BTCASE + MR-BAT × 8)	Required	Required	
	Absolute position storage unit (MR-BTAS01)	Required	Not required	
Alarm/Warning	Alarms and warnings only for direct drive servo	Added		Added or changed alarms and warnings ・Encoder error 3 (21.☐) ・Absolute position erased (25.☐) ・Initial magnetic pole detection error (27.☐) ・Encoder counter error (2B.☐) ・Servo control error (42.☐) ・Direct drive motor overheat (46.☐) ・Battery cable disconnection warning (92.1) ・Battery warning (9F.☐) ・Direct drive motor overheat warning (E2.1)

14.1.2 Combinations of servo amplifier and direct drive motor

The following shows the combinations of servo amplifier and direct drive motor. The drive motor is available for servo amplifiers of which software version is B3 or above.

Direct drive motor	Servo amplifier							
	MR-J3W-22B		MR-J3W-44B		MR-J3W-77B		MR-J3W-1010B	
	A-axis	B-axis	A-axis	B-axis	A-axis	B-axis	A-axis	B-axis
TM-RFM002C20	○		○					
TM-RFM004C20			○		○		○	
TM-RFM006C20					○		○	
TM-RFM006E20					○		○	
TM-RFM012E20					○		○	
TM-RFM018E20							○	
TM-RFM012G20					○		○	
TM-RFM040J10					○		○	

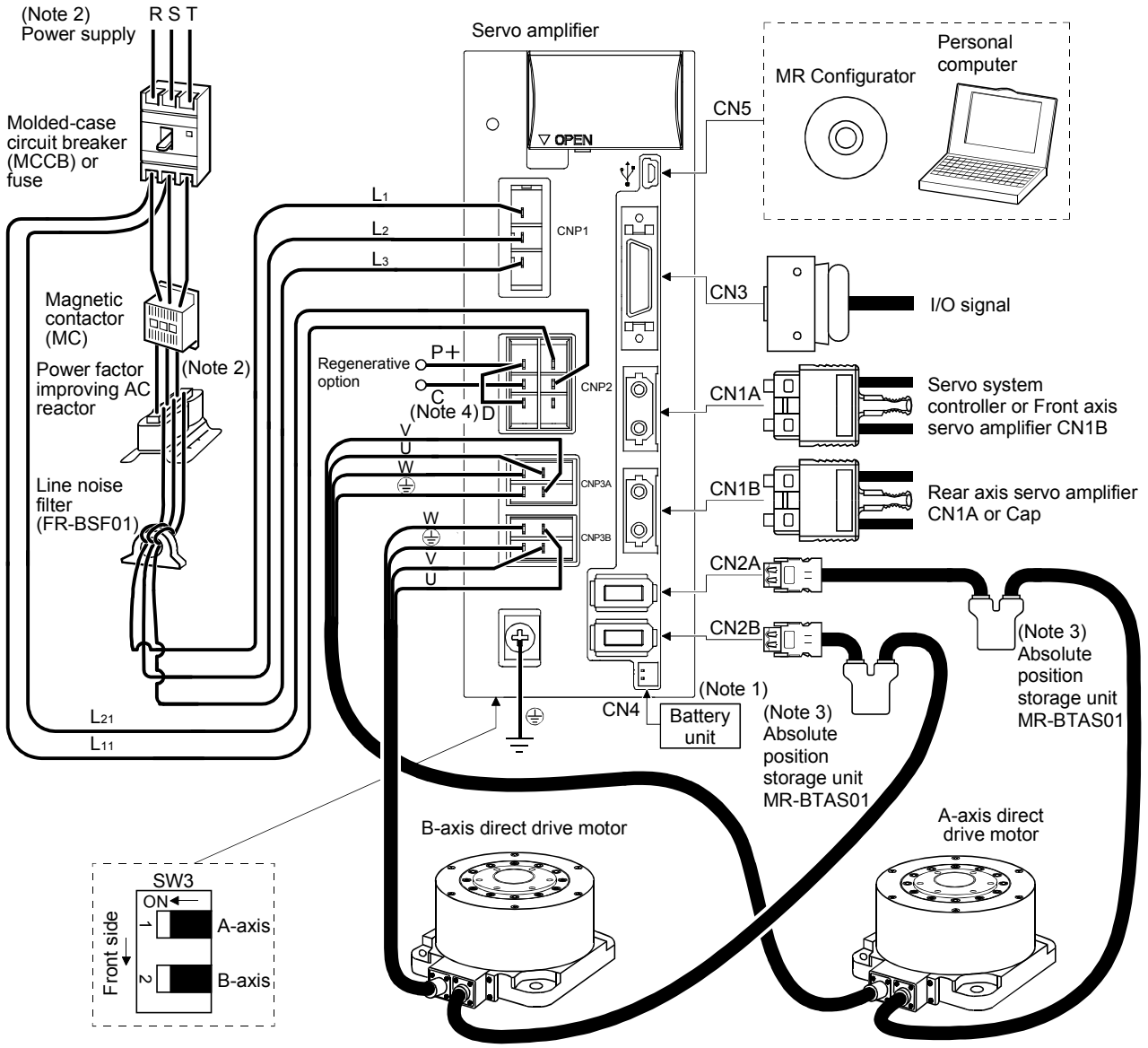
14.1.3 Configuration including peripheral equipment

CAUTION

- Connecting a direct drive motor for different axis to the CNP3A or CNP3B connector may cause a malfunction.

POINT

- Equipment other than the servo amplifier and direct drive motor are optional or recommended products.
- When using the direct drive motor, turn on SW3.



Note 1. The battery unit consists of a battery case (MR-BTCASE) and 8 batteries (MR-BAT). The unit is used for the absolute position detection system in the position control mode. (Refer to section 12.3.)

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

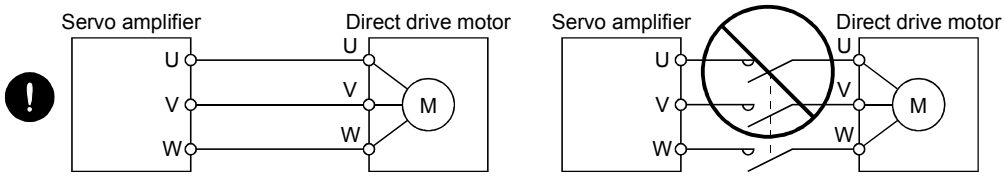
3. The absolute position storage unit is used for the absolute position detection system.

4. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.

14.2 Connection of servo amplifier and direct drive motor

CAUTION

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



(1) Connection instructions

WARNING

- To avoid an electric shock, insulate the connections of the power supply terminals.

CAUTION

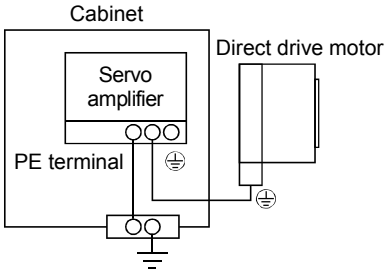
- Connect the wires to the correct phase terminals (U, V, and W) of the servo amplifier and direct drive motor. Otherwise, the direct drive motor operates normally.
- Do not connect AC power supply directly to the direct drive motor. Otherwise, it may cause a malfunction.

POINT

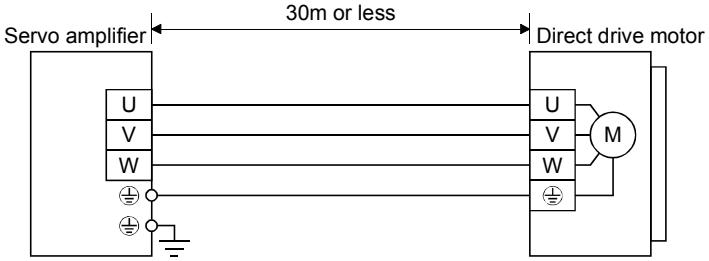
- Refer to section 14.8 for the specifications of the encoder cable to use.

This section explains the connection of the direct drive motor power (U, V, and W). Use of the optional connector set is recommended for connection between the servo amplifier and direct drive motor. Refer to section 14.8 for details of the options.

For grounding, connect the grounding lead wire from the servo motor to the protective earth (PE) terminal of the servo amplifier, and then connect the wire from the servo amplifier to the ground via the protective earth of the cabinet. Do not connect the wire directly to the protective earth of the cabinet.



(2) Power supply cable wiring diagrams
Fabricate a cable as shown below.
Refer to section 14.3.2 (1) for the wires used for the cable.



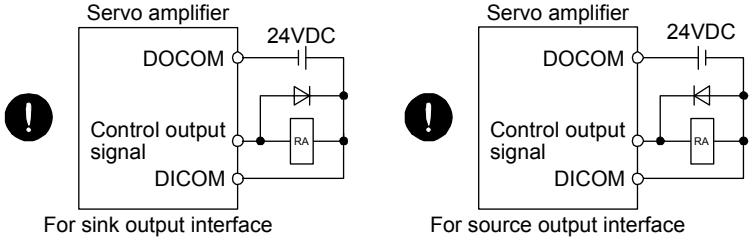
14.3 Signals and wiring

⚠ WARNING

- Any person who is involved in wiring should be fully competent to do the work.
- Before wiring, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N− is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.
- Ground the servo amplifier and the direct drive motor securely.
- Do not attempt to wire the servo amplifier and direct drive motor until they have been installed. Otherwise, it may cause an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.

⚠ CAUTION

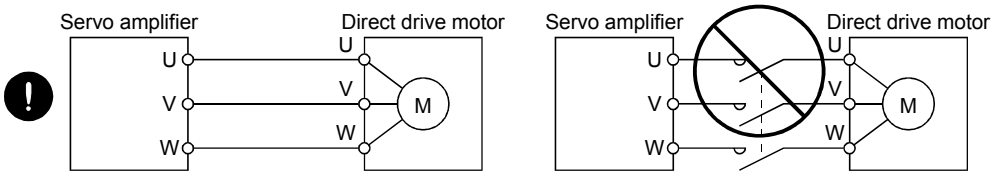
- Wire the equipment correctly and securely. Otherwise, the direct drive motor may operate unexpectedly, resulting in injury.
- Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.
- Ensure that polarity (+/−) is correct. Otherwise, a burst, damage, etc. may occur.
- The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop (EM1) and other protective circuits may not operate.



- Electromagnetic interference may be given to the electronic equipment used near the servo amplifier. Use a noise filter, etc. to minimize the influence of electromagnetic interference.
- Do not install a power capacitor, surge killer, or radio noise filter (FR-BIF option) on the power wire of the direct drive motor.

CAUTION

- When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a transistor fault or the like may overheat the regenerative resistor, causing a fire.
- Do not modify the equipment.
- Connect the servo amplifier power output (U, V, and W) to the direct drive motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.



14.3.1 Notes of this chapter

This chapter does not include the following items. For the items, refer to the corresponding sections below.

Item	Reference
Explanation of power supply system	Section 3.3
Signal (device) explanations	Section 3.5
Alarm occurrence timing chart	Section 3.6
Interface	Section 3.7 (except internal connection diagrams)
Treatment of cable shield external conductor	Section 3.8
SSCNETⅢ cable connection	Section 3.9
Grounding	Section 3.12
Control axis selection	Section 3.13

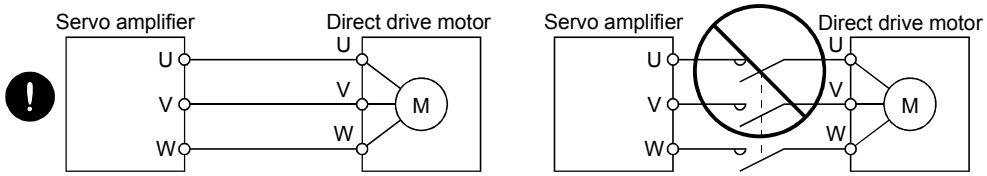
14.3.2 Input power supply circuit

⚠ CAUTION

- Always connect a magnetic contactor between the power supply and the main circuit power supply (L1, L2, and L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.
- When alarms are occurring in both axes of A and B, shut off the main circuit power supply. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the regenerative resistor.
- Check the servo amplifier model, and then input proper voltage to the servo amplifier power supply. If input voltage exceeds the upper limit, the servo amplifier will break down.
- Connecting a direct drive motor for different axis to the CNP3A or CNP3B connector may cause a malfunction.

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 next axis servo amplifier displays "AA" at the indicator and turns into base circuit shut-off. The direct drive motor stops with starting dynamic brake.
- For details of the signals, refer to section 3.3.
- Connect the servo amplifier power output (U, V, and W) to the direct drive motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.



Wire the power supply/main circuit so that the main circuit power supply is shut off and the servo-on command turned off as soon as an alarm occurring, an enabled servo forced stop, or an enabled controller forced stop. A molded-case circuit breaker (MCCB) must be used with the input cables of the main circuit power supply.

(1) Selection example of wires

POINT
・Wires indicated in this section are separated wires. ・Selection condition of wire size is as follows. Construction condition: One wire is constructed in the air. Wire length: 30m or less

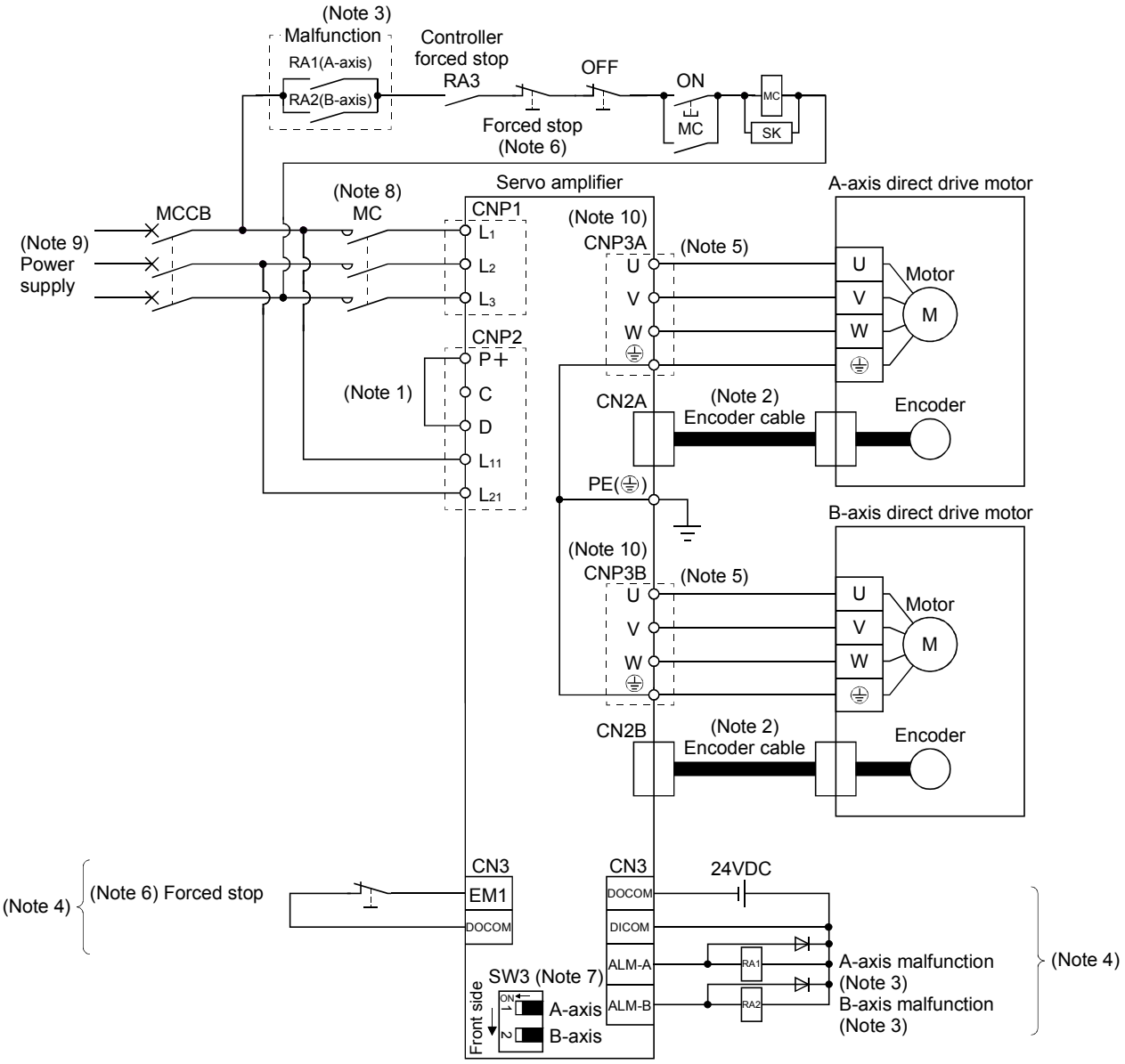
Use the 600V Grade heat-resistant polyvinyl chloride insulated wire (HIV wire). The following table shows the wire size selection example.

Table 14.1 Wire size selection example (HIV wire)

Servo amplifier	Wire [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
MR-J3W-22B	2 (AWG14)				
MR-J3W-44B					
MR-J3W-77B					
MR-J3W-1010B					

Note 1. Wires are selected based on the highest rated current among combining servo motors.
2. The wire size is for extension cables used when the wiring length is longer than 10m.
3. Use the crimp terminal specified as below for the PE terminal of the servo amplifier.
Crimp terminal: FVD2-4
Tool: YNT-1614
Manufacturer: Japan Solderless Terminals
Tightening torque: 1.2N・m

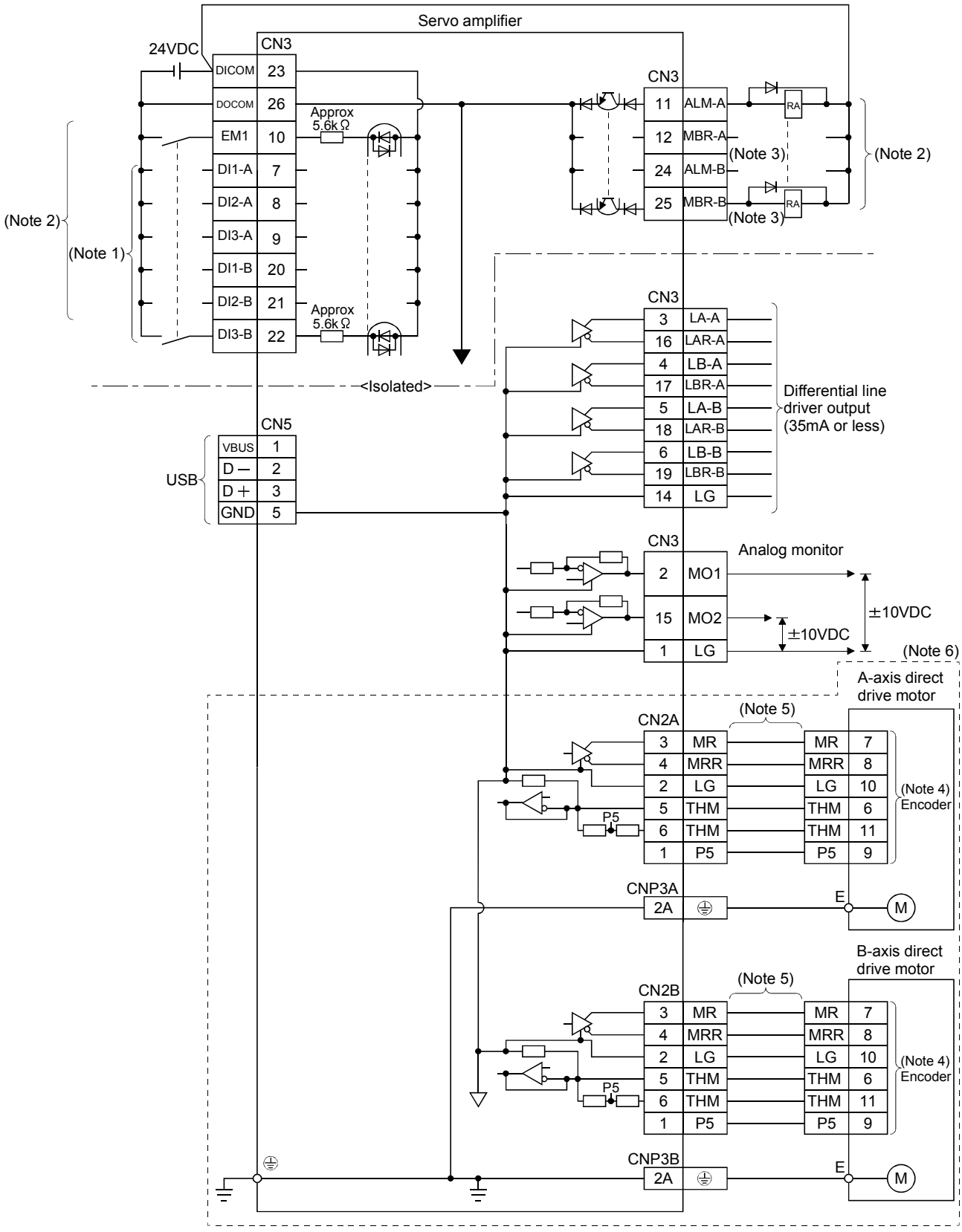
(2) Connection example



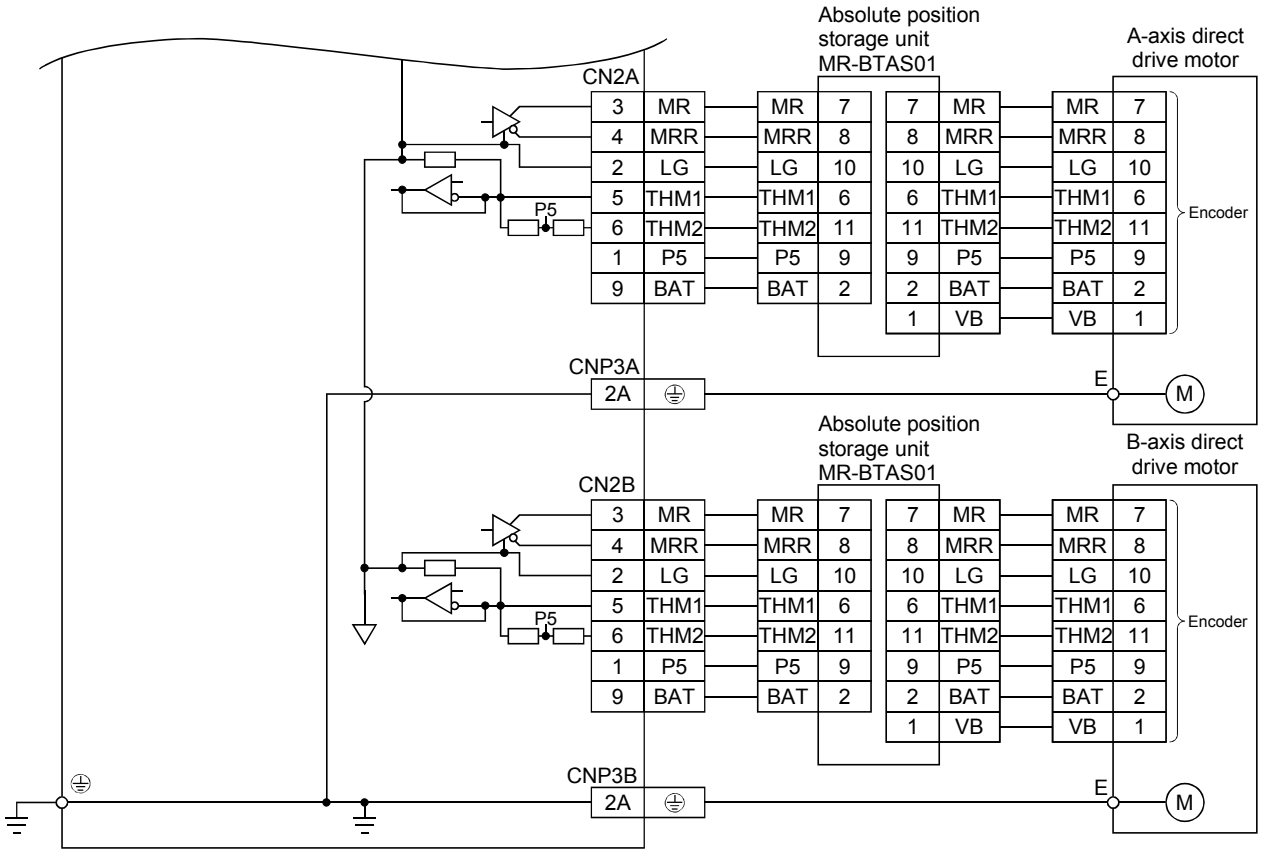
Note 1. Always connect between P+ and D terminals. When using the regenerative option, refer to section 11.2.

2. Fabricate the encoder cables according to 14.8.1. When you use the cables for the absolute position detection system, absolute position units are required.
3. If disabling malfunction (ALM-A/ALM-B) output with the parameter, configure up the power supply circuit which switches off the magnetic contactor after detection of alarm occurrence on the controller side. This example is to continue the operation in another axis even if an alarm occurs either A-axis or B-axis. When stopping operation of both axes at an alarm occurrence for one axis, connect RA1 and RA2 in series.
4. This is for sink I/O interface. For source I/O interface, refer to section 3.7.3.
5. Refer to section 14.2 for wiring power lines.
6. Configure up the circuit which shuts off main circuit power with external circuit at forced stop 1 (EM1) off.
7. This connection example is for using a direct drive motor. Turn on SW3.
   (Refer to section 3.14.)
8. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80ms or less.
9. For 1-phase 200VAC to 230VAC, connect the power supply to L1 and L2. Leave L3 open. Refer to section 1.3 for the power supply specification.
10. Connecting a servo motor for different axis to the CNP3A or CNP3B connector may cause a malfunction.

14.3.3 Internal connection diagram



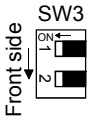
Note 1. Signal can be assigned for these pins with the controller setting. For contents of signals, refer to the instruction manual of the controller.
2. This is for sink I/O interface. For source I/O interface, refer to section 3.7.3.
3. When you using a direct drive motor, use MBR (Electromagnetic brake interlock) for an external brake mechanism.
4. The encoder detects speed, position, and temperature of the direct drive motor.
5. The encoder cable should be fabricated by the customer. (Refer to section 14.8.1.)
6. The connection is for incremental system. For the connection for the absolute position detection system, refer to the following diagram.



14.4 Operation and functions

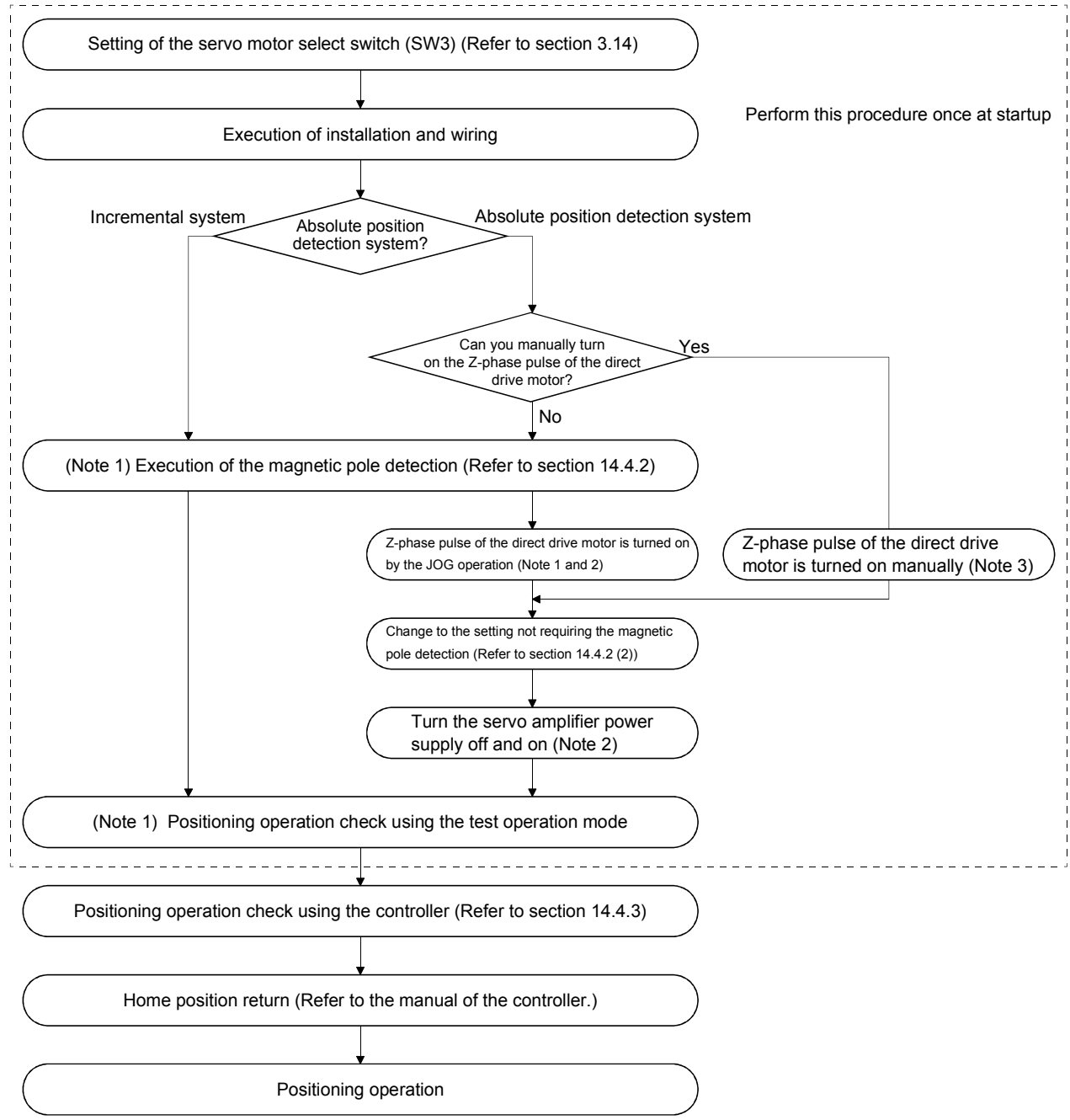
POINT

- When using a linear servo motor, turn on SW3.



14.4.1 Startup procedure

Start up the direct drive servo in the following procedure.



Note 1. Use MR Configurator.

2. For the absolute position detection system, always turn on the Z-phase pulse of the direct drive motor while the servo amplifier power is on, and then turn the servo amplifier power supply off and on again. By turning off and on the power supply, the absolute position becomes confirmed. Without this operation, the absolute position will not be regained properly, and a warning will occur at the controller.
3. If the Z-phase pulse of the direct drive motor can be turned on manually, the Z-phase pulse does not have to be turned on by the magnetic pole detection or the JOG operation.
   For this operation, always connect the direct drive motor encoder and the servo amplifier, and turn on only the control circuit power supply of the servo amplifier (L_{11} and L_{21}) (turn off the main circuit power supply L_1, L_2, and L_3). Perform this operation by considering the safety.

14.4.2 Magnetic pole detection

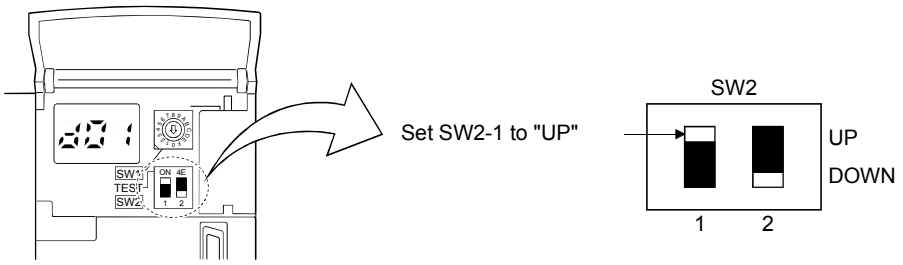
POINT
・The magnetic pole detection is not required for the configured absolute position detection system where the Z-phase pulse of the direct drive motor can be turned on manually. For this operation, always connect the direct drive motor encoder and the servo amplifier and turn on the control circuit power supply of the servo amplifier. Perform this operation by considering the safety.

Before the positioning operation of the direct drive motor, make sure to perform the magnetic pole detection. Before starting up the equipment, perform the test operation (positioning operation) of MR Configurator.

(1) Preparation for the magnetic pole detection

POINT
・When the test operation mode is selected with the test operation select switch (SW2-1), the SSCNETⅢ communication for the servo amplifier in the test operation mode and the following servo amplifiers is blocked.

For the magnetic pole detection, use the test operation mode (positioning operation) of MR Configurator. Turn off the servo amplifier power, and set the test operation select switch (SW2-1) as shown below. Turning on the power enables the test operation mode.



(2) Operation at the magnetic pole detection

⚠ WARNING	・Note that the magnetic pole detection automatically starts simultaneously with the turning-on of the servo-on command.

⚠ CAUTION	・If the magnetic pole detection is not executed properly, the direct drive motor may operates unexpectedly.

POINT

・Make a machine components for using stroke limits (FLS/RLS). If stroke limits (FLS/RLS) are not used, the machine may be damaged due to a collision.
・At the magnetic pole detection, whether the motor rotates in the forward or reverse direction is unpredictable.
・Depending on the setting value of Parameter No.PL09 (Magnetic pole detection voltage level), an overload, overcurrent, magnetic pole detection alarm, or others may occur.
・When performing the positioning operation from a controller, use the sequence which confirms the normal completion of the magnetic pole detection and the servo-on status, then outputs the positioning command. If the controller outputs the positioning command before Ready (RD) turns on, the command may not be accepted or a servo alarm may occur.
・After the magnetic pole detection, check the positioning accuracy with the test operation (positioning operation function) of MR Configurator.
・The accuracy of the magnetic pole detection improves with no load.

The magnetic pole detection is required in the following cases.

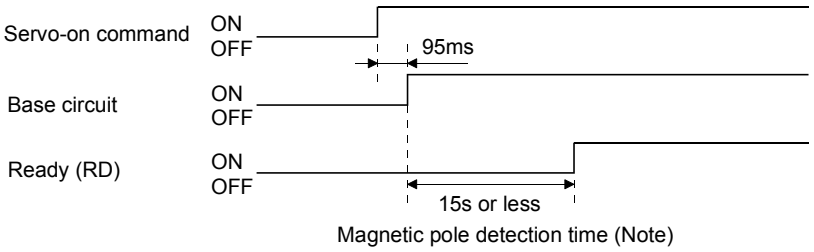
1) Using the motor in the incremental system (Refer to (2) (a) of this section.)

2) Using the absolute position detection system with the following cases. (Refer to (2) (b) of this section.)
   ・When the system is set up (at the first startup of equipment)
   ・When the direct drive motor is replaced
   ・When the Z-phase pulse of the direct drive motor is not turned on manually
   ・When Absolute position erased (25.□) is occurred

(a) Incremental system

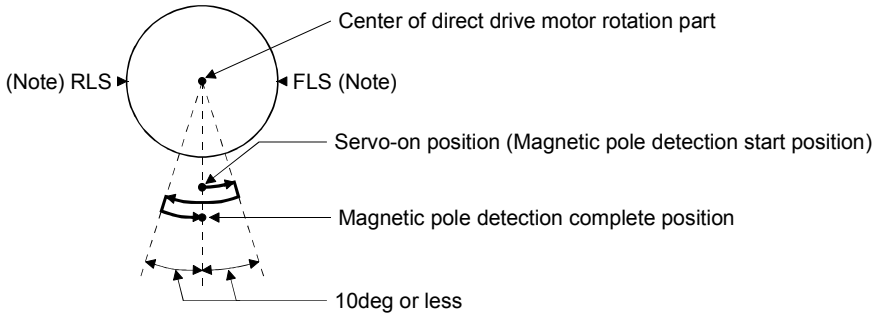
For the incremental system, the magnetic pole detection is required every time the power is turned on. By turning on the servo-on command from the controller after the power-on, the magnetic pole detection is automatically carried out. Therefore, you do not need to set the parameter (first digit of parameter 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) are on.

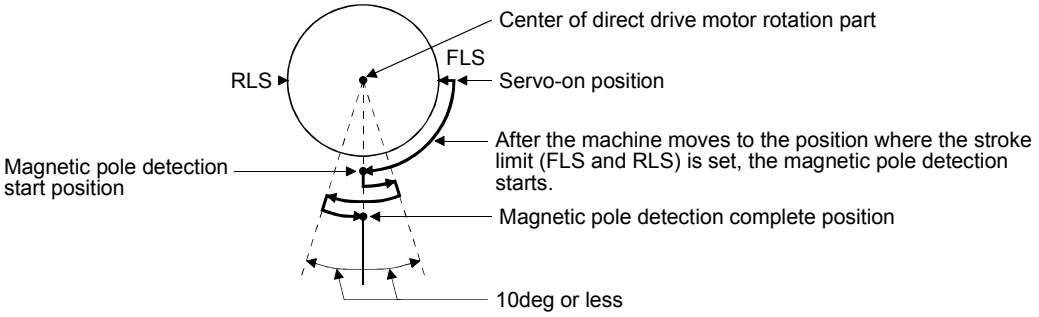
2) Direct drive motor movement (when FLS and RLS are on)



Note. When the stroke limit (FLS or RLS) turns off during the magnetic pole detection, the magnetic pole detection is carried on to the opposite direction. When both FLS and RLS are off, Initial magnetic pole detection error (27) will occur.

3) Direct drive motor movement (when FLS or RLS is off)

When FLS or RLS is off at servo-on, the magnetic pole detection is carried out as follows.

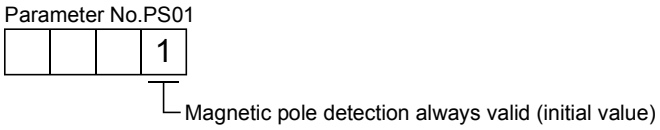


(b) Absolute position detection system

POINT
・Turn on the Z-phase pulse of the direct drive motor in JOG operation after the magnetic pole detection.

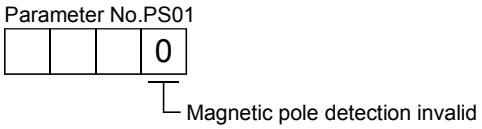
Perform the magnetic pole detection in the following procedure.

1) Set parameter No.PS01 (Special function selection 1) to "□□□1 (Magnetic pole detection enabled)".



2) Execute the magnetic pole detection. (Refer to (2) (a) 1) and 2) of this section.)

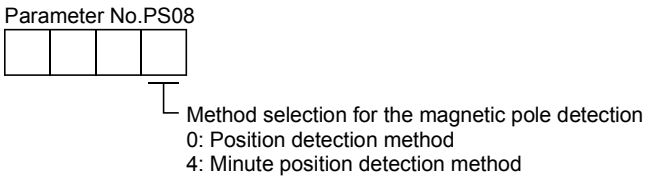
3) After the completion of the magnetic pole detection, change Parameter No.PS01 to "□□□0 (Magnetic pole detection disabled)".



After the magnetic pole detection, by turning on the Z-phase pulse of the direct drive motor in JOG operation and by disabling the magnetic pole detection function with Parameter No.PS01, the magnetic pole detection after each power-on is not required.

(3) Magnetic pole detection method setting

Set the magnetic pole detection method using the first digit of parameter No.PS08 (Magnetic pole detection method selection).



(4) Setting of the magnetic pole detection voltage level by the position detection method
For the magnetic pole detection by the position detection method, set the voltage level with parameter No.PS09 (Magnetic pole detection voltage level). For the magnetic pole detection by the minute position detection method, the voltage level setting is not required.

(a) Guideline of parameter settings
Set the parameters by referring to the following table.

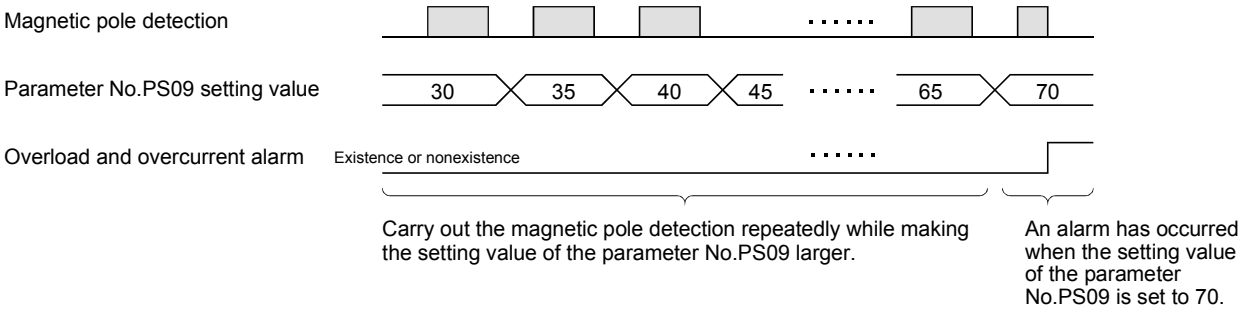
Parameter No.PS09 setting value (guide value) / Servo status	Small ← Medium → Large (Less than 10 (Default value) More than 50)	
Torques required for operation	Small	Large
Overload, overcurrent alarm	Seldom occurs	Frequently occurs
Magnetic pole detection alarm	Frequently occurs	Seldom occurs
Magnetic pole detection accuracy	Low	High

(b) Setting procedure
1) Perform the magnetic pole detection, and increase the setting value of parameter No.PS09 (Magnetic pole detection voltage level) until Overload 1 (50.☐), Overload 2 (51.☐), Overload warning 1 (E1.☐), and Overload warning 2 (EC.1) occur. Increase the setting value by "five" as a guide value. When these alarms and warnings occur during the magnetic pole detection by using MR Configurator, the test operation of MR Configurator automatically completes and the servo-off status is established.

2) Specify the setting value to approximately 70% of the value of Overload 1 (50.☐), Overload 2 (51.☐), Overload warning 1 (E1.☐), and Overload warning 2 (EC.1) occurrence as the final setting value. However, if Initial magnetic pole detection error (27.☐) occurs with this value, specify a value intermediate between the value set at [AL.50 Overload 1], [AL.51 Overload 2], [AL.E1 Overload warning 1], or [AL.EC Overload warning 2] occurrence and the value set at the magnetic pole detection alarm occurrence, as the final setting value.

3) Perform the magnetic pole detection again with the final setting value.

(c) Setting example

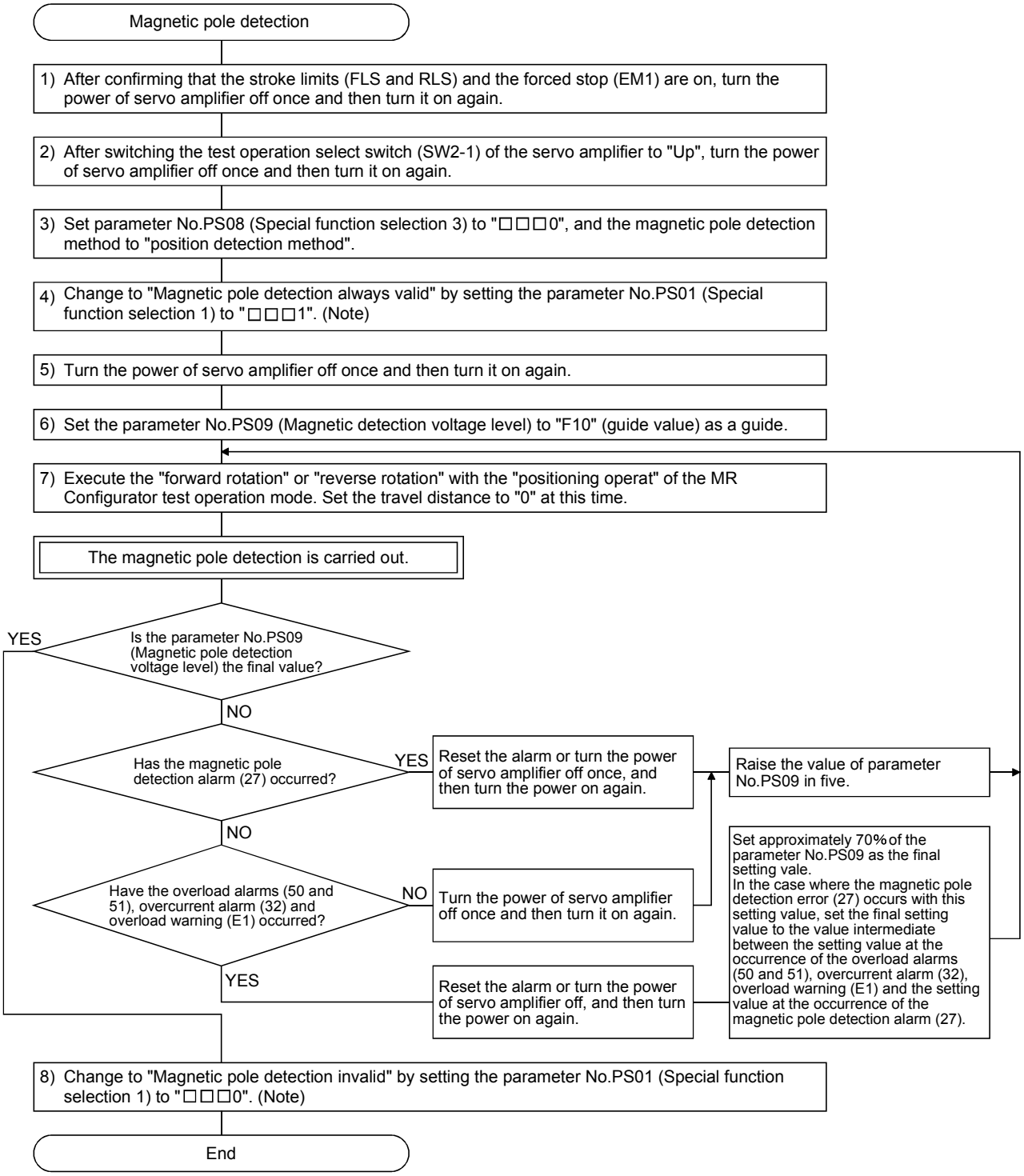


In this example, the final setting value of parameter No.PS09 is 49 (setting value at the alarm occurrence = 70 × 0.7).

(5) Magnetic pole detection method by using MR Configurator

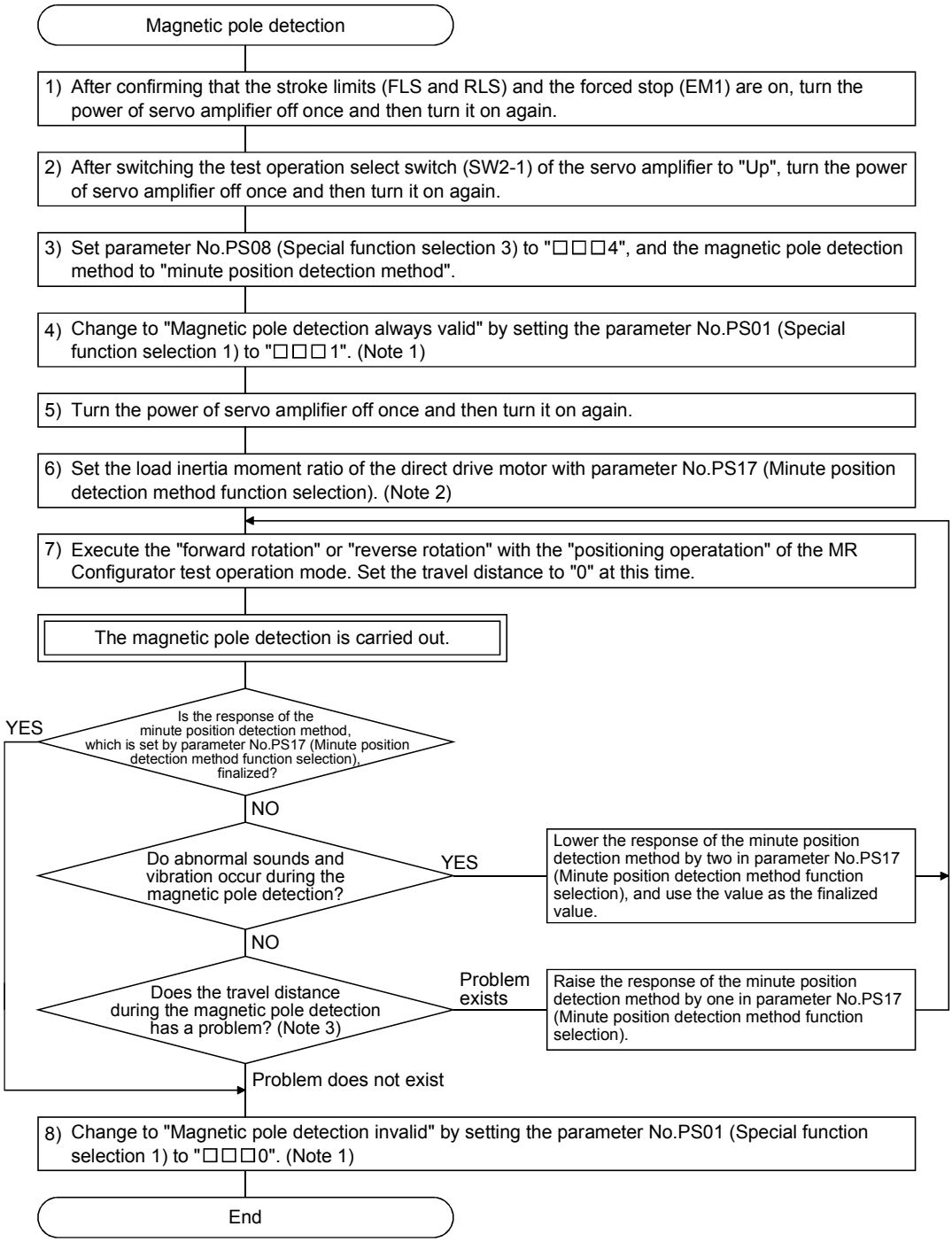
The following shows the magnetic pole detection procedure by using MR Configurator.

(a) Magnetic pole detection by the position detection method



Note. For the incremental system, the parameter No.PS01 setting is not required.

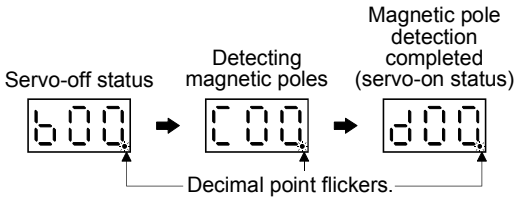
(b) Magnetic pole detection by the minute position detection method



Note 1. For the incremental system, the parameter No.PS01 setting is not required.

2. If the load to direct drive motor inertia ratio is unknown, perform the magnetic pole detection by the position detection method, and then perform the auto tuning to set an estimated value.
For the magnetic pole detection by the minute position detection method, the maximum rotation angle at the magnetic pole detection must be five degrees or less. To shorten the travel distance, increase the response by the minute position detection method in parameter No.PS17 (Function selection for minute position detection method).

(c) State transition of the servo amplifier display (3-digit, 7-segment LED) at the magnetic pole detection
When the magnetic pole detection with MR Configurator is normally executed, the servo amplifier display (3-digit, 7-segment LED) shows the state as below.



14.4.3 Operation from controller

To configure the absolute position detection system by using the direct drive motor, the battery unit (MR-BTCASE＋MR-BAT×8) and the absolute position storage unit MR-BTAS01 are required.
The direct drive servo can be used with any of the following controllers.

Servo system controller	Model		Software version (Note)
Motion controller	Q17□DCPU	SV13/SV22	00H or above
		SV43	00B or above
	Q170MCPU	SV13/SV22	00G or above
		SV43	
Positioning module	QD75MH□		101120000000000-B or above
	LD77MH□		All software versions

Note. For software versions and other details, refer to each servo system controller manual.

(1) Operation method
Positioning operation from the controller is basically performed like the MR-J3W-□B servo amplifier.
For the incremental system, the magnetic pole detection is automatically performed at the first servo-on after the power-on. For this reason, when performing the positioning operation, create the sequence which surely confirms the servo-on status as the inter lock condition of the positioning command.
Also, some parameter settings and the home position return differ according to the controller type.

(2) Servo system controller setting

(a) Setting precautions

The following servo parameters will be enabled by cycling the servo amplifier power after the controller writes the parameters to the servo amplifier.

Setting item					Set content	
					Motion controller Q17□DCPU/Q170MCPU	(Note 3) Positioning module QD75MH□/LD77MH□
Servo parameter	Servo amplifier setting				MR-J3-B DD	MR-J3-B DD (Note 4)
	Motor setting				Automatic setting	
	No.	(Note 1) Symbol	Name	Default value		
	PA01	**STY	Control mode (Note 2)	0000h	0060h	0060h
	PC01	*ERZ	Error excessive alarm level	0	Set the items as required.	Set QD75MH□ with sequence program. When you start up the direct drive motor, initial values of these parameters should be set. Refer to (b) and (c) of this section.
	PC03	*ENRS	Encoder output pulse selection	0010h		
	PD03		This parameter is not used. (Note 2)	0020h		
	PD04			0021h		
	PS01	**LIT1	Special function selection 1	0301h		
	PS04	*LIT2	Special function selection 2	0003h		
	PS05	LB1	Servo control position deviation error detection level	0		
	PS06	LB2	Servo control speed deviation error detection level	0		
	PS07	LB3	Servo control torque deviation error detection level	100		
	PS08	*LIT3	Special function selection 3	0010h		
	PS09	LPWM	Magnetic pole detection voltage level	30		
	PS10		This parameter is not used. (Note 2)	5		
	PS11			100		
	PS12			500		
	PS17	LTSTS	Minute position detection method function selection	0000h		
	PS18	IDLV	Minute position detection method identification signal amplitude	0000h		

Note 1. The parameter whose symbol is preceded by * is enabled with the following conditions:

*: After setting the parameter, power off and on the servo amplifier or reset the controller.

**: After setting the parameter, cycle the power of the servo amplifier.

2. For QD75MH□, make sure to set the default value.

3. Note the followings.

- If the parameter (servo parameter) of servo amplifier has been changed, it automatically reads the servo parameter and stores in the buffer memory of QD75MH□/LD77MH□. However, it does not reflect to the flash ROM.
- When turning off, resetting the power of QD75MH□/LD77MH□ or turning off the control circuit power supply of servo amplifier right after changing the servo parameter, the servo parameter may not reflect to the buffer memory of QD75MH□/LD77MH□. In such a case, change it again.

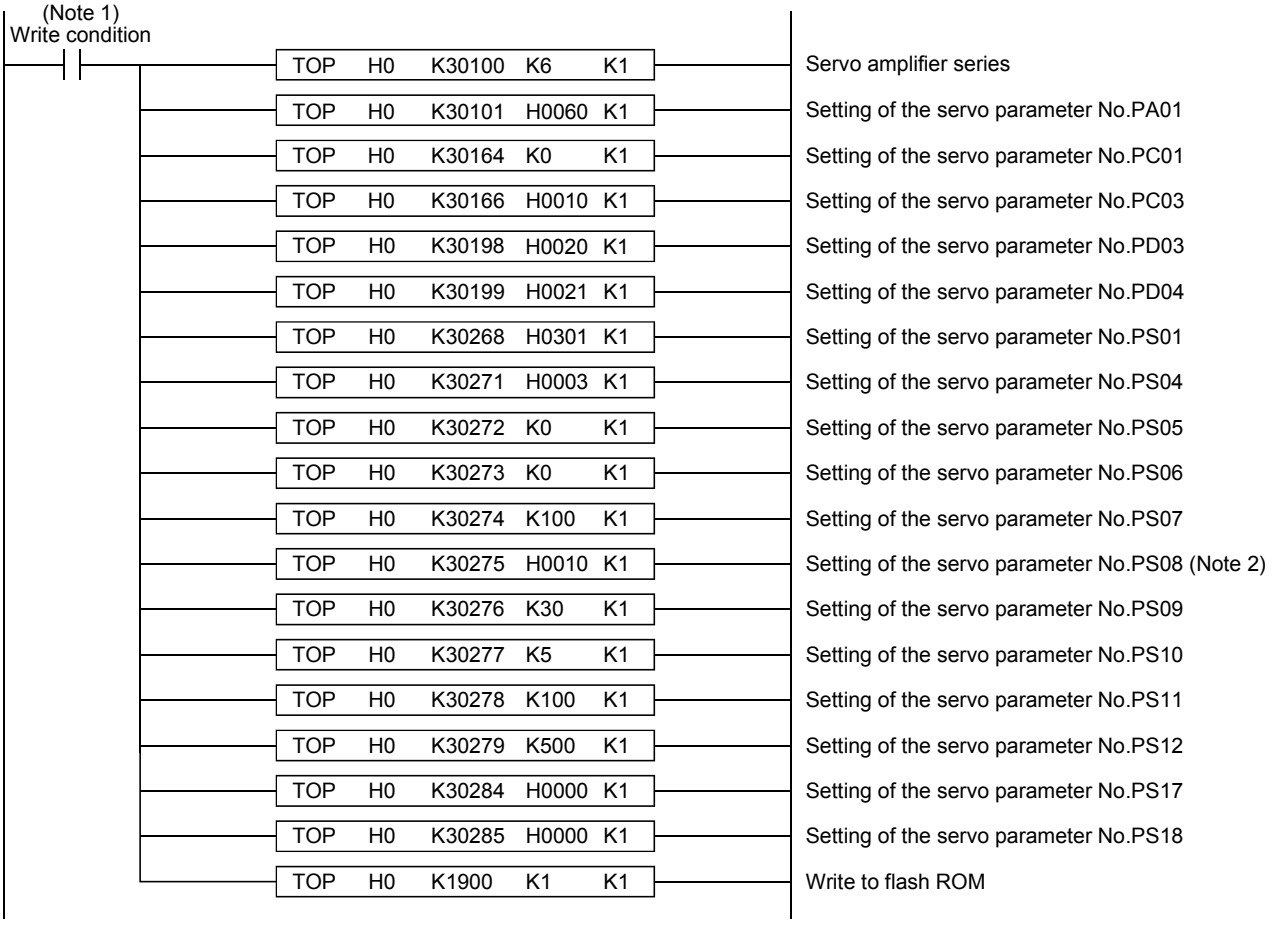
4. Set QD75MH□ with sequence program. (Refer to (b) of this section.)

(b) Sequence program example of servo parameters on the positioning module

POINT

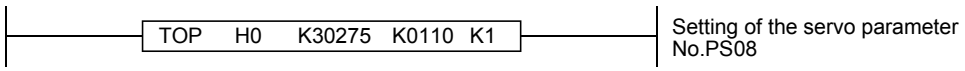
- For QD75MH□, the parameter error (37.□) will occur if servo parameters are not initialized.
- The number of write time to the flash ROM is limited to 100,000. Therefore, try to write to the flash ROM only when changing the servo parameter instead of writing with every sequence program. When controlling multiple axes, write the servo parameters to all axes.

1) Sequence program example when QD75MH□ is used.
The following shows the example of writing the axis No.1 servo parameter to the flash ROM. After changing the servo parameter, turn on the power of QD75MH□ again or reset the CPU, then send the setting value to the servo amplifier. Refer to (2) (c) of this section for the address of the special setting parameters (No.PS□) of the servo parameters.



Note 1. Configure a sequence program where the servo parameters are written to the flash ROM only when a servo parameter is changed.

2. Change the sequence program of the servo parameter No.PS08 to the following sequence program for the magnetic pole detection without the stroke limit (FLS and RLS).



However, do not change to this sequence program if using the stroke limit (FLS and RLS) at the QD75MH□ side.

2) Initialization of the servo parameter at the startup of direct drive servo
   a) Before turning the power of servo amplifier on, write the servo parameter default value, which is unique to the direct drive servo, to the flash ROM of QD75MH□ referring to the sequence program example shown in (2) (b) of this section.
   b) After completion of writing to the flash ROM, turn the power of servo amplifier on.

POINT
・Once the default values are written to the flash ROM at startup, servo parameters are not required to be written at next power on or later. If the module write with GX Configurator-QP has been performed using QD75MH□, however, initialize the servo parameters again.

(c) QD75MH□ buffer memory address of special setting parameters (No.PS□)

Description			Default value	Unit	Buffer memory address			
No.	Symbol (Note)	Name			Axis 1	Axis 2	Axis 3	Axis 4
PS01	**LIT1	Special function selection 1	0301h		30268	30468	30668	30868
PS02		This parameter is not used.	1000h		30269	30469	30669	30869
PS03			1000h		30270	30470	30670	30870
PS04	*LIT2	Special function selection 2	0003h		30271	30471	30671	30871
PS05	LB1	Servo control position deviation error detection level	0	0.01rev	30272	30472	30672	30872
PS06	LB2	Servo control speed deviation error detection level	0	r/min	30273	30473	30673	30873
PS07	LB3	Servo control torque deviation error detection level	100	%	30274	30474	30674	30874
PS08	*LIT3	Special function selection 3	0010h		30275	30475	30675	30875
PS09	LPWM	Magnetic pole detection voltage level	30	%	30276	30476	30676	30876
PS10		This parameter is not used.	5		30277	30477	30677	30877
PS11			100		30278	30478	30678	30878
PS12			0000h		30279	30479	30679	30879
PS13			0000h		30280	30480	30680	30880
PS14			0		30281	30481	30681	30881
PS15			0000h		30282	30482	30682	30882
PS16			0000h		30283	30483	30683	30883
PS17	LTSTS	Minute position detection method function selection	0000h		30284	30484	30684	30884
PS18	IDLV	Minute position detection method identification signal amplitude	0000h	%	30285	30485	30685	30885
PS19		This parameter is not used.	0000h		30286	30486	30686	30886
PS20			0000h		30287	30487	30687	30887
PS21			0000h		30288	30488	30688	30888
PS22			0000h		30289	30489	30689	30889
PS23			0000h		30290	30490	30690	30890
PS24			0000h		30291	30491	30691	30891
PS25			0000h		30292	30492	30692	30892
PS26			0000h		30293	30493	30693	30893
PS27			0000h		30294	30494	30694	30894
PS28			0000h		30295	30495	30695	30895
PS29			0000h		30296	30496	30696	30896
PS30			0000h		30297	30497	30697	30897
PS31			0000h		30298	30498	30698	30898
PS32			0000h		30299	30499	30699	30899

Note. The parameter whose symbol is preceded by * is enabled with the following conditions:

*: After setting the parameter, power off and on the servo amplifier or reset the controller.

**: After setting the parameter, cycle the power of the servo amplifier.

14.4.4 Function

(1) Servo control error detection function

POINT
▪ For the servo control error detection function, the position and speed deviation error detections are enabled by default. (parameter No.PS04: □□□3)

If the servo control gets unstable for some reasons, the direct drive motor may not operate properly. To detect this state and to stop operation, the servo control error detection function is used as a protective function.
The servo control error detection function has three different detection methods: the position deviation, speed deviation, and torque deviation. An error is detected when each method is enabled with parameter No.PS04 (Special function selection 4). The detection level can be changed with parameter Nos.PS05, PS06 and PS07.

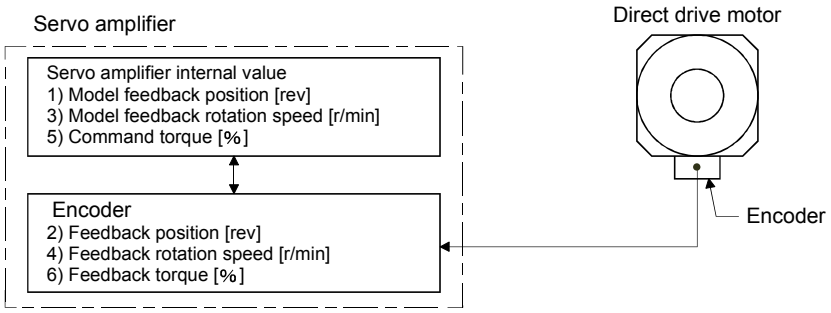
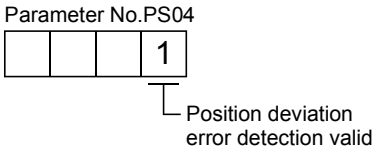


Figure 14.1 Outline of servo control error detection function

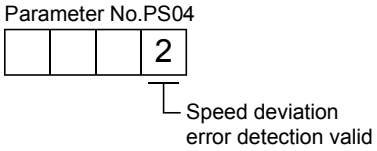
(a) Position deviation error detection
Set parameter No.PS04 to "□□□1" to enable the position deviation error detection.



When you compare the model feedback position (1)) and the feedback position (2)) in figure 14.1, if the deviation is more than the value of parameter No.PS05 (Servo control position deviation error detection level) (1 rev to 1000 rev), the alarm (Servo control error 42.□) will occur and the motor will stop. The default value of parameter No.PS05 is 0.09rev. Change the set value as required.

(b) Speed deviation error detection

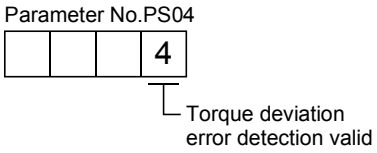
Set parameter No.PS04 to "□□□1" to enable the speed deviation error detection.



When you compare the model feedback position (3)) and the feedback position (4)) in figure 14.1, if the deviation is more than the value of parameter No.PS06 (Servo control speed deviation error detection level) (1 rev to 2000 rev), the alarm (Servo control error 42.□) will occur and the motor will stop. The default value of parameter No.PS06 is 100r/min. Change the set value as required.

(c) Torque deviation error detection

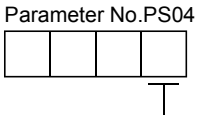
Set parameter No.PS04 to "□□□4" to enable the torque deviation error detection.



When you compare the command torque (5)) and the feedback torque (6)) in figure 14.1, if the deviation is more than the value of parameter No.PS07 (Servo control torque deviation error detection level) (1% to 1000%), the alarm (Servo control error 42.□) will occur and the motor will stop. The default value of parameter No.PS05 is 100%. Change the set value as required.

(d) Detecting multiple deviation errors

When parameter No.PS04 is set as follows, multiple deviation errors can be detected. For the error detection methods, refer to (1) (a), (b), and (c) of this section.



Setting value	Position deviation error detection	Speed deviation error detection	Torque deviation error detection
1	○		
2		○	
3	○	○	
4			○
5	○		○
6		○	○
7	○	○	○

14.5 Parameters

> **CAUTION**
> - Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable.
> - If fixed values are written in the digits of a parameter, do not change these values.

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.
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 direct drive servo.
Option setting parameters (No.Po□□)	These are only for MR-J3W.

14.5.1 Parameter writing inhibit (parameter No.PA19)

> POINT
> ・To enable the parameter value, cycle the power or reset the controller after setting the parameter.

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

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

14.5.2 Basic setting parameters (No.PA□□)

(1) Parameter list

> POINT
>
> ▪ The parameter whose symbol is preceded by * is enabled with the following conditions:
> * : After setting the parameter, cycle the power or reset the controller.
> **: After setting the parameter, cycle the power.

No.	Symbol	Name	Each/ common (Note 1)	Default value (Note 2)	Unit	Reference
PA01	**STY	Control mode	Each	0000h		(2) of this section
PA02	**REG	Regenerative option	Common	0000h		Section 5.1.4
PA03	*ABS	Absolute position detection system	Each	0000h		(2) of this section
PA04	*AOP1	Function selection A-1	Common	0000h		Section 5.1.6
PA05		This parameter is not used. Do not change this value by any means.		0		
PA06				1		
PA07				1		
PA08	ATU	Auto tuning mode	Each	0001h		Section 5.1.7
PA09	RSP	Auto tuning response	Each	12		
PA10	INP	In-position range	Each	100	pulse	(2) of this section
PA11		This parameter is not used. Do not change this value by any means.		1000.0		
PA12				1000.0		
PA13				0000h		
PA14	*POL	Rotation direction selection	Each	0		(2) of this section
PA15	*ENR	Encoder output pulses	Each	4000		Section 5.1.10
PA16		This parameter is not used. Do not change this value by any means.		0		
PA17				0000h		
PA18				0000h		
PA19	*BLK	Parameter writing inhibit	Each	000Bh		Section 14.5.1

Note 1. Each: Set parameters for each axis of A and B.
Common: Set parameters for common axis of A and B. Be sure to set the same value to the both axes. When the setting values are different, the value set at last will be enabled.
2. The values are common in A-axis and B-axis.

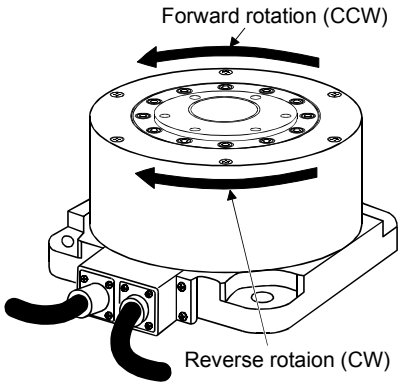
(2) Detail list

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Each/ common</th><th>Default value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PA01</td><td>**STY</td><td>Control mode
"□□0□" (Rotary servo motor) is selected as the initial value.
When using the direct drive motor, always select "□□6□".

Parameter No.PA01
0 0 _ 0
Control mode selection
0: Rotary servo motor
4: Linear servo motor
6: Direct drive motor</td><td>Each</td><td>0000h</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>PA03</td><td>*ABS</td><td>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 incremental system is being used, parameter error (37.2) occurs.

POINT
· This parameter cannot be used in the speed control mode.</td><td>Each</td><td>0000h</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>PA14</td><td>*POL</td><td>Rotation direction selection
Select a rotation direction of the direct drive motor.

<table><tr><th rowspan="2">Setting value</th><th colspan="2">Direct drive motor rotation direction</th></tr><tr><th>When positioning address increases</th><th>When positioning address decreases</th></tr><tr><td>0</td><td>CCW</td><td>CW</td></tr><tr><td>1</td><td>CW</td><td>CCW</td></tr></table>


POINT
· This parameter cannot be used in the speed control mode.</td><td>Each</td><td>0</td><td></td><td>0/1</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Each/ common</th><th>Default value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PA19</td><td>*BLK</td><td>Parameter writing inhibit
<table>
<tr><th rowspan="2">Setting value</th><th rowspan="2">Operation</th><th colspan="6">Applicable parameters</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>Writing</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>Writing</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>Writing</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>Writing</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>Writing</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>Writing</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>Writing</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>Writing</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>Writing</td><td>PA19 only</td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td>Each</td><td>000Bh</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

14.5.3 Gain/filter parameters (No.PB□□)

POINT

- The parameter whose symbol is preceded by * is enabled with the following conditions:
  * : After setting the parameter, cycle the power or reset the controller.
  **: After setting the parameter, cycle the power.

No.	Symbol	Name	Each/ common (Note 1)	Default value (Note 2)	Unit	Reference
PB01	FILT	Adaptive tuning mode (adaptive filter II)	Each	0000h		Section 5.2.2
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control)	Each	0000h		
PB03		This parameter is not used. Do not change this value by any means.		0		
PB04	FFC	Feed forward gain	Each	0	%	Section 5.2.2
PB05		This parameter is not used. Do not change this value by any means.		500		
PB06	GD2	Ratio of load inertia moment to direct drive motor inertia moment	Each	7.0	Multiplier	Section 5.2.2
PB07	PG1	Model loop gain	Each	24	rad/s	
PB08	PG2	Position loop gain	Each	37	rad/s	
PB09	VG2	Speed loop gain	Each	823	rad/s	
PB10	VIC	Speed integral compensation	Each	33.7	ms	
PB11	VDC	Speed differential compensation	Each	980		
PB12		This parameter is not used. Do not change this value by any means.		0		
PB13	NH1	Machine resonance suppression filter 1	Each	4500	Hz	Section 5.2.2
PB14	NHQ1	Notch shape selection 1	Each	0000h		
PB15	NH2	Machine resonance suppression filter 2	Each	4500	Hz	
PB16	NHQ2	Notch shape selection 2	Each	0000h		
PB17		Automatic setting parameter				
PB18	LPF	Low-pass filter setting	Each	3141	rad/s	
PB19	VRF1	Vibration suppression control vibration frequency setting	Each	100.0	Hz	
PB20	VRF2	Vibration suppression control resonance frequency setting	Each	100.0	Hz	
PB21		This parameter is not used. Do not change this value by any means.		0.00		
PB22				0.00		
PB23	VFBF	Low-pass filter selection	Each	0000h		Section 5.2.2
PB24	*MVS	Slight vibration suppression control selection	Each	0000h		
PB25		This parameter is not used. Do not change this value by any means.		0000h		
PB26	*CDP	Gain changing selection	Each	0000h		Section 5.5.2
PB27	CDL	Gain changing condition	Each	10		
PB28	CDT	Gain changing time constant	Each	1	ms	
PB29	GD2B	Gain changing ratio of load inertia moment to direct drive motor inertia moment	Each	7.0	Multiplier	
PB30	PG2B	Gain changing position loop gain	Each	37	rad/s	
PB31	VG2B	Gain changing speed loop gain	Each	823	rad/s	
PB32	VICB	Gain changing speed integral compensation	Each	33.7	ms	

No.	Symbol	Name	Each/ common (Note 1)	Default value (Note 2)	Unit	Reference
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	Each	100.0	Hz	Section 5.5.2
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	Each	100.0	Hz	
PB35		This parameter is not used. 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		

Note 1. Each: Set parameters for each axis of A and B.
Common: Set parameters for common axis of A and B. Be sure to set the same value to the both axes. When the setting values are different, the value set at last will be enabled.
2. The values are common in A-axis and B-axis.

14.5.4 Extension setting parameters (No.PC□□)

POINT

・The parameter whose symbol is preceded by * is enabled with the following conditions:
* : After setting the parameter, cycle the power or reset the controller.
**: After setting the parameter, cycle the power.

No.	Symbol	Name	Each/ common (Note 1)	Default value (Note 2)	Unit	Reference
PC01	ERZ	Error excessive alarm level	Each	0	rev	Section 5.3.2
PC02	MBR	Electromagnetic brake sequence output	Each	0	ms	
PC03	*ENRS	Encoder output pulse selection	Each	0010h		
PC04	**COP1	Function selection C-1	Each	0000h		
PC05	**COP2	Function selection C-2	Each	0000h		
PC06	*COP3	Function selection C-3	Each	0000h		
PC07	ZSP	Zero speed	Each	50	r/min	
PC08		This parameter is not used. Do not change this value by any means.		0		
PC09	MOD1	Analog monitor 1 output	Common	0000h		Section 5.3.2
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		This parameter is not used. Do not change this value by any means.		0		
PC14				0		
PC15	SNO	Station number selection	Common	0		Section 5.3.2
PC16		This parameter is not used. Do not change this value by any means.		0000h		
PC17	**COP4	Function selection C-4	Each	0000h		Section 5.3.2
PC18		This parameter is not used. Do not change this value by any means.		0000h		
PC19				0000h		
PC20				0000h		
PC21	*BPS	Alarm history clear	Each	0000h		Section 5.3.2
PC22		This parameter is not used. Do not change this value by any means.		0000h		
PC23				0000h		
PC24				0000h		
PC25				0000h		
PC26				0000h		
PC27	**COP9	Function selection C-9	Each	0000h		Section 5.3.2
PC28		This parameter is not used. Do not change this value by any means.		0000h		
PC29				0000h		
PC30				0000h		
PC31				0000h		
PC32				0000h		

Note 1. Each: Set parameters for each axis of A and B.
Common: Set parameters for common axis of A and B. Be sure to set the same value to the both axes. When the setting values are different, the value set at last will be enabled.
2. The values are common in A-axis and B-axis.

14.5.5 I/O setting parameters (No.PD□□)

POINT

・The parameter whose symbol is preceded by * is enabled with the following conditions:
*: After setting the parameter, cycle the power or reset the controller.

No.	Symbol	Name	Each/ common (Note 1)	Default value (Note 2)	Unit	Reference
PD01		This parameter is not used. Do not change this value by any means.		0000h		
PD02				0000h		
PD03				0020h		
PD04				0021h		
PD05				0022h		
PD06				0000h		
PD07	*D01	Output signal device selection 1 (A-axis: CN3-12, B-axis: CN3-25)	Each	0005h		Section 5.4.2
PD08		This parameter is not used. Do not change this value by any means.		0004h		
PD09	*D03	Output signal device selection 3 (A-axis: CN3-11, B-axis: CN3-24)	Each	0003h		Section 5.4.2
PD10		This parameter is not used. Do not change this value by any means.		0000h		
PD11				0004h		
PD12				0000h		
PD13				0000h		
PD14	*DOP3	Function selection D-3	Each	0000h		Section 5.4.2
PD15		This parameter is not used. Do not change this value by any means.		0000h		
PD16				0000h		
PD17				0000h		
PD18				0000h		
PD19				0000h		
PD20				0		
PD21				0		
PD22				0		
PD23				0		
PD24				0000h		
PD25				0000h		
PD26				0000h		
PD27				0000h		
PD28				0000h		
PD29				0000h		
PD30				0000h		
PD31				0000h		
PD32				0000h		

Note 1. Each: Set parameters for each axis of A and B.
Common: Set parameters for common axis of A and B. Be sure to set the same value to the both axes. When the setting values are different, the value set at last will be enabled.
2. The values are common in A-axis and B-axis.

14.5.6 Special setting parameters (No.PS□□)

(1) Parameter list

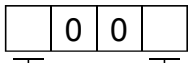
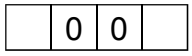
POINT

- The parameter whose symbol is preceded by * is enabled with the following conditions:
  *: After setting the parameter, cycle the power or reset the controller.
  **: After setting the parameter, cycle the power.

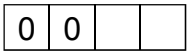
No.	Symbol	Name	Each/ common (Note 1)	Default value (Note 2)	Unit	Reference
PS01	**LIT1	Special function selection 1	Each	0301h		(2) of this section
PS02		This parameter is not used. Do not change this value by any means.		1000		
PS03				1000		
PS04	*LIT2	Special function selection 2	Each	0003h		(2) of this section
PS05	LB1	Servo control position deviation error detection level	Each	0	0.01 rev	
PS06	LB2	Servo control speed deviation error detection level	Each	0	r/min	
PS07	LB3	Servo control torque deviation error detection level	Each	100	%	
PS08	*LIT3	Special function selection 3	Each	0010h		
PS09	LPWM	Magnetic pole detection voltage level	Each	30	%	
PS10		This parameter is not used. Do not change this value by any means.		5		
PS11				100		
PS12				500		
PS13				0000h		
PS14				0		
PS15				0000h		
PS16				0000h		
PS17	LTSTS	Minute position detection method function selection	Each	0000h		(2) of this section
PS18	IDLV	Minute position detection method identification signal amplitude	Each	0000h	%	
PS19		This parameter is not used. Do not change this value by any means.		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: Set parameters for each axis of A and B.
Common: Set parameters for common axis of A and B. Be sure to set the same value to the both axes. When the setting values are different, the value set at last will be enabled.
2. The values are common in A-axis and B-axis.

(2) Detail list

No.	Symbol	Name and function	Each/ common	Default value	Unit	Setting range
PS01	**LIT1	Special function selection 1 The magnetic pole detection setting and the valid/invalid setting of the direct drive motor thermistor can be selected. (Refer to section 14.4.2.) Direct drive motor magnetic pole detection setting is unnecessary for an incremental system.  Direct drive motor magnetic pole detection setting 0: Magnetic pole detection invalid 1: Magnetic pole always valid Direct drive motor thermistor valid/invalid setting 0: Thermistor error detection valid 1: Thermistor error detection invalid POINT ・To protect the direct drive motor from overheating, usually fabricate a cable that includes a thermistor wire. Set the thermistor error detection to be valid with this parameter.	Each	0301h		Refer to Name and function column.
PS02		This parameter is not used. Do not change this value by any means.		1000		
PS03				1000		
PS04	*LIT2	Special function selection 2 Servo control error detection function and servo control error reset can be selected.  Servo control error detection function selection (Refer to section 14.4.4) 0: Invalid 1: Position deviation error detection valid 2: Speed deviation error detection valid 3: Position/speed detection deviation error detection valid 4: Torque deviation error detection valid 5: Position/torque deviation error detection valid 6: Speed/torque deviation error detection valid 7: Position/speed/torque deviation error detection valid Servo control error detection reset selection Set the controller reset condition of the servo control error detection (42.☐). 0: Reset impossible (Reset by switching off is possible.) 1: Reset possible	Each	0003h		Refer to Name and function column.
PS05	LB1	Servo control position deviation error detection level This is used to set the position deviation error detection level of the servo control error detection. When the deviation between a model feedback position and actual feedback position is larger than the setting value, Servo control error (42.1) will occur. (Refer to section 14.4.4.) Setting "0" will be regarded as 0.09rev by the servo amplifier.	Each	0	0.01rev	0 to 1000
PS06	LB2	Servo control speed deviation error detection level This is used to set the speed deviation error detection level of the servo control error detection. When the deviation between a model feedback speed and actual feedback speed is larger than the setting value, Servo control error (42.2) will occur. (Refer to section 14.4.4.) Setting "0" will be regarded as 100r/min by the servo amplifier.	Each	0	r/min	0 to 2000

No.	Symbol	Name and function	Each/ common	Default value	Unit	Setting range
PS07	LB3	Servo control torque deviation error detection level This is used to set the torque deviation error detection level of the servo control error detection. When the deviation between a command torque and actual feedback torque is larger than the setting value, Servo control error (42.3) will occur. (Refer to section 14.4.4.) Setting "0" will be regarded as 100% by the servo amplifier.	Each	100	%	0 to 1000
PS08	*LIT3	Special function selection 3 Select the valid/invalid setting of the stroke limit and the magnetic pole detection method for the magnetic pole detection. (Refer to section 14.4.2 (3).) When not using the stroke limit (FLS and RLS) of the servo amplifier, invalidate the stroke limit for the magnetic pole detection. 0 □ 1 □ Method selection for the magnetic pole detection 0: Position detection method 4: Minute position detection method Valid/invalid setting of the stroke limit (FLS and RLS) for the magnetic pole detection 0: Valid 1: Invalid	Each	0010h		Refer to Name and function column.
PS09	LPWM	Magnetic pole detection voltage level This is used to set a direct current exciting voltage level during the magnetic pole detection. When overload alarm (50.□ and 51.□) or overcurrent alarm (32.□) occurs, set the smaller value. If Initial magnetic pole detection error occurs during the magnetic pole detection, increase the setting value. (Refer to section 14.4.2 (2).)	Each	30	%	0 to 100
PS10		This parameter is not used. Do not change this value by any means.		5		
PS11				100		
PS12				500		
PS13				0000h		
PS14				0		
PS15				0000h		
PS16				0000h		

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Each/ common</th><th>Default value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PS17</td><td>LTSTS</td><td>Minute position detection method function selection
Set the response and the load to motor inertia moment ratio of the minute position detection method.
To make the parameter valid, set parameter No.PS08 (Special function selection 3) to "□□□4" (minute position detection method). (Refer to section 14.4.2 (5).)


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>Middle response</td></tr><tr><td>1</td><td rowspan="6">↕</td><td>9</td><td rowspan="6">↕</td></tr><tr><td>2</td><td>A</td></tr><tr><td>3</td><td>B</td></tr><tr><td>4</td><td>C</td></tr><tr><td>5</td><td>D</td></tr><tr><td>6</td><td>E</td></tr><tr><td>7</td><td>Middle response</td><td>F</td><td>High response</td></tr></table>
Selecting the load inertia moment ratio at the direct drive motor, which decides the response of the minute position detection method
<table><tr><th>Setting</th><th>Load inertia moment ratio</th><th>Setting</th><th>Load inertia moment 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</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 (Special function selection 3) to "□□□4". Identification signal is "100%" when "0000h" is set. (Refer to section 14.4.2 (5).)</td><td>Each</td><td>0000h</td><td>%</td><td>0000h to 006Fh</td></tr>
<tr><td>PS19</td><td></td><td>This parameter is not used. Do not change this value 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>
<tr><td>PS27</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS28</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS29</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS30</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS31</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
<tr><td>PS32</td><td></td><td></td><td></td><td>0000h</td><td></td><td></td></tr>
</table>

14.5.7 Option setting parameters (No.Po□□)

POINT

- The parameter whose symbol is preceded by * is enabled with the following conditions:
  *: After setting the parameter, cycle the power or reset the controller.
  **: After setting the parameter, cycle the power.

No.	Symbol	Name	Each/ common (Note 1)	Default value (Note 2)	Unit	Reference
Po01	*OOP1	Function selection O-1	Common	0000h		Section 5.5.2
Po02	SGRA	Axis selection for graphing analog data (MR Configurator)	Common	0000h		
Po03	SGRD	Axis selection for graphing digtal data (MR Configurator)	Common	0000h		
Po04	**OOP2	Function selection O-2	Common	0000h		
Po05		This parameter is not used. Do not change this value by any means.		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: Set parameters for each axis of A and B.
Common: Set parameters for common axis of A and B. Be sure to set the same value to the both axes. When the setting values are different, the value set at last will be enabled.
2. The values are common in A-axis and B-axis.

14.6 Troubleshooting

> POINT
> ・If an alarm which indicates each axis in the stop method column occurs, the axis without the alarm operates the servo motor as per normal.

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

14.6.1 Alarm and warning list

When an error occurs during operation, the corresponding alarm or warning is displayed. Refer to section 14.6.2 and 8.3 for alarms, and section 14.6.3 and 8.4 for warnings to take an appropriate action. When an alarm occurs, ALM-A/ALM-B will turn off.
After its cause has been removed, the alarm can be deactivated in any of the methods marked O in the alarm deactivation column. Warnings are automatically canceled after the cause of occurrence is removed.

	Display	Name	Alarm deactivation			Detection system (Note 3)	Stop system (Note 4)
			Power off to on	Error reset	CPU reset		
Alarm	10	Undervoltage	○	○	○	Common	All axes
	11	Switch setting error	○			Common	All axes
	12	Memory error 1 (RAM)	○			Common	All axes
	13	Clock error	○			Common	All axes
	15	Memory error 2 (EEP-ROM)	○			Common	All axes
	16	Encoder initial communication error 1	○			Each	Each
	17	Board error	○			Common	All axes
	19	Memory error 3 (Flash-ROM)	○			Common	All axes
	1A	Motor combination error	○			Each	Each
	1E	Encoder initial communication error 2	○			Each	Each
	1F	Encoder initial communication error 3	○			Each	Each
	20	Encoder normal communication error 1	○			Each	Each
	21	Encoder normal communication error 2	○			Each	Each
	24	Main circuit error	○	○	○	Each	All axes
	25	Absolute position erased	○			Each	Each
	27	Initial magnetic pole detection error	○	○	○	Each	Each
	2B	Encoder counter error	○			Each	Each
	30	Regenerative error	(Note 1) ○	(Note 1) ○	(Note 1) ○	Common	All axes
	31	Overspeed	○	○	○	Each	Each
	32	Overcurrent	○			Each	All axes
	33	Overvoltage	○	○	○	Common	All axes
	34	SSCNET receive error 1	○	(Note 2) ○	○	Each	Each
	35	Command frequency error	○	○	○	Each	Each
	36	SSCNET receive error 2	○	○	○	Each	Each
	37	Parameter error	○			Each	Each
	42	Servo control error	○	(Note 5) ○	(Note 5) ○	Each	Each
	45	Main circuit device overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○	Common	All axes

	Display	Name	Alarm deactivation			Detection system (Note 3)	Stop system (Note 4)
			Power off to on	Error reset	CPU reset		
Alarm	46	Direct drive motor overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each	Each
	47	Cooling fan error	○			Common	All axes
	50	Overload 1	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each	Each
	51	Overload 2	(Note 1) ○	(Note 1) ○	(Note 1) ○	Each	Each
	52	Error excessive	○	○	○	Each	Each
	8A	USB communication time-out error	○	○	○	Common	All axes
	8E	USB communication error	○	○	○	Common	All axes
	888	Watchdog	○			Common	All axes
Warning	91	Main circuit device overheat warning				Common	
	92	Battery cable disconnection warning				Each	
	96	Home position setting warning				Each	
	9F	Battery warning				Each	
	E0	Excessive regeneration warning				Common	
	E1	Overload warning 1				Each	
	E2	Direct drive motor overheat warning				Each	
	E3	Absolute position counter warning				Each	
	E4	Parameter warning				Each	
	E6	Servo forced stop warning				Common	All axes
	E7	Controller forced stop warning				Common	All axes
	E8	Cooling fan speed reduction warning				Common	
	E9	Main circuit off warning				Common	All axes
	EB	The other axis error warning				Each	All axes
	EC	Overload warning 2				Each	
	ED	Output watt excess warning				Each	

Note 1. Wait for about 30 minutes as cooling time after removing the cause of occurrence, then deactivate the alarm.

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

3. Indicates detected axis of alarm/warning.
   Each: Alarm/warning will be detected for each axis.
   Common: Alarm/warning will be detected as a common axis.

4. When an alarm/warning occurs, following axis will stop.
   Each axis: Only detected axis will stop.
   All axes: All axes will stop.

5. To cancel it, set parameter No.PS04 to "1□□□".

14.6.2 Remedies for alarms

⚠ CAUTION	・When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation. Otherwise, it may cause injury. ・If Absolute position erased (25.1) occurs, always make home position setting again. Otherwise, it may cause an unexpected operation. ・When alarms are occurring in both axes of A and B, shut off the main circuit power supply. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the regenerative resistor.

POINT

・When any of the following alarms has occurred, do not cycle the power repeatedly to restart. Doing so will cause a malfunction of the servo amplifier and direct drive motor. Remove its cause and allow about 30 minutes for cooling before resuming the 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.☐)
  ・Overload 1 (50.☐)
  ・Overload 2 (51.☐)
  ・Main circuit device overheat (45.☐)
  ・Direct drive motor overheat (46.☐)
・To deactivate the alarm, cycle the power, command the error reset, or CPU reset from the servo system controller. For details, refer to section 14.6.1.

When an alarm occurs, Malfunction (ALM-A/ALM-B) switches off and the dynamic brake is operated to stop the direct drive motor. At this time, the display indicates the alarm No.
Remove the cause of the alarm in accordance with this section. Use MR Configurator to refer to the cause of alarm occurrence.

Alarm No.: 10		Name: Undervoltage		Stop system: All axes	
Alarm content		・The voltage of the control circuit power supply has dropped. ・The voltage of the main circuit power supply has dropped.			
Display	Detail name	Cause	Check method	Check result	Action
10.1	Voltage drop in the control circuit power	Same as for the rotary servo motors. Refer to section 8.3.			
10.2	Voltage drop in the main circuit power				

Alarm No.: 11		Name: Switch setting error		Stop system: All axes	
Alarm content		・Rotary axis setting switch was incorrectly set. ・DIP switch was incorrectly set. ・Servo motor selection switch was incorrect set.			
Display	Detail name	Cause	Check method	Check result	Action
11.1	Rotary switch setting error	Same as for the rotary servo motors. Refer to section 8.3.			
11.2	DIP switch setting error				
11.3	Servo motor select switch setting error				
11.4	Servo motor select switch setting error 2				

Alarm No.: 12		Name: Memory error 1 (RAM)		Stop system: All axes	
Alarm content		・A part (CPU) in the servo amplifier is failure. ・A part (custom IC) in the servo amplifier is failure.			
Display	Detail name	Cause	Check method	Check result	Action
12.1	CPU built-in RAM error	Same as for the rotary servo motors. Refer to section 8.3.			
12.2	CPU data RAM error				
12.3	Custom IC RAM error				

Alarm No.: 13		Name: Clock error		Stop system: All axes	
Alarm content		・Fault was found in the printed board. ・A clock error transmitted from the controller occurred.			
Display	Detail name	Cause	Check method	Check result	Action
13.1	Clock error	Same as for the rotary servo motors. Refer to section 8.3.			

Alarm No.: 15		Name: Memory error 2 (EEP-ROM)		Stop system: All axes	
Alarm content		・A part (EEP-ROM) in the servo amplifier is failure.			
Display	Detail name	Cause	Check method	Check result	Action
15.1	EEP-ROM error at power on	Same as for the rotary servo motors. Refer to section 8.3.			
15.2	EEP-ROM error during operation				

Alarm No.: 16		Name: Encoder initial communication error 1		Stop system: Each axis	
Alarm content		・An error occurred in the communication between the encoder and the servo amplifier.			
Display	Detail name	Cause	Check method	Check result	Action
16.1	Encoder receive data error 1	Same as for the rotary servo motors. Refer to section 8.3.			
16.2	Encoder receive data error 2				
16.3	Encoder receive data error 3				
16.5	Encoder transmission data error 1				
16.6	Encoder transmission data error 2				
16.7	Encoder transmission data error 3				

Alarm No.: 17		Name: Board error		Stop system: All axes	
Alarm content		・A part in the servo amplifier is failure			
Display	Detail name	Cause	Check method	Check result	Action
17.1	AD converter error	Same as for the rotary servo motors. 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 system: All axes	
Alarm content		・A part (Flash-ROM) in the servo amplifier is failure.			
Display	Detail name	Cause	Check method	Check result	Action
19.1	Flash-ROM error 1	Same as for the rotary servo motors. Refer to section 8.3.			
19.2	Flash-ROM error 2				

Alarm No.: 1A		Name: Servo motor combination error			Stop system: Each axis	
Alarm content		・Combination of servo amplifier and servo motor is incorrect.				
Display	Detail name	Cause		Check method	Check result	Action
1A.1	Motor combination error	1)	Combination of servo amplifier and servo motor is incorrect.	Check the model name of the direct drive motor and corresponding servo amplifier.	The combination is not correct.	Use them in the correct combination.
					The combination is correct.	Check 2).
		2)	Rotary servo setting was selected in the parameter.	Check the parameter No. PA01 setting. Rotary servo motor: "□□0□" Linear servo motor: "□□4□" Direct drive motor: "□□6□"	Direct drive motor was selected.	Use them in the correct combination.

Alarm No.: 1E		Name: Encoder initial communication error 2			
Alarm content		・The encoder is malfunctioning.			
Display	Detail name	Cause	Check method	Check result	Action
1E.1	Encoder failure	Same as for the rotary servo motors. Refer to section 8.3.			

Alarm No.: 1F		Name: Encoder initial communication error 3			
Alarm content		・The connected encoder is not compatible with the servo amplifier.			
Display	Detail name	Cause	Check method	Check result	Action
1F.1	Incompatible encoder	Same as for the rotary servo motors. Refer to section 8.3.			

Alarm No.: 20		Name: Encoder normal communication error 1			
Alarm content		・An error occurred in the communication between the encoder and the servo amplifier.			
Display	Detail name	Cause	Check method	Check result	Action
20.1	Encoder receive data error 1	Same as for the rotary servo motors. Refer to section 8.3.			
20.2	Encoder receive data error 2				
20.3	Encoder receive data error 3				
20.5	Encoder transmission data error 1				
20.6	Encoder transmission data error 2				
20.7	Encoder transmission data error 3				

Alarm No.: 21		Name: Encoder normal communication error 2			Stop system: Each axis	
Alarm content		・Error is found in the encoder data.				
Display	Detail name	Cause		Check method	Check result	Action
21.1	Encoder data error	Same as for the rotary servo motors. Refer to section 8.3.				
21.2	Encoder data update error					
21.3	Encoder data waveform error	1)	Something near the device caused it.	Check for noise, and other factors.	Problem found.	Take countermeasures against its cause.
					No problem found.	Check 2).
		2)	Encoder failure	Replace the direct drive motor, and then check the repeatability.	It is not repeatable.	Replace the direct drive motor.

Alarm No.: 24		Name: Main circuit error			Stop system: All axes
Alarm content		・Ground fault occurred at the servo motor power lines of the servo amplifier. ・A ground fault occurred at the servo motor.			
Display	Detail name	Cause	Check method	Check result	Action
24.1	Ground fault detected by hardware detection circuit	Same as for the rotary servo motors. Refer to section 8.3.			
24.2	Ground fault detected by software detection function				

Alarm No.: 25		Name: Absolute position erased			Stop system: Each axis	
Alarm content		・An error was found in the absolute position data. ・Power was switched on for the first time in the absolute position detection system. ・When the alarm occurs, startup the direct drive servo again, and then make home position setting.				
Display	Detail name	Cause		Check method	Check result	Action
25.1	Absolute position data erase	1)	Power was switched on for the first time in the absolute position detection system.	Check if the action stated in the left is performed.	Performed.	Check that the battery is mounted, and make home position return.
					Not performed.	Check 2).
		2)	The battery was removed (replaced) when the control circuit power supply was off.	Check if the action stated in the left is performed.	Performed.	Check that the battery is mounted, and make home position return.
					Not performed.	Check 3).
		3)	The battery voltage is low. (Battery is consumed.)	Check the battery voltage with a tester.	Below 3.0VDC.	Replace the battery.
					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 the encoder cable.
					No problem found.	Check 6).
		6)	The absolute position storage unit is malfunctioning.	Check if it occurs with a new absolute position storage unit.	It does not occur.	Replace the absolute position storage unit.
					It occurs.	Check 7).
		7)	Encoder failure	Check if it occurs with a new battery.	It occurs.	Replace the servo motor.

Alarm No.: 27		Name: Initial magnetic pole detection error			Stop system: Each axis	
Alarm content		・The initial magnetic pole detection was not completed properly.				
Display	Detail name	Cause		Check method	Check result	Action
27.1	Magnetic pole detection abnormal termination	1)	A moving part collided against the machine.	Check if it collided.	It collided.	Move the start position of the magnetic pole detection.
					It did not collided.	Check 2).
		2)	Power line wiring failure	The servo motor power lines are not routed correctly.	Problem found.	Correct the wiring.
					No problem found.	Check 3).
		3)	Accuracy of the initial magnetic pole detection is not satisfactory.	The travel distance at the magnetic pole detection is short.	It is too 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 limit switches.	Problem found.	Remove the cause. Change the location of the magnetic pole detection.
					No problem found.	Check 2).
		2)	The magnetic pole detection voltage level is small.	The travel distance at the magnetic pole detection is short.	It is too short.	Review the parameter No.PS09 setting.
27.3	Magnetic pole detection limit switch error	1)	Both of the magnetic pole detection limit switches are off.	Check if the limit switches are off.	They are off.	Turn on the limit switches.

Alarm No.: 27		Name: Initial magnetic pole detection error			Stop system: Each axis	
Alarm content		・The initial magnetic pole detection was not completed properly.				
Display	Detail name	Cause		Check method	Check result	Action
27.4	Magnetic pole detection estimated error	1)	The estimated value of magnetic pole detection is not correct.	Check it with the check method for alarm display "27.1".		
27.5	Magnetic pole detection position deviation error	1)	Position deviation increased during the magnetic pole detection.	Check it with the check method for alarm display "27.1".		
27.6	Magnetic pole detection speed deviation error	1)	Speed deviation increased during the magnetic pole detection.	Check it with the check method for alarm display "27.1".		
27.7	Magnetic pole detection current error	1)	The current reached the alarm level during the magnetic pole detection.	Check it with the check method for alarm display "27.1".		

Alarm No.: 28		Name: Encoder counter error			Stop system: Each axis	
Alarm content		・Data which encoder created is failure. ・When the alarm occurs, startup the direct drive servo again, and then make home position setting.				
Display	Detail name	Cause		Check method	Check result	Action
2B.1	Encoder counter error 1	1)	Encoder cable is faulty.	Check the condition of the shielded part.	The shielded part is broken.	Repair the cable.
					The shielded part has no problem.	Check 2).
		2)	Something near the device caused it.	Check the noise, ambient temperature, etc.	Problem found.	Take countermeasures against its cause.
					No problem found.	Check 3).
		3)	Encoder failure	Replace the direct drive motor, and then check the repeatability.	It is not repeatable.	Replace the direct drive motor.
2B.2	Encoder counter error 2	1)	Encoder cable is faulty.	Check it with the check method for alarm display "2B.1".		
		2)	Something near the device caused it.			
		3)	Encoder failure			

Alarm No.: 30		Name: Regenerative error		Stop system: All axes	
Alarm content		・Permissible regenerative power of the built-in regenerative resistor or regenerative option is exceeded. ・A regenerative transistor in the servo amplifier is malfunctioning.			
Display	Detail name	Cause	Check method	Check result	Action
30.1	Regeneration heat error	Same as for the rotary servo motors. Refer to section 8.3.			
30.2	Regenerative transistor error				
30.3	Regenerative transistor feedback data error				

Alarm No.: 31		Name: Overspeed		Stop system: Each axis	
Alarm content		・Direct drive motor speed exceeded the instantaneous permissible speed.			
Display	Detail name	Cause	Check method	Check result	Action
31.1	Motor speed error	Same as for the rotary servo motors. Refer to section 8.3.			

Alarm No.: 32		Name: Overcurrent		Stop system: All axes	
Alarm content		・Current that flew is higher than the permissible current of the servo amplifier.			
Display	Detail name	Cause	Check method	Check result	Action
32.1	Overcurrent detected at hardware detection circuit (during operation)	Same as for the rotary servo motors. 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 system: All axes	
Alarm content		・The value of the bus voltage exceeded 400VDC.			
Display	Detail name	Cause	Check method	Check result	Action
33.1	Main circuit voltage error	Same as for the rotary servo motors. Refer to section 8.3.			

Alarm No.: 34		Name: SSCNET receive error 1		Stop system: Each axis	
Alarm content		・SSCNETⅢ communication is malfunctioning. (continuous communication error with 3.5ms interval)			
Display	Detail name	Cause	Check method	Check result	Action
34.1	SSCNET receive data error	Same as for the rotary servo motors. Refer to section 8.3.			
34.2	SSCNET communication connector connection error				
34.3	SSCNET communication data error				
34.4	Hardware error signal detection				

Alarm No.: 35		Name: Command frequency error		Stop system: Each axis	
Alarm content		・Input pulse frequency of command pulse is too high.			
Display	Detail name	Cause	Check method	Check result	Action
35.1	Command frequency error	Same as for the rotary servo motors. Refer to section 8.3.			

Alarm No.: 36		Name: SSCNET receive error 2		Stop system: Each axis	
Alarm content		・SSCNETⅢ communication is malfunctioning. (intermittent communication error with about 70ms interval)			
Display	Detail name	Cause	Check method	Check result	Action
36.1	Continuous communication data error	Same as for the rotary servo motors. Refer to section 8.3.			

Alarm No.: 37		Name: Parameter error		Stop system: Each axis	
Alarm content		・Parameter setting is incorrect.			
Display	Detail name	Cause	Check method	Check result	Action
37.1	Parameter setting range error	Same as for the rotary servo motors. Refer to section 8.3.			
37.2	Parameter combination error				

Alarm No.: 42		Name: Servo control error			Stop system: Each axis	
Alarm content		・A servo control error occurred.				
Display	Detail name	Cause		Check method	Check result	Action
42.1	Servo control error by position deviation	1)	Connection of the direct drive motor is not correct.	Check the wiring.	Problem found.	Wire it correctly.
					No problem found.	Check 2).
		2)	The initial magnetic pole detection was not executed.	Execute the magnetic pole detection again, and then check the repeatability.	It is not repeatable.	Execute the magnetic pole detection.
					It is repeatable.	Check 3).
		3)	The position deviation reached the detection level.	Check the operation status. (Check the value of droop pulses.)	The deviation is large.	Review the operation status. Review the setting of parameter No.PS05 (Servo control position deviation error detection level) as required.
42.2	Servo control error by speed deviation	1)	Connection of the direct drive motor is not correct.	Check the wiring.	Problem found.	Wire it correctly.
					No problem found.	Check 2).
		2)	The initial magnetic pole detection was not executed.	Execute the magnetic pole detection again, and then check the repeatability.	It is not repeatable.	Execute the magnetic pole detection.
					It is repeatable.	Check 3).
		3)	The speed deviation reached the detection level.	Check the operation status. (Calculate the deviation between the speed command and direct drive motor speed.)	The deviation is large.	Review the operation status. Review the setting of parameter No.PS06 (Servo control speed deviation error detection level) as required.
42.3	Servo control error by torque detection	1)	Connection of the direct drive motor is not correct.	Check the wiring.	Problem found.	Wire it correctly.
					No problem found.	Check 2).
		2)	The initial magnetic pole detection was not executed.	Execute the magnetic pole detection again, and then check the repeatability.	It is not repeatable.	Execute the magnetic pole detection.
					It is repeatable.	Check 3).
		3)	The thrust deviation reached the detection level.	Check the operation status. (Calculate the deviation between the current command and torque.)	The deviation is large.	Review the operation status. Review the setting of parameter No.PS07 (Servo control torque deviation error detection level) as required.

Alarm No.: 45		Name: Main circuit device overheat		Stop system: All axes	
Alarm content		・Inside of the servo amplifier overheated.			
Display	Detail name	Cause	Check method	Check result	Action
45.1	Main circuit device overheat error	Same as for the rotary servo motors. Refer to section 8.3.			
45.5	Board temperature error				

Alarm No.: 46		Name: Direct drive motor overheat			Stop system: Each axis	
Alarm content		・The direct drive motor overheated.				
Display	Detail name	Cause		Check method	Check result	Action
46.1	Encoder thermal sensor error	Same as for the rotary servo motors. Refer to section 8.3.				
46.2	Direct drive motor thermal sensor error	1)	Ambient temperature of the direct drive motor has exceeded 40℃.	Check the ambient temperature of the direct drive motor.	It is over 40℃.	Lower the ambient temperature of the direct drive motor.
					It is 40℃ or less.	Check 2).
		2)	The direct drive motor has been under overload status.	Check the effective load ratio.	The effective load ratio is large.	Reduce the load or review the operation pattern.
					The effective load ratio is small.	Check 3).
		3)	The thermal sensor in the direct drive motor is malfunctioning.	Check the direct drive motor temperature when the alarm occurs.	The direct drive motor temperature is low.	Replace the direct drive motor.
46.3	Thermistor wire disconnected error	1)	A thermistor wire is not connected.	Check if the thermistor wire is connected.	It is not connected.	Connect it.
					It is connected.	Check 2).
		2)	The thermistor wire is disconnected.	Check the thermistor wire.	It is disconnected.	Repair the lead wire.
					It is not disconnected.	Replace the direct drive motor.

Alarm No.: 47		Name: Cooling fan error			Stop system: All axes	
Alarm content		・The speed of the servo amplifier cooling fan decreased. ・The speed decreased to the alarm level or less.				
Display	Detail name	Cause		Check method	Check result	Action
47.1	Cooling fan stop error	Same as for the rotary servo motors. Refer to section 8.3.				
47.2	Cooling fan speed reduction error					

Alarm No.: 50		Name: Overload 1		Stop system: Each axis	
Alarm content		・Load exceeded overload protection characteristic of servo amplifier.			
Display	Detail name	Cause	Check method	Check result	Action
50.1	Thermal overload error 1 during operation	Same as for the rotary servo motors. Refer to section 8.3.			
50.2	Thermal overload error 2 during operation				
50.3	Thermal overload error 4 during operation				
50.4	Thermal overload error 1 during a stop				
50.5	Thermal overload error 2 during a stop				
50.6	Thermal overload error 4 during a stop				

Alarm No.: 51		Name: Overload 2		Stop system: Each axis	
Alarm content		・Maximum output current flowed for several seconds continuously due to machine collision or the like.			
Display	Detail name	Cause	Check method	Check result	Action
51.1	Thermal overload error 3 during operation	Same as for the rotary servo motors. Refer to section 8.3.			
51.2	Thermal overload error 3 during a stop				

Alarm No.: 52		Name: Error excessive		Stop system: Each axis	
Alarm content		・The droop pulses existing between the model position and the actual servo motor position reached the alarm level.			
Display	Detail name	Cause	Check method	Check result	Action
52.3	Excess droop pulses	Same as for the rotary servo motors. Refer to section 8.3.			
52.4	Error excessive during 0 torque limit				

Alarm No.: 8A		Name: USB communication time-out error		Stop system: All axes	
Alarm content		・Communication between the servo amplifier and a communication device (PC, etc.) stopped for the specified time or longer.			
Display	Detail name	Cause	Check method	Check result	Action
8A.1	USB communication time-out error	Same as for the rotary servo motors. Refer to section 8.3.			

<table>
<tr><td colspan="2">Alarm No.: 8E</td><td colspan="3">Name: USB communication error</td><td colspan="2">Stop system: All axes</td></tr>
<tr><td colspan="2">Alarm content</td><td colspan="5">・The USB communication error occurred between the servo amplifier and communication device (e.g. personal computer).</td></tr>
<tr><td>Display</td><td>Detail name</td><td>Cause</td><td>Check method</td><td>Check result</td><td>Action</td></tr>
<tr><td>8E.1</td><td>USB communication receive error</td><td colspan="4" rowspan="5">Same as for the rotary servo motors.
Refer to section 8.3.</td></tr>
<tr><td>8E.2</td><td>USB communication checksum error</td></tr>
<tr><td>8E.3</td><td>USB communication character error</td></tr>
<tr><td>8E.4</td><td>USB communication command error</td></tr>
<tr><td>8E.5</td><td>USB communication data No. error</td></tr>
</table>

14.6.3 Remedies for warnings

CAUTION	・If Absolute position counter warning (E3.☐) occurs, always make home position setting again. Otherwise, it may cause an unexpected operation.

POINT

・When any of the following alarms has occurred, do not cycle the power of the servo amplifier repeatedly to restart. Doing so will cause a malfunction of the servo amplifier and direct drive motor. If the power of the servo amplifier is switched off/on during the alarms, allow more than 30 minutes for cooling before resuming operation.
  ・Excessive regeneration warning (E0.☐)
  ・Main circuit device overheat warning (91.☐)
  ・Overload warning (E1.☐)　・Direct drive motor overheat warning (E2.☐)

When a warning whose stop system is "All axis" in the following table occurs, the servo amplifier will be the servo-off status and the servo motor will stop 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.
Eliminate the cause of the warning according to this section. Use MR Configurator to refer to the cause of warning occurrence.

Warning No.: 91		Name: Main circuit device overheat warning		Stop method: No stop (common detection)	
Warning description		・The temperature inside of the servo amplifier reached a warning level.			
Display	Detail name	Cause	Check method	Check result	Action
91.1	Main circuit device overheat warning	Same as for the rotary servo motors. Refer to section 8.4.			
91.2	Board temperature warning				

Alarm No.: 92		Name: Battery cable disconnection warning			Stop method: No stop (each-axis detection)	
Warning description		・Absolute position detection system battery voltage is low.				
Display	Detail name	Cause		Check method	Check result	Action
92.1	Encoder battery disconnection warning signal detection	1)	The absolute position storage unit has not connected.	Check if the absolute position storage unit is connected.	It is not connected.	Connect the absolute position storage unit.
					It is connected.	Check 2).
		2)	Battery cable is disconnected.	Check the battery cable.	Problem found.	Replace the battery. Repair the cable.
					No problem found.	Check 3).
		3)	Battery voltage dropped. (detected by encoder)	Measure the battery voltage.	It is below 3.0VDC.	Replace the battery.
					It is 3.0VDC or more.	Check 4).
		4)	An encoder cable is disconnected.	Check if the encoder cable is disconnected.	It is disconnected.	Repair or replace the encoder cable.

Warning No.: 96		Name: Home position setting warning			Stop method: No stop (each-axis detection)
Warning description		・Home position setting could not be made.			
Display	Detail name	Cause	Check method	Check result	Action
96.1	In-position error at home positioning	Same as for the rotary servo motors. Refer to section 8.4.			
96.2	Command input error at home positioning				

Alarm No.: 9F		Name: Battery warning				Stop method: No stop (each-axis detection)
Warning description		・Absolute position detection system battery voltage is low.				
Display	Detail name	Cause		Check method	Check result	Action
9F.1	Low battery	Same as for the rotary servo motors. Refer to section 8.4.				
9F.2	Battery degradation	1)	The absolute position storage unit has not connected.	Check if the absolute position storage unit is connected.	It is not connected.	Connect the absolute position storage unit.
					It is connected.	Check 2).
		2)	The battery has deteriorated. (detected by encoder)	Replace the battery.	It is not repeatable.	Replace the battery.

Warning No.: 91		Name: Excessive regeneration warning			Stop method: No stop (common detection)
Warning description		・There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative resistor or regenerative option.			
Display	Detail name	Cause	Check method	Check result	Action
E0.1	Excessive regeneration warning	Same as for the rotary servo motors. Refer to section 8.4.			

Warning No.: E1		Name: Overload warning 1		Stop method: No stop (each-axis detection)	
Warning description		・Overload alarm (50.☐, 51.☐) may occur.			
Display	Detail name	Cause	Check method	Check result	Action
E1.1	Thermal overload warning 1 during operation	Same as for the rotary servo motors. Refer to section 8.4.			
E1.2	Thermal overload warning 2 during operation				
E1.3	Thermal overload warning 3 during operation				
E1.4	Thermal overload warning 4 during operation				
E1.5	Thermal overload warning 1 during a stop				
E1.6	Thermal overload warning 2 during a stop				
E1.7	Thermal overload warning 3 during a stop				
E1.8	Thermal overload warning 4 during a stop				

Warning No.: E2		Name: Direct drive motor overheat warning			Stop method: No stop (each-axis detection)	
Warning description		・Direct drive motor overheat (46.☐) may occur.				
Display	Detail name	Cause		Check method	Check result	Action
E2.1	Direct drive motor overheat warning	1)	The direct drive motor temperature reached 85% of the alarm level of Direct drive motor overheat (46.2).	Check it with the check method for alarm No. "46.2".		

Alarm No.: E3		Name: Absolute position counter warning		Stop method: No stop (each-axis detection)	
Warning description		・The multi-revolution counter value of the absolute position encoder exceeded the maximum range. ・Absolute position encoder pulses are faulty.			
Display	Detail name	Cause	Check method	Check result	Action
E3.1	Absolute position counter travel distance excess warning	Same as for the rotary servo motors. Refer to section 8.4.			
E3.2	Encoder absolute position counter error warning				

Warning No.: E4		Name: Parameter warning		Stop method: No stop (each-axis detection)	
Warning description		・Out of the setting range was attempted to write during parameter writing.			
Display	Detail name	Cause	Check method	Check result	Action
E4.1	Parameter setting range error warning	Same as for the rotary servo motors. Refer to section 8.4.			

Warning No.: E6		Name: Servo forced stop warning		Stop system: All axes	
Warning description		・Forced stop signal was turned off.			
Display	Detail name	Cause	Check method	Check result	Action
E6.1	Forced stop warning	Same as for the rotary servo motors. Refer to section 8.4.			

Warning No.: E7		Name: Controller forced stop warning		Stop system: All axes	
Warning description		・The forced stop signal of the servo system controller was enabled.			
Display	Detail name	Cause	Check method	Check result	Action
E7.1	Controller forced stop warning	Same as for the rotary servo motors. Refer to section 8.4.			

Warning No.: E8		Name: Cooling fan speed reduction warning		Stop method: No stop (common detection)	
Warning description		・The cooling fan speed decreased to the warning occurrence level or less.			
Display	Detail name	Cause	Check method	Check result	Action
E8.1	Decreased cooling fan speed warning	Same as for the rotary servo motors. Refer to section 8.4.			

Warning No.: E9		Name: Main circuit off warning		Stop system: All axes (common detection)	
Warning description		・The servo-on command was inputted with main circuit power supply off. ・The bus voltage dropped during the direct drive motor driving under 50r/min.			
Display	Detail name	Cause	Check method	Check result	Action
E9.1	Servo-on signal on during main circuit off	Same as for the rotary servo motors. Refer to section 8.4.			
E9.2	Bus voltage drop during low speed operation				
E9.3	Ready-off signal on during main circuit off				

Warning No.: EB		Name: The other axis error warning		Stop system: All axes (each-axis detection)	
Warning description		・In the other axis, an alarm demanding all axes stop (11.☐, 15.☐, 17.☐, 24.☐, and 32.☐) occurred.			
Display	Detail name	Cause	Check method	Check result	Action
EB.1	The other axis error warning	Same as for the rotary servo motors. Refer to section 8.4.			

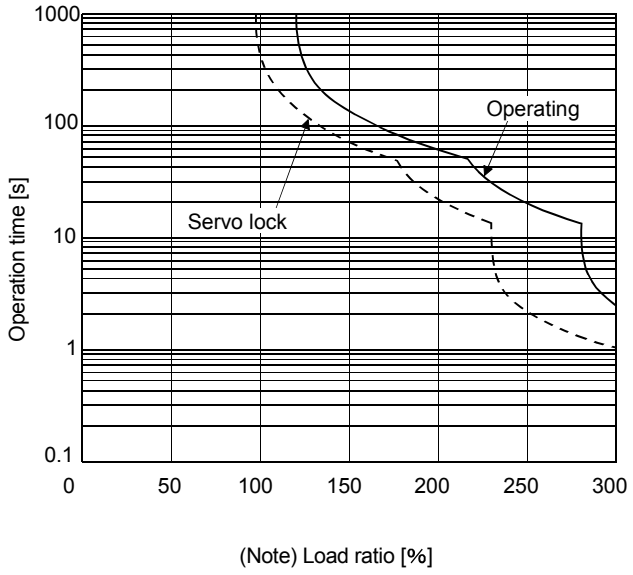
Warning No.: EC		Name: Overload warning 2		Stop method: No stop (each-axis detection)	
Warning description		・Operation, in which a current exceeding the rating flew intensively in any of the U, V, and W phases of the servo motor, was repeated.			
Display	Detail name	Cause	Check method	Check result	Action
EC.1	Overload warning 2	Same as for the rotary servo motors. Refer to section 8.4.			

Warning No.: ED		Name: Output watt excess warning		Stop method: No stop (each-axis detection)	
Warning description		・The status, in which the output wattage (speed × torque) of the direct drive motor exceeded the rated output, continued steadily.			
Display	Detail name	Cause	Check method	Check result	Action
ED.1	Output watt excess	Same as for the rotary servo motors. Refer to section 8.4.			

14.7 Characteristics

14.7.1 Overload protection characteristics

An electronic thermal is built in the servo amplifier to protect the servo amplifier, the direct drive motor, and direct drive motor power lines from overloads.
Overload 1 alarm (50.☐) occurs if overload operation performed is above the electronic thermal protection curve shown in fig. 14.2. Overload 2 alarm (51.☐) occurs if the maximum current is applied continuously for several seconds due to machine collision, etc. Use the equipment on the left-side area of the continuous or broken line in the graph.
For the system where the unbalanced torque occurs, such as a vertical axis system, it is recommended that the unbalanced torque of the machine be kept at 70% or less of the motor's rated torque. When mounting MR-J3W-44B closely, use it with 90% or lower of the effective load ratio.
The MR-J3W servo amplifier has solid-state direct drive motor overload protection for each axis. (The direct drive motor overload current (full load current) is set on the basis of 115% rated current of the servo amplifier.)



MR-J3W-44B/MR-J3W-77B/MR-J3W-1010B

Note. If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a direct drive motor stop status (servo-lock status) or in a 30r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal protection.

Fig. 14.2 Electronic thermal protection characteristics

14.7.2 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 to motor inertia ratio is 1000 time while decelerating from rated speed to a stop with frequency of once in 10 minutes.
- Be sure to enable Forced stop (EM1) after the direct drive motor stops when using Forced stop (EM1) frequently in other than emergency.

(1) Dynamic brake operation

(a) Calculation of coasting distance

Fig. 14.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use equation 14.1 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the direct drive motor and machine operation speeds. (Refer to (1) (b) of this section.)

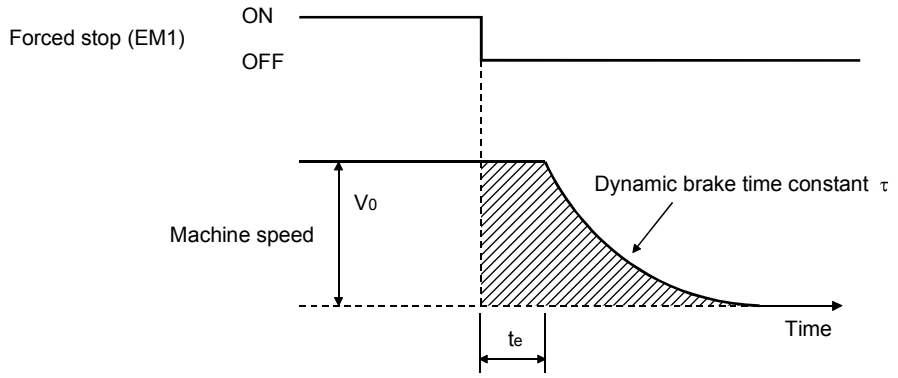


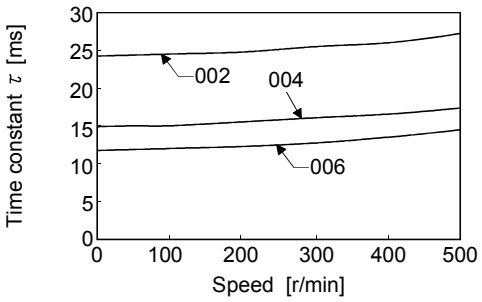
Fig. 14.3 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ te + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \quad \text{(14.1)}$$

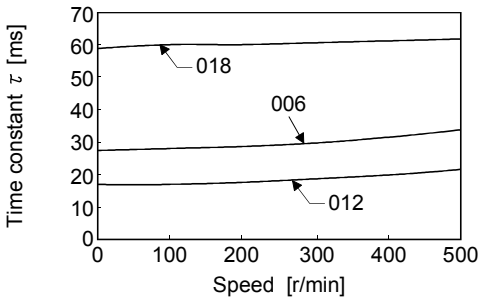
L_{max} : Maximum coasting distance ..... [mm][in]
Vo : Machine's fast feed speed .....[mm/min][in/min]
J_M : direct drive motor inertia moment .....[$\times 10^{-4}$ kg・m^2][oz・in^2]
J_L : Load moment of inertia converted into equivalent value on direct drive motor rotor .....[$\times 10^{-4}$ kg・m^2][oz・in^2]
τ : Dynamic brake time constant .....[s]
te : Delay time of control section (Note).....[s]
Note. There is internal relay delay time of about 10ms.

(b) Dynamic brake time constant

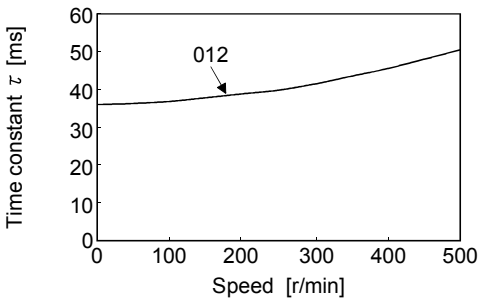
The following shows necessary dynamic brake time constant τ for equation 14.1.



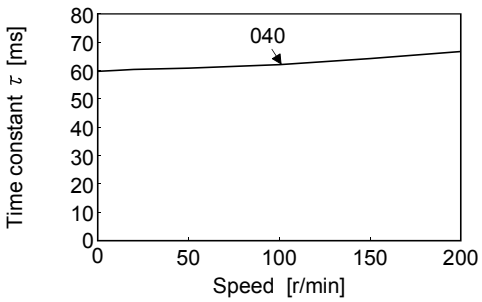
TM-RFM□C20



TM-RFM□E20



TM-RFM□G20



TM-RFM□J10

(2) Permissible load to motor inertia ratio when the dynamic brake is used

Use the dynamic brake under the load to motor inertia ratio indicated in the following table. If the ratio is higher than this value, the built-in dynamic brake may burn. If there is a possibility that the ratio may exceed the value, contact your local sales office.

The values of the permissible load to motor inertia ratio in the table are the values at the maximum rotation speed of the direct drive motor.

The value in the parenthesis shows the value at the rated speed of the direct drive motor.

Direct drive motor	Servo amplifier							
	MR-J3W-22B		MR-J3W-44B		MR-J3W-77B		MR-J3W-1010B	
	A-axis	B-axis	A-axis	B-axis	A-axis	B-axis	A-axis	B-axis
TM-RFM002C20	100 (300)		100 (300)					
TM-RFM004C20			100 (300)		100 (300)		100 (300)	
TM-RFM006C20					100 (300)		100 (300)	
TM-RFM006E20					100 (300)		100 (300)	
TM-RFM012E20					100 (300)		100 (300)	
TM-RFM018E20							100 (300)	
TM-RFM012G20					50 (300)		50 (300)	
TM-RFM040J10					50 (200)		50 (200)	

14.8 Options for direct drive motor

⚠ WARNING	・Before connecting any option or peripheral equipment, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N− is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠ CAUTION	・Use specified auxiliary equipment and options. Otherwise, it may cause a malfunction or fire.

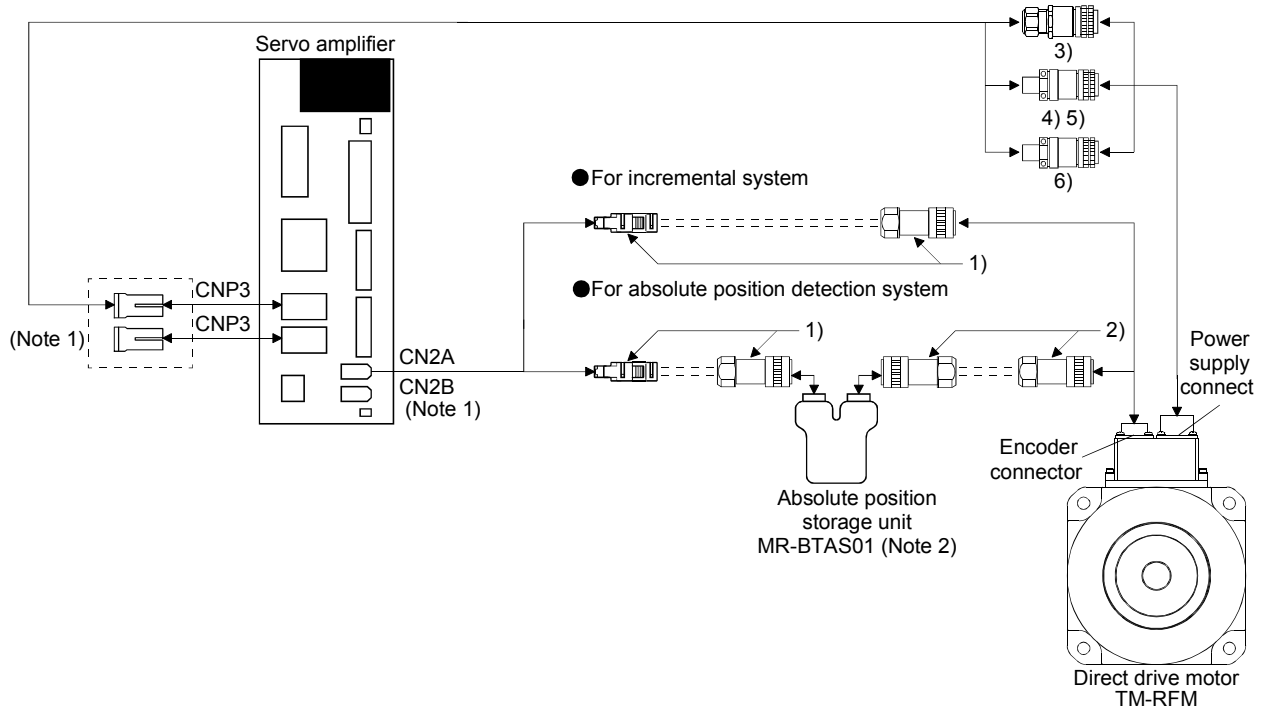
14.8.1 Cable/connector sets

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 direct drive motor.
If the IP rating of the cable, connector, servo amplifier and direct drive motor vary, the overall IP rating depends on the lowest IP rating of all components.

Purchase the cable and connector options indicated in this section.

(1) Cable combinations



Note 1. Options for B-axis are the same as for A-axis.
2. Always make connection for use in an absolute position detection system. (Refer to section 14.8.2.)

No.	Product	Model	Description	Application
1)	Encoder connector set	MR-J3DDCNS	  For connection between servo amplifier and direct drive motor. For connection between servo amplifier and absolute position storage unit. Refer to section 14.8.1 (2) for details.	IP67
2)	Encoder connector set	MR-J3DDSPS	  For connection between absolute position storage unit and direct drive motor. Refer to section 14.8.1 (2) for details.	IP67
3)	Power connector set	MR-PWCNF	Plug: CE05-6A14S-2SD-D (DDK) Cable clamp: YSO14-9 to 11 (Daiwa Dengyo) Applicable cable Applicable wire size: 0.3mm^2 (AWG22) to 1.25mm^2 (AWG16) Overall diameter of cable: ϕ8.3 to 11.3mm  For TM-RFM□C20 For TM-RFM□C20	IP67
4)	Power connector set	MR-PWCNS4	Plug: CE05-6A18-10SD-D-BSS Cable clamp: CE3057-10A-1-D (DDK) Applicable cable Applicable wire size: 2mm^2 (AWG14) to 3.5mm^2 (AWG12) Overall diameter of cable: ϕ10.5 to 14.1mm  For TM-RFM□G20	IP67
5)	Power connector set	MR-PWCNS5	Plug: CE05-6A22-22SD-D-BSS Cable clamp: CE3057-12A-1-D (DDK) Applicable cable Applicable wire size: 5.5mm^2 (AWG10) to 8mm^2 (AWG8) Overall diameter of cable: ϕ12.5 to 16mm  For TM-RFM040J10 For TM-RFM120J10	IP67
6)	Power connector set	MR-PWCNS3	Plug: CE05-6A32-17SD-D-BSS Cable clamp: CE3057-20A-1-D (DDK) Applicable cable Applicable wire size: 14mm^2 (AWG6) to 22mm^2 (AWG4) Overall diameter of cable: ϕ22 to 23.8mm  For TM-RFM240J10	Be sure to use this when correspon ding to EN IP67

(2) Encoder connector set

(a) MR-J3DDCNS

This connector set is used to fabricate an encoder cable for the incremental system or the absolute position detection system (between the servo amplifier and the absolute position storage unit).

Parts	Description
Connector set	MR-J3DDCNS (option)   Servo amplifier-side connector Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) or Connector set: 54599-1019 (Molex) Encoder side or absolute position storage unit (connect from servo amplifier) side connector Plug: RM15WTPZK-12S Cord clamp: JR13WCCA-8(72) (Hirose Electric) Applicable wire size: 0.25mm^2 (AWG 23) to 0.5mm^2 (AWG20)

(b) MR-J3DDSPS

This connector set is used to fabricate an encoder cable for the absolute position detection system (between the absolute position storage unit and the direct drive motor).

Parts	Description
Connector set	MR-J3DDSPS (option)   Absolute position storage unit-side connector Plug: RM15WTPZ-12P(72) Cord clamp: JR13WCCA-8(72) (Hirose Electric) Encoder side connector Plug: RM15WTPZK-12S Cord clamp: JR13WCCA-8(72) (Hirose Electric) Applicable wire size: 0.25mm^2 (AWG 23) to 0.5mm^2 (AWG20)

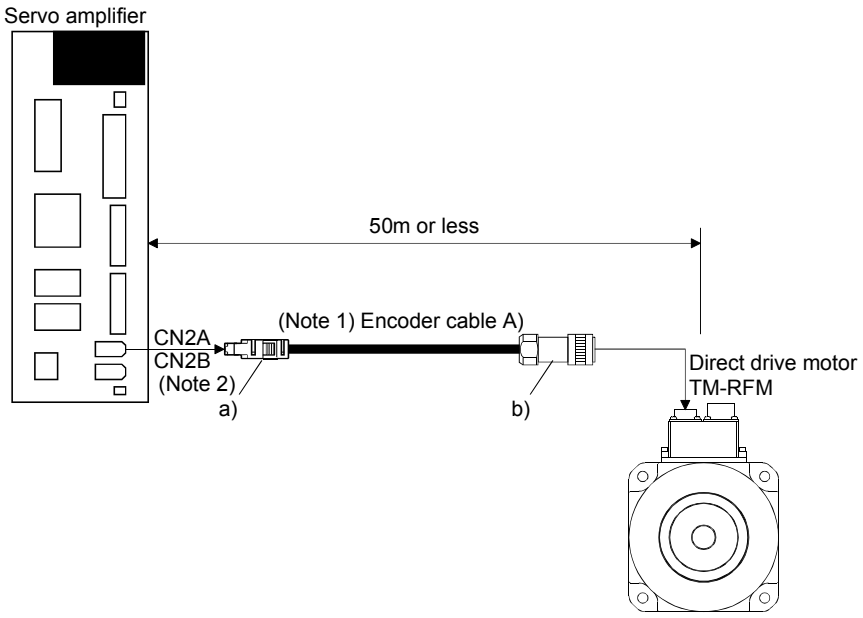
(3) Fabricating encoder cables

POINT

- The encoder cables should be fabricated by the customer. When fabricating the cable, prepare the following parts (a) or (b), and fabricate it according to the wiring diagram in (c).
- Fabricate the encoder cable to be 50m or shorter between the servo amplifier and the direct drive motor.
- To configure the absolute position detection system by using the direct drive motor, the battery unit (MR-BTCASE＋MR-BAT×8) and the absolute position storage unit MR-BTAS01 are required.
- For the absolute position detection system, refer to chapter 12.
- Replacing battery unit (MR-BTCASE＋MR-BAT×8) should be during control circuit power supply on.
  Replacing the unit during control circuit power supply off will cause Absolute position erased alarm (25.1).

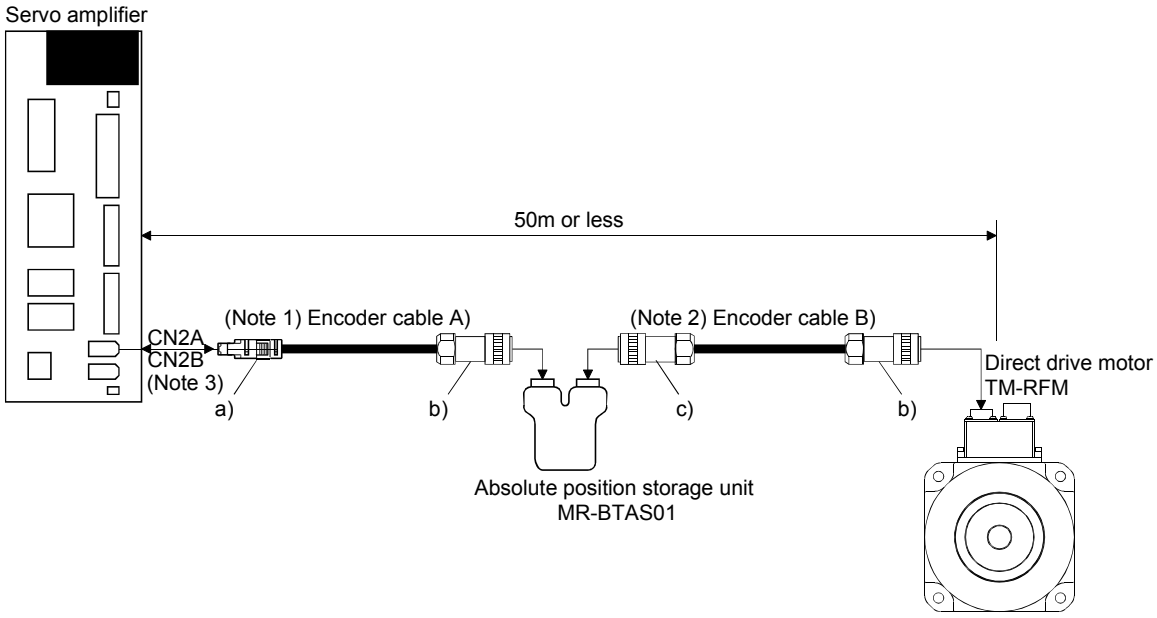
(a) Combinations of encoder cables

1) For incremental system



Note 1. Refer to section (3) (b) 1) of this section for details.
2. Options for B-axis are the same as for A-axis.

2) For absolute position detection system

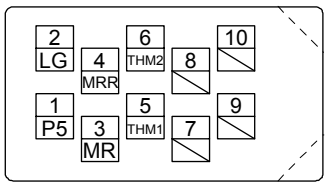
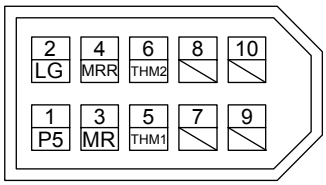
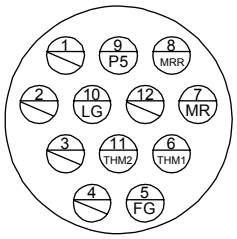


Note 1. Refer to section (3) (b) 2) of this section for details.
2. Refer to section (3) (b) 3) of this section for details.
3. Options for B-axis are the same as for A-axis.
4. For cables of 20m or longer, contact your local sales office.

(b) Wiring diagram of encoder cable

1) Encoder cable A)

a) Connector details

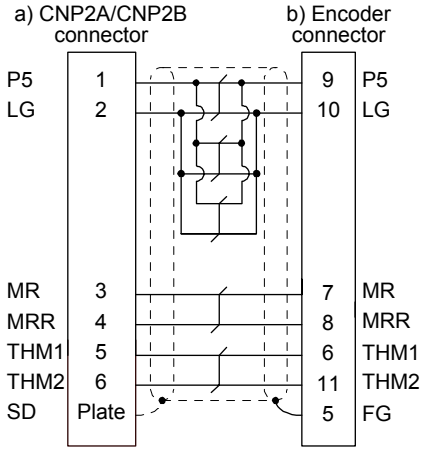
a) CNP2A/CNP2B connector	b) Encoder connector
Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) Connector set: 54599-1019 (Molex)	Straight plug: RM15WTPZK-12S Cord clamp: JR13WCCA-8(72) (Hirose Electric) Recommended cable: 20276 VSVPAWG #23 × 6P KB-0492 (Note 3) (Bando Densen)
 View seen from wiring side. (Note 1)	or  View seen from wiring side. (Note 1)
	 View seen from the wiring side. (Note 2)

Note 1. Do not connect anything to the pins shown as ▨. Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.

2. Do not connect anything to the pins shown as ◡.

3. Purchase from Toa Electric Industry Co. Ltd., Nagoya Branch

b) Internal wiring diagram

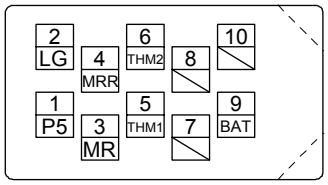
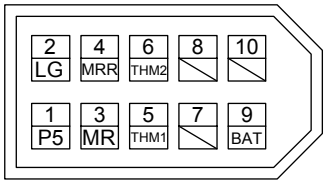
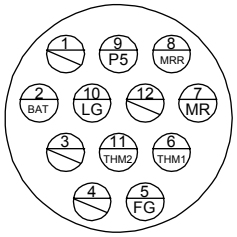


Refer to the following table for the required wires to fabricate the encoder cable.

Core size	Conductor resistance of one core	Overall diameter
0.25mm^2	63.6Ω/km or less	ϕ8.2mm

2) Encoder cable b)

a) Connector details

c) CNP2A/CNP2B connector	d) Absolute position storage unit connector
Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (3M) Connector set: 54599-1019 (Molex)	Straight plug: RM15WTPZK-12S Cord clamp: JR13WCCA-8(72) (Hirose Electric) Recommended cable: 20276 VSVPAWG #23 × 6P KB-0492 (Note 3) (Bando Densen)
 View seen from wiring side. (Note 1) or  View seen from wiring side. (Note 1)	 View seen from the wiring side. (Note 2)

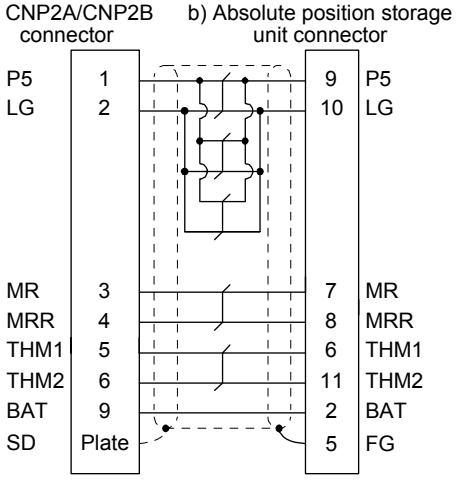
Note 1. Do not connect anything to the pins shown as ▨. Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.

2. Do not connect anything to the pins shown as ◡.

3. Purchase from Toa Electric Industry Co. Ltd., Nagoya Branch

b) Cable internal wiring diagram

When the distance between the servo amplifier and the direct drive motor is within 20m (Note)



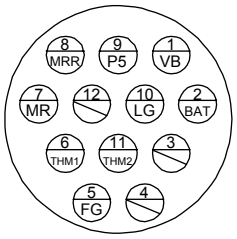
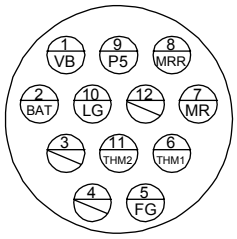
Note. For cables of 20m or longer, contact your local sales office.

Refer to the following table for the required wires to fabricate the encoder cable.

Core size	Conductor resistance of one core	Cable OD
0.25mm^2	63.6Ω/km or less	ϕ6.2mm

3) Encoder cable c)

a) Connector details

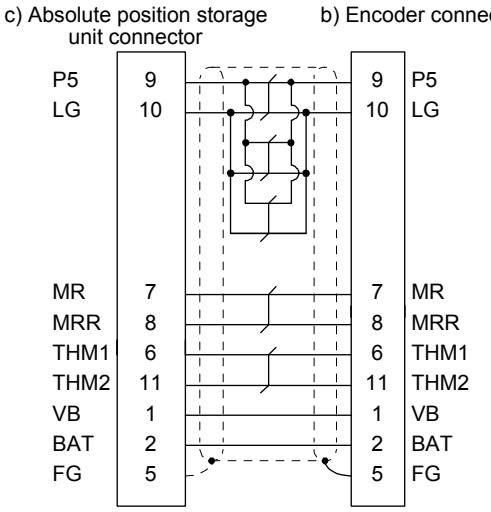
e) Absolute position storage unit connector	f) Encoder connector
Straight plug: RM15WTPZ-12P(72) Cord clamp: JR13WCCA-8(72) (Hirose Electric) Recommended cable: 20276 VSVPAWG #23×6P KB-0492 (Note 2) (Bando Densen)	Straight plug: RM15WTPZK-12S Cord clamp: JR13WCCA-8(72) (Hirose Electric) Recommended cable: 20276 VSVPAWG #23×6P KB-0492 (Note 2) (Bando Densen)
	
View seen from the wiring side. (Note 1)	View seen from the wiring side. (Note 1)

Note 1. Do not connect anything to the pins shown as ◡.

2. Purchase from Toa Electric Industry Co. Ltd., Nagoya Branch

b) Internal wiring diagram

When the distance between the servo amplifier and the direct drive motor is within 20m (Note)



Note. For cables of 20m or longer, contact your local sales office.

Refer to the following table for the required wires to fabricate the encoder cable.

Core size	Conductor resistance of one core	Overall diameter
0.25mm^2	63.6Ω/km or less	ϕ8.2mm

14.8.2 Absolute position storage unit MR-BTAS01

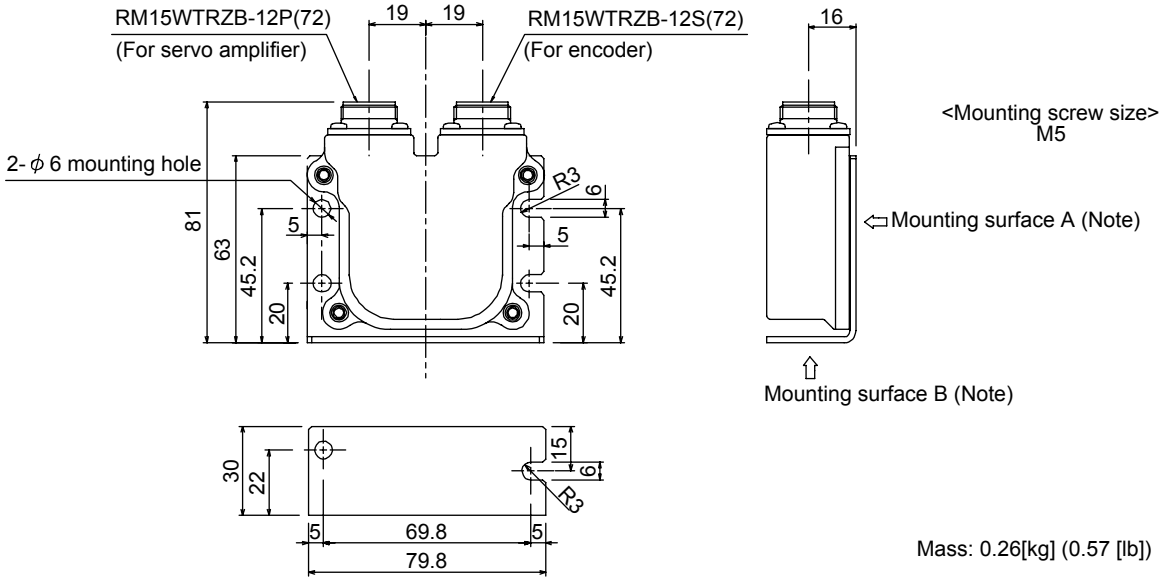
POINT
・Replacing the MR-BTAS01 absolute position storage unit will erase the absolute position. Start up the direct drive motor again and perform home positioning according to section 14.4.1.
・Replacing battery unit (MR-BTCASE＋MR-BAT×8) should be during control circuit power supply on. Replacing the unit during control circuit power supply off will cause Absolute position erased (25.1).
・Absolute position erased (25.1) will occur if the encoder cable is disconnected.

To configure the absolute position detection system by using the direct drive motor, the battery unit (MR-BTCASE＋MR-BAT×8) and the absolute position storage unit MR-BTAS01 are required.

(1) Connection method with the encoder cable
Refer to section 14.8.1 (3) (a) 2).

(2) Dimensions

[Unit: mm]



Mass: 0.26[kg] (0.57 [lb])

Note. When mounting the unit outside the cabinet, fix the mounting surface A with four screws. When mounting the unit inside the cabinet, you can also fix the mounting surface B with two screws.

(3) Environment

The following table indicates the environment for the absolute position storage unit.

Item		Environment
Ambient temperature	Operation	0℃ to 55℃ (non-freezing)
	Storage	−20℃ to 65℃ (non-freezing)
Ambient humidity	Operation	90%RH or less (non-condensing)
	Storage	90%RH or less (non-condensing)
Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, oil and water.
Altitude		1000m or less above sea level
Vibration resistance		When the mounting surface A is fixed: 49m/s^2 (directions of X, Y, and Z axes) When the mounting surface B is fixed: 5.9m/s^2 (directions of X, Y, and Z axes)

15. MR-J3W-0303BN6 SERVO AMPLIFIER

This chapter explains MR-J3W-0303BN6 servo amplifier. The contents of this chapter are only for MR-J3W-0303BN6 servo amplifier. Refer to the corresponding sections for each item below.

Item	Reference
Normal gain adjustment	Chapter 6
Special adjustment functions	Chapter 7

15.1 Functions and configuration

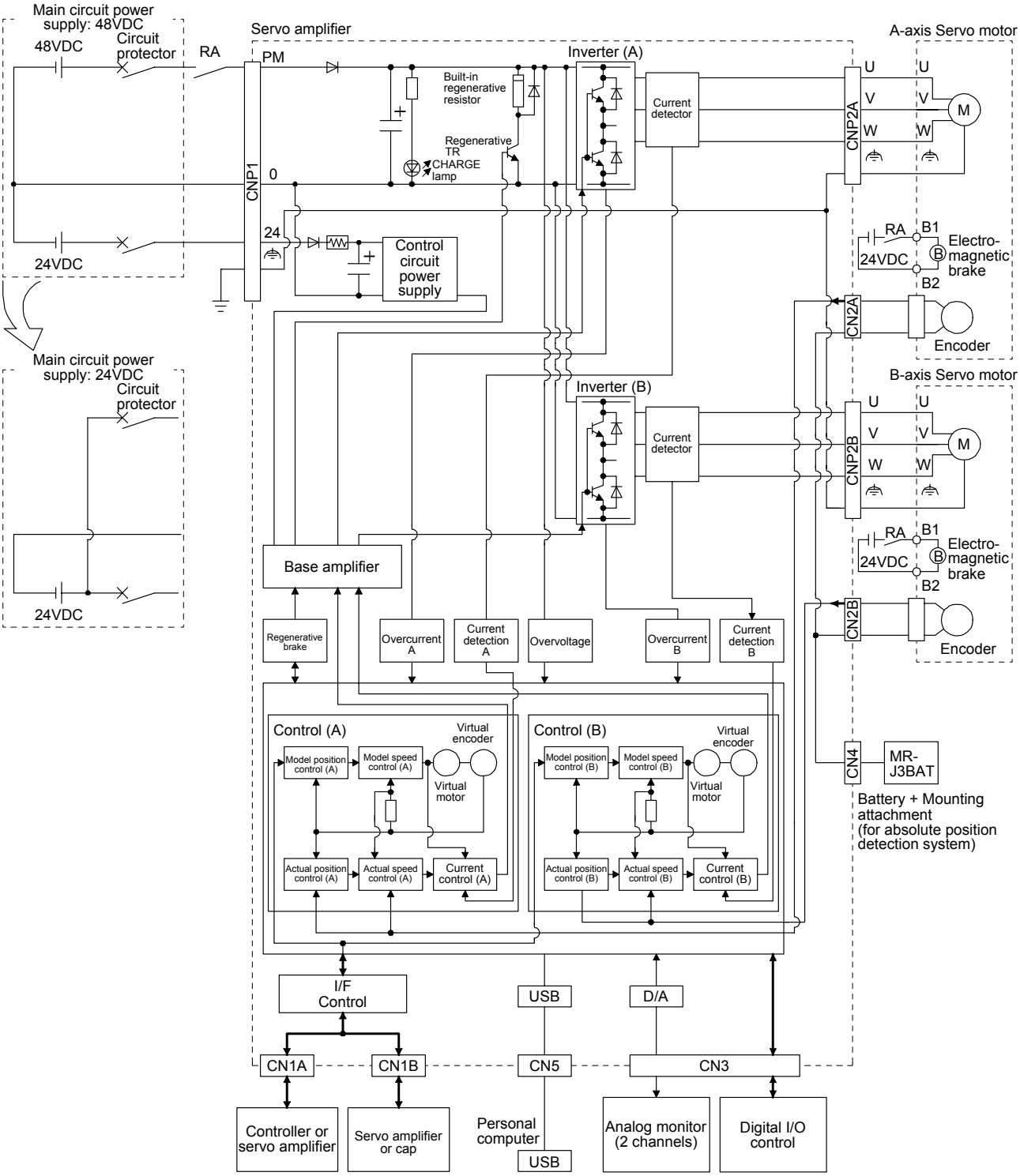
POINT

- This section does not include the following items. For details of the items, refer to each section of the detailed description field.

Item	Detailed explanation
Summary	Section 1.1
Function list	Section 1.4

15.1.1 Function block diagram

The function block diagram of this servo is shown below.



15.1.2 Servo amplifier standard specifications

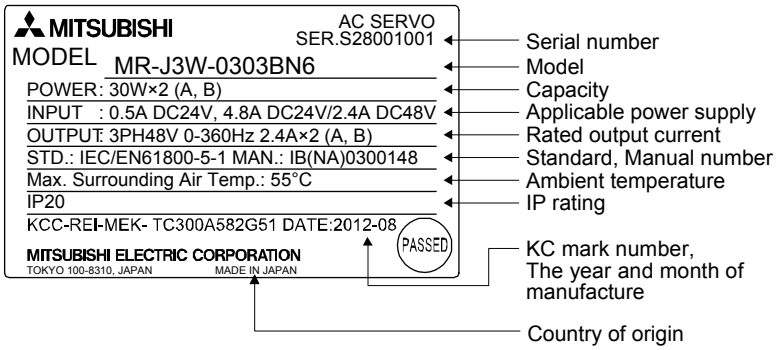
Item \ Servo amplifier				MR-J3W-0303BN6	
Rated output				30W (A-axis)	30W (B-axis)
Output	Rated voltage			3-phase 48VAC	
	Rated current		[A]	2.4	2.4
Main circuit power supply input	Voltage			48VDC/24V (Note 6)	
	Rated current		[A]	48VDC, 2.4A/24VDC, 4.8A	
	Permissible voltage fluctuation			48VDC, within±15%/24VDC, within±10%	
	Power supply capacity			Refer to section 15.8.2.	
	Inrush current			Refer to section 15.8.4.	
Control circuit power supply	Voltage			24VDC	
	Rated current		[A]	0.5	
	Permissible voltage fluctuation			Within±10%	
	Power consumption		[W]	10	
	Inrush current			Refer to section 15.8.4.	
Interface power supply	Voltage			24VDC±10%	
	Current capacity		[A]	0.25 (Note 1)	
Capacitor regeneration	Reusable regenerative energy (Note 3)		[J]	0.9	
	Rotary servo motor Moment of inertia J equivalent to permissible charging amount (Note 4)		[$\times 10^{-4}$kg・m^2]	0.18	
Control method				Sine-wave PWM control, current control method	
Built-in regenerative resistor			[W]	1.3	
Dynamic brake				Built-in (Note 5)	
Protective functions				Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal), servo motor overheat protection, encoder error protection, regenerative error protection, undervoltage, instantaneous power failure protection, overspeed protection, and error excessive protection	
Structure				Natural-cooling, open (IP rating: IP20)	
Close mounting				○ (Note 2)	
Environment	Ambient temperature	Operation	[°C]	0 to 55 (non-freezing)	
			[°F]	32 to 131 (non-freezing)	
		Storage	[°C]	−20 to 65 (non-freezing)	
			[°F]	−4 to 149 (non-freezing)	
	Ambient humidity	Operation		90%RH or less (non-condensing)	
		Storage			
	Ambience			Indoors (no direct sunlight) free from corrosive gas, flammable gas, oil mist, dust, and dirt	
	Altitude			1000m or less above sea level	
	Vibration resistance			5.9m/s^2, at 10Hz to 55Hz (directions of X, Y and Z axes)	
Mass			[kg]	0.3	
			[lb]	0.66	

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. Operate the servo amplifier at 75% load ratio and at the ambient temperatures of 0℃ to 45℃.
3. Regenerative energy is generated when the machine, whose moment of inertia is equivalent to the permissible charging amount, decelerates from the rated speed to stop.
4. This is moment of inertia when the motor decelerates from the rated speed to stop. It will be moment of inertia for two axes when two motors decelerate simultaneously. It will be moment of inertia for each axis when multiple motors do not decelerate simultaneously.
5. Electronic dynamic brake deceleration is built-in. It will not operate while the control circuit power supply is off. In addition, It will not be operate depending on the contents of alarms and warnings. Refer to chapter 8 for details.
6. When using it with 24VDC, set the parameter No.Po04 to "1□□□".

15.1.3 Model designation

(1) Rating plate



(2) Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.

MR－J 3W－□B 6

Series name

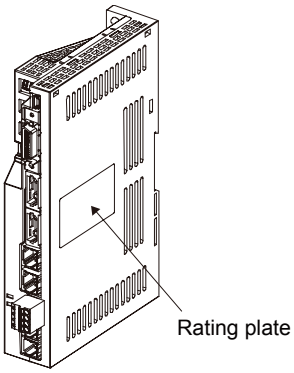
Main circuit power supply: 48VDC/24VDC

Interface

Symbol	Interface
B	SSCNETⅢ
BN	

Rated output

Symbol	Rated output [W]	
	A axis	B axis
0303	30	30

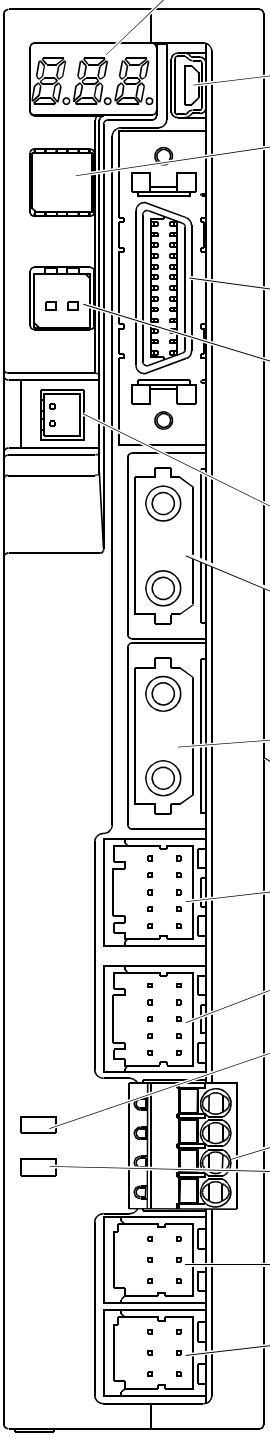


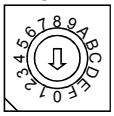
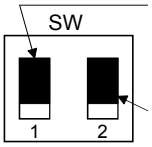
15.1.4 Combination with servo motor

The following table lists combinations of servo amplifiers and servo motors. The same combinations is applied to the servo motors with an electromagnetic brake.

Servo motor	MR-J3W-0303BN6	
	A-axis	B-axis
HG-AK0136	○	
HG-AK0236	○	
HG-AK0336	○	

15.1.5 Parts identification

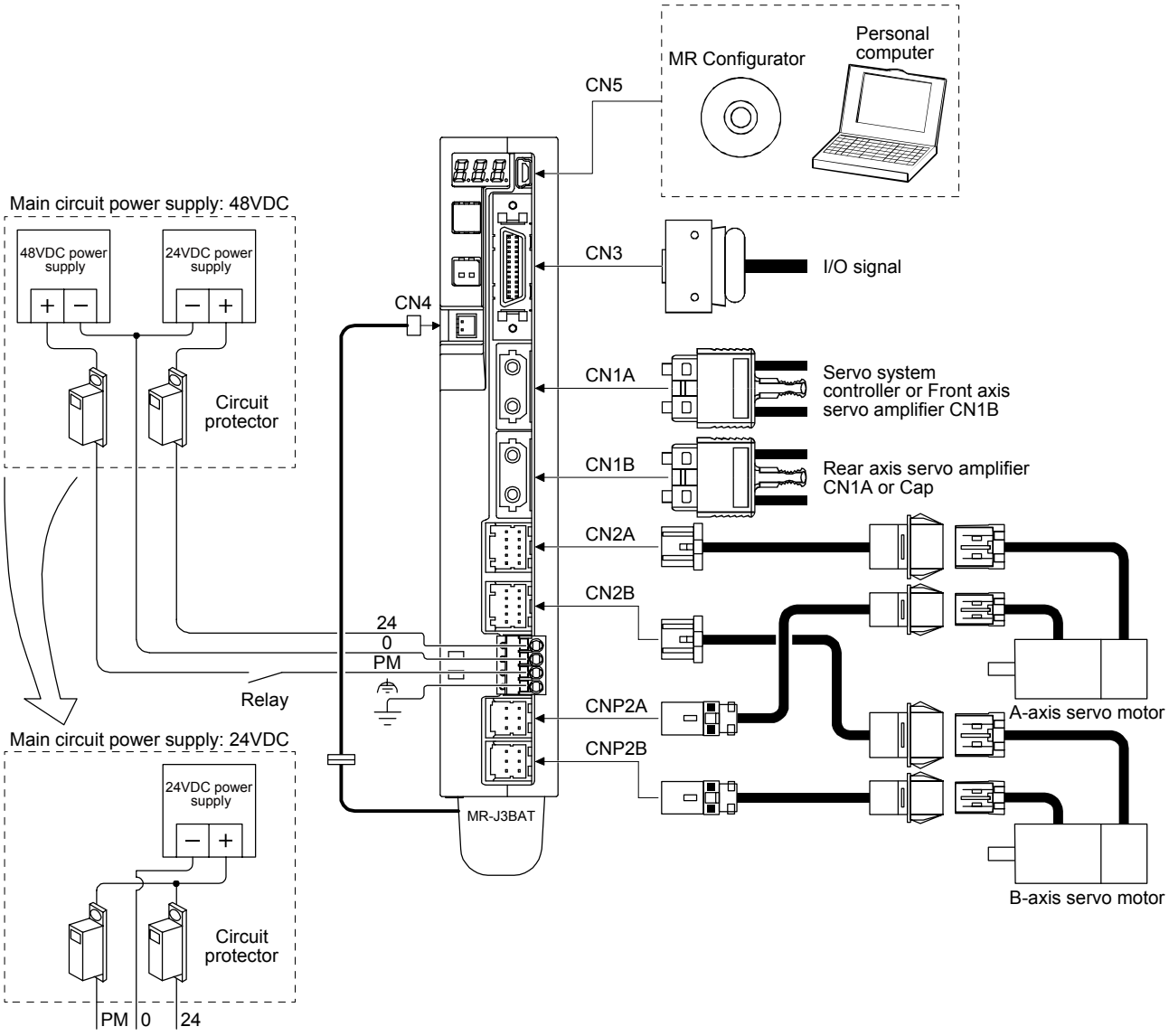


Name/Application	Detailed explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 4.3
USB communication connector (CN5) Connect the personal computer.	Section 11.4
Rotary axis setting switch (SW1) SW  Used to set the axis No. of servo amplifier.	Section 3.13
I/O signal connector (CN3) Used to connect digital I/O signals. More over an analog monitor is output.	Section 15.3.2 Section 15.3.4
 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).	Section 3.13
Battery connector (CN4) Used to connect the battery for absolute position data backup. Battery is not required in fully closed control.	Section 15.10
SSCNET Ⅲ cable connector (CN1A) Used to connect the servo system controller or the front axis servo amplifier.	Section 3.9
SSCNET Ⅲ cable connector (CN1B) Used to connect the rear axis servo amplifier. For the final axis, puts a cap.	Section 3.9
Rating plate	
A-axis servo motor encoder connector (CN2A) Used to connect the A-axis servo motor encoder.	Section 15.3.4 Section 15.9.1
B-axis servo motor encoder connector (CN2B) Used to connect the B-axis servo motor encoder.	Section 15.3.4 Section 15.9.1
Control circuit power voltage error lamp (24V ERROR) When a voltage of the control circuit power voltage (24VDC) is out of permissible range, this will light in yellow.	Section 15.4.2
Main circuit power supply connector (CNP1) Connect the input power supply.	Section 15.3.1 Section 15.9.1
Charge lamp (CHARGE) When the main circuit is charged, this will light in red. While this lamp is lit, do not reconnect the cables.	
A-axis servo motor power output connector (CNP2A) Connect the A-axis servo motor.	Section 15.3.1 Section 15.3.3
B-axis servo motor power output connector (CNP2B) Connect the B-axis servo motor.	Section 15.3.1 Section 15.3.3

15.1.6 Configuration including peripheral equipment

CAUTION	・Connecting a servo motor for different axis to the CNP2A or CNP2B connector may cause a malfunction.

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



15.2 Installation (direction and clearances)

WARNING

- To prevent electric shock, ground each equipment securely.

CAUTION

- Stacking in excess of the specified number of product packages is not allowed.
- Install the equipment on incombustible material. Installing it directly or close to combustibles will lead to a fire.
- Install the equipment in a load-bearing place in accordance with the Instruction Manual.
- Do not get on or put heavy load on the equipment. Otherwise, it may cause injury.
- Use the equipment within the specified environment. (For the environment, refer to section 1.3.)
- Provide an adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier.
- Do not block the intake and exhaust areas of the servo amplifier. Otherwise, it may cause a malfunction.
- Do not drop or strike the servo amplifier. Isolate it from all impact loads.
- 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 handling the servo amplifier, be careful about the edged parts such as corners of the servo amplifier.
- The servo amplifier must be installed in a metal cabinet.
- The equipment must be installed in the specified direction. Otherwise, it may cause a malfunction.
- Leave specified clearances between the servo amplifier and the cabinet walls or other equipment. Otherwise, it may cause a malfunction.

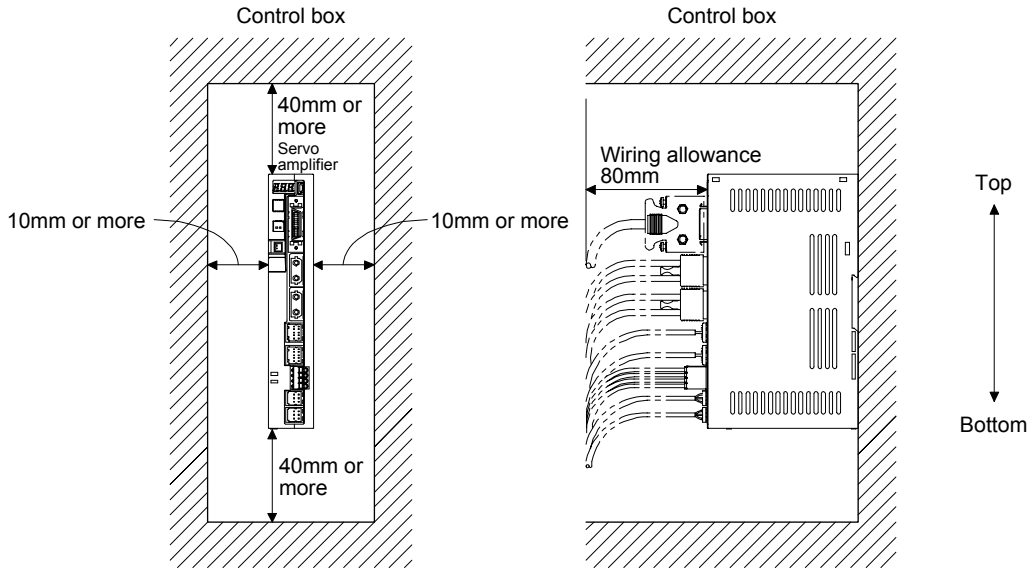
POINT

- This section does not include the following items. For details of the items, refer to each section of the detailed description field.

Item	Detailed explanation
Summary	Section 1.1
Function list	Section 1.4

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

(1) Installation of one servo amplifier

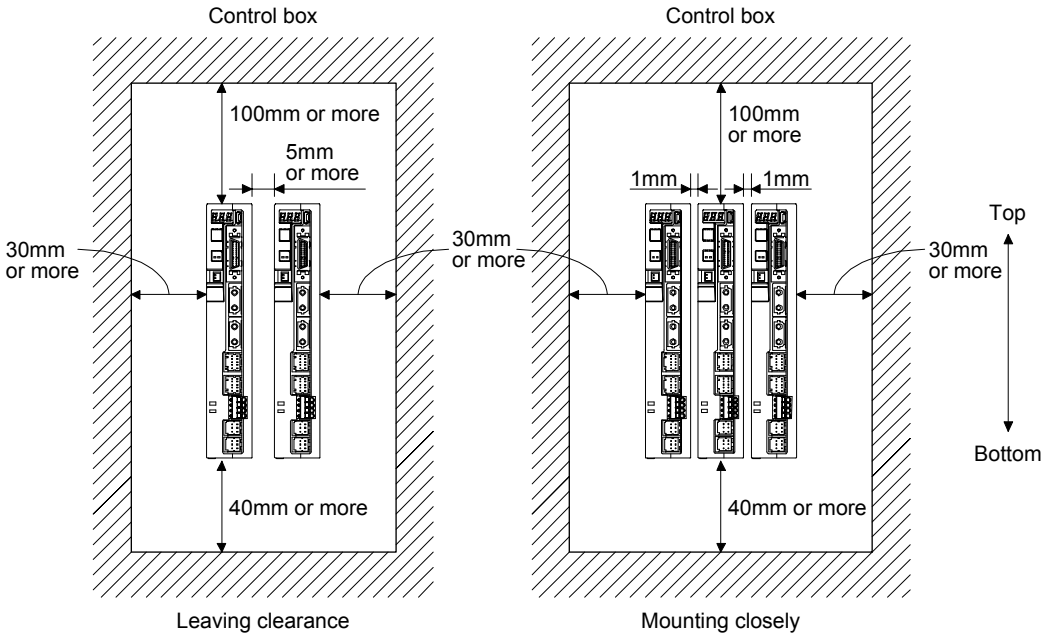


(2) Installation of two or more servo amplifiers

POINT
・You can mount the MR-J3W-0303BN6 servo amplifiers closely. When mounting them closely, operate the servo amplifier at 75% load ratio and at the ambient temperatures of 0℃ to 45℃.

Not to make inside the cabinet stuffy, circulate air by making the clearances between top/bottom and inside cabinets larger.

When mounting the servo amplifiers closely, leave a clearance of 1mm between the adjacent servo amplifiers in consideration of mounting tolerances.



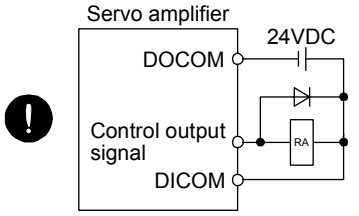
15.3 Signals and wiring

WARNING

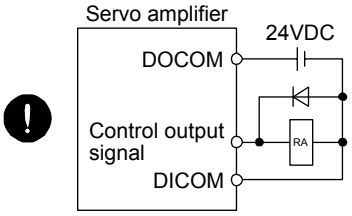
- Any person who is involved in wiring should be fully competent to do the work.
- Before wiring, turn off the power and check that the charge lamp turns off. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of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

CAUTION

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



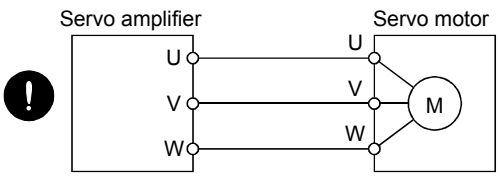
For sink output interface

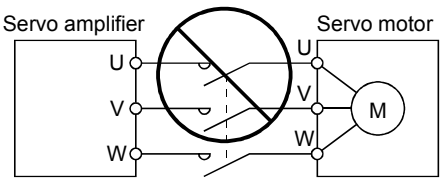


For source output interface

CAUTION

- Electromagnetic interference may be given to the electronic equipment used near the servo amplifier. Use a noise filter, etc. to minimize the influence of electromagnetic interference.
- Do not install a power capacitor, surge killer or radio noise filter (FR-BIF option) with the power line of the servo motor.
- Do not modify the equipment.
- Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.





POINT

・This section does not include the following items. For details of the items, refer to each section of the detailed description field.

Item	Detailed explanation
Interface	Section 3.7
Treatment of cable shield external conductor	Section 3.8
SSCNETⅢ cable connection	Section 3.9
Control axis selection	Section 3.13

15.3.1 Input power supply circuit

⚠ CAUTION

・Always connect a circuit protector between the power supply and power supply voltage input terminals (24, 0, and PM) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a circuit protector is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.

・When alarms are occurring in both axes of A and B, shut off the main circuit power supply. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the regenerative resistor.

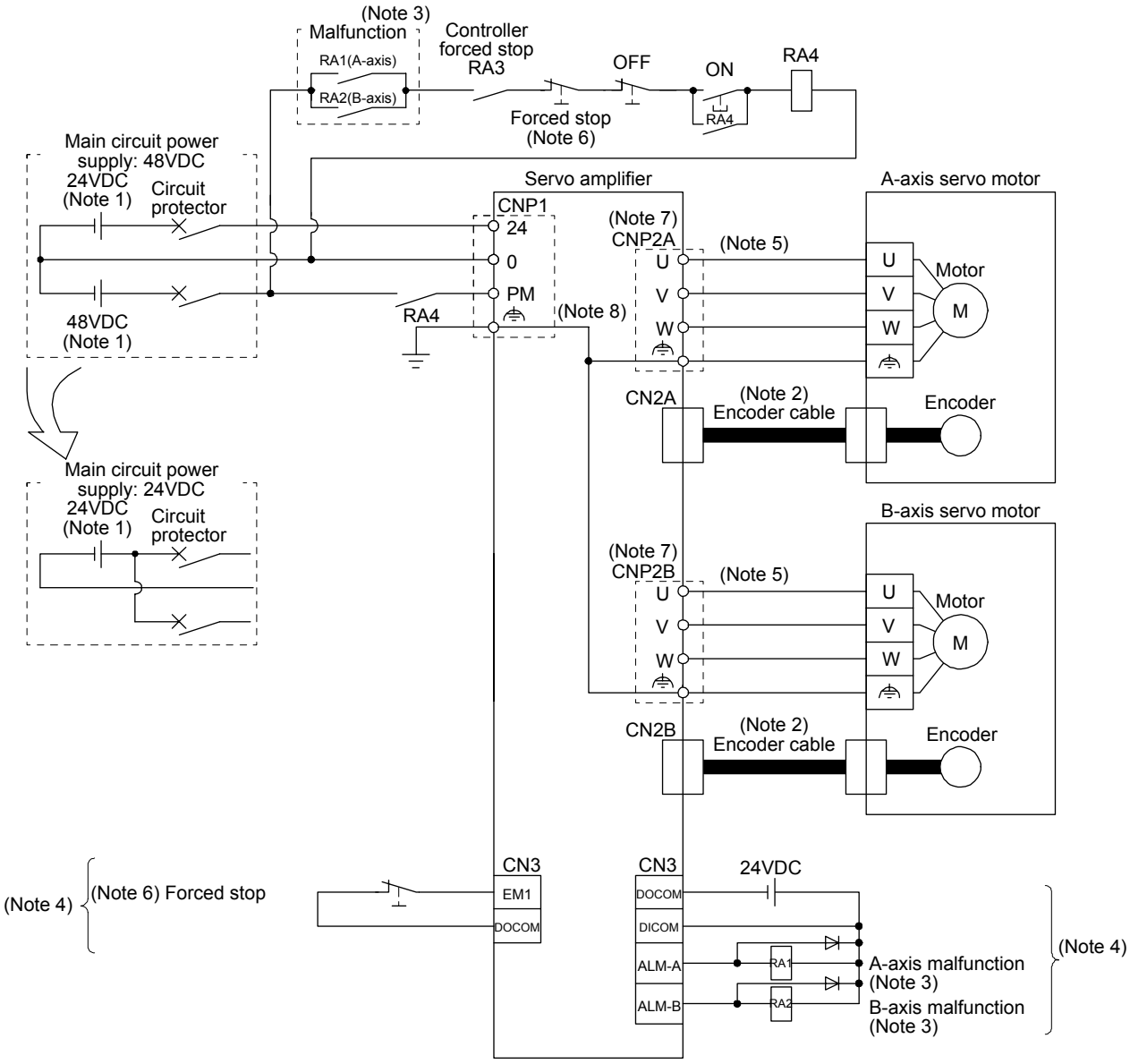
・Check the servo amplifier model, and then input proper voltage to the servo amplifier power supply. If input voltage exceeds the upper limit, the servo amplifier will break down.

・Connecting a servo motor for different axis to the CNP2A or CNP2B connector may cause a malfunction.

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 next axis servo amplifier displays "AA" at the indicator and turns into base circuit shut-off. The servo motor will stop.

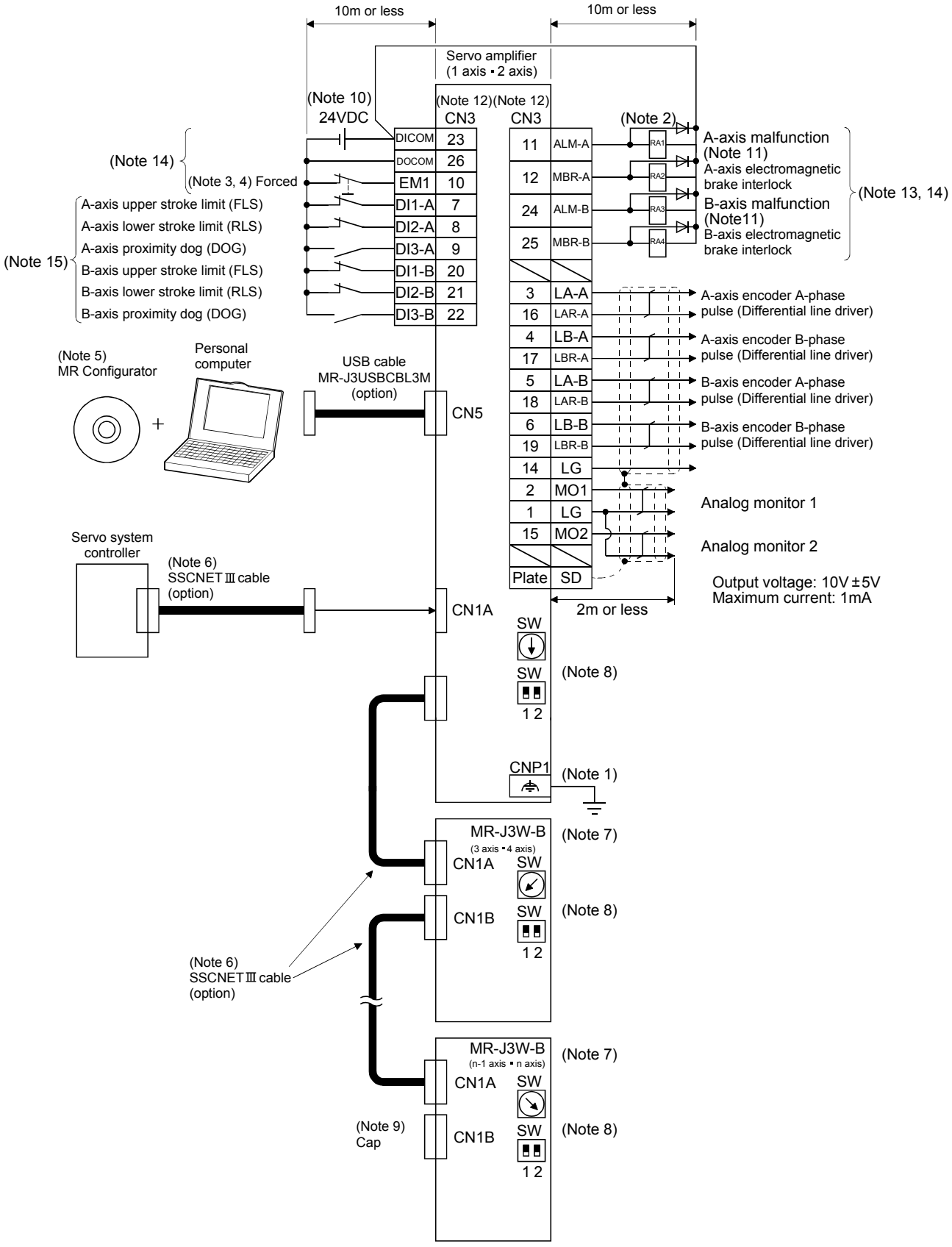
Wire the power supply/main circuit so that the main circuit power supply is shut off and the servo-on command turned off as soon as an alarm occurring, an enabled servo forced stop, or an enabled controller forced stop. A circuit protector must be used with the input cables of the power supply.



Note 1. Use reinforced insulating type for 24VDC and 48VDC power supply. Connect at power supply part for - side wiring (0V). Refer to section 15.3.3 (1) (c) for selecting power supply.

2. For the encoder cable, using optional cable is recommended. Refer to section 15.9.1 for selection of the cable.
3. If disabling malfunction (ALM-A/ALM-B) output with the parameter, configure up the circuit which switches off the main circuit power supply after detection of alarm occurrence on the controller side. This example is to continue the operation in another axis even if an alarm occurs either A-axis or B-axis. When stopping operation of both axes at an alarm occurrence for one axis, connect RA1 and RA2 in series.
4. This is for sink I/O interface. For source I/O interface, refer to section 3.7.3.
5. Refer to section 15.3.6 for wiring power lines.
6. Configure up the circuit which shuts off main circuit power with external circuit at forced stop 1 (EM1) off.
7. Connecting a servo motor for different axis to the CNP2A or CNP2B connector may cause a malfunction.
8. The noiseless grounding (⏚) terminals of CNP2A and CNP2B are connected to the noiseless grounding (⏚) terminal of CNP1 in the servo amplifier. Be sure to ground from the noiseless grounding (⏚) terminal of CNP1 to the grounding terminal of the cabinet.

15.3.2 I/O signal connection example



Note 1. To prevent electric shock, be sure to connect the noiseless grounding (⏚) of CNP1 of the servo amplifier to the grounding terminal of the cabinet.

2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will malfunction and will not output signals, disabling Forced stop (EM1) and other protective circuits.
3. If the controller does not have forced stop function, always install the forced stop switch (normally closed contact).
4. Always turn on Forced stop (EM1) for driving. (normally closed contact) Setting the parameter No.PA04 to "□1□□" will disable Forced stop (EM1).
5. Use MRZJW3-SETUP 221E. (Refer to section 11.4.)
6. Use SSCNETⅢ cables listed in the following table.

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

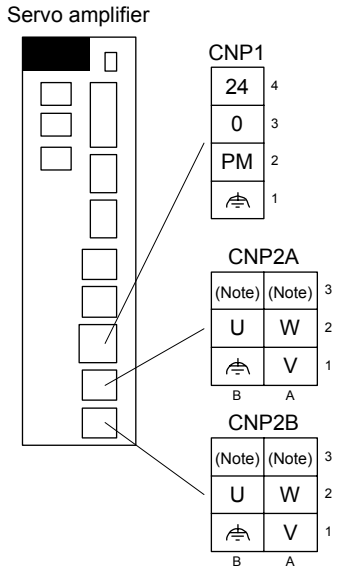
7. The wiring of the third and subsequent axes is omitted.
8. Up to 16 axes can be connected. Refer to section 3.13 for setting of axis selection.
9. Make sure to cap the unused CN1B connector.
10. Supply 24VDC±10% 250mA current for interfaces from outside. 250mA is the value applicable when all I/O 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. Malfunction (ALM-A/ALM-B) will be on in normal alarm-free condition. (Normally closed contact)
12. The pins with the same signal name are connected in the servo amplifier.
13. The signals can be changed by parameter No.PD07 and PD09.
14. This is for sink I/O interface. For 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, and 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□, LD77MH□, Q173DSCPU, Q172DSCPU, and QD77MS. For Q173DSCPU, Q172DSCPU, or QD77MS, use a controller in the SSCNETⅢ mode.

15.3.3 Explanation of power supply system

(1) Signal explanations

POINT
▪ Do not connect anything to the pins for manufacturer setting.

(a) Pin assignment and connector applications



Connector	Name	Function/application
CNP1	Power supply connector	Input main circuit power supply and control circuit power supply.
CNP2A	A-axis servo motor power output connector	Connect with the A-axis servo motor.
CNP2B	B-axis servo motor power output connector	Connect with the B-axis servo motor.

Note. It is for manufacturer setting. Do not connect anything to the pins for manufacturer setting.

(b) Detailed explanation

Symbol	Connection target (application)	Description
24	Main circuit/control circuit power supply	Used to connect＋of the control circuit power supply (24VDC).
0		Used to connect－of the main circuit power supply and control circuit power supply.
PM		Used to connect＋of the main circuit power supply (48VDC).
U/V/W/⏚	Servo motor power	Connect to the servo motor power terminals (U, V, W, and ⏚). Connect the servo amplifier power output (U, V, W, and ⏚) to the servo motor power input (U, V, W, and ⏚) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.
⏚	Noiseless grounding	Connect this to the grounding terminal of cabinet.

(c) Selection of the main circuit/control circuit power supply

The inrush current at power on will be large because a resistance for protecting inrush current is not built-in in the main circuit power supply of the servo amplifier. The electric capacity of the capacitor is approximately 560 μF. When the load characteristic (overcurrent protection criteria) of the power unit is current fold back method, the power cannot startup. Be careful to select power. Especially when the power is turned ON/OFF on the power unit output side, approximately 100 μs to 300 μs instantaneous current will flowed at power on due to capacitor charge. Therefore, a power unit such as one which operates overcurrent at 1ms or less cannot be used.

In addition, when using a switching power supply for input power supply of the control circuit power supply, use a reinforced insulating type. A circuit to protect inrush current at power on is built-in in the control circuit power supply.

(2) Power-on sequence

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

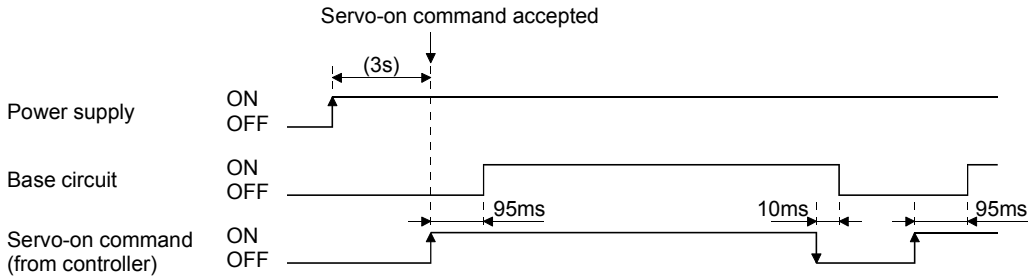
(a) Power-on procedure

1) When wiring the power supply, be sure to use a circuit protector for the power supply (24, 0, and PM) as shown in section 15.3.1. Configure up an external sequence so that the relay connected to PM turns off when an alarm occurs in both axes of A and B.

2) When using a 48VDC power supply, 24 and 0 should be turned on simultaneously with PM and 0, or should be turned on before PM and 0. If the control circuit power supply is turned on with the main circuit power supply off, and then the servo-on command is transmitted, Main circuit off warning (AL.E9) will occur. Turning on the main circuit power supply stops the warning and starts the normal operation.

3) The servo amplifier receives the servo-on command within 3s after the main circuit power supply is switched on. (Refer to (2) (b) of this section.)

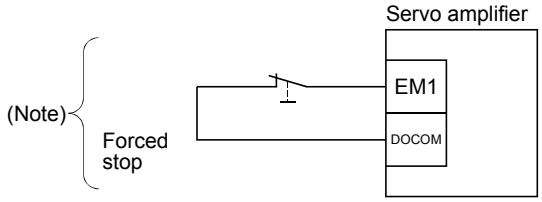
(b) Timing chart



(c) Forced stop

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

If the controller does not have a forced stop function, configure a circuit which shut off the main circuit power supply simultaneously with EM1 off at forced stop. When EM1 is turned off, dynamic brake will start to stop the servo motor. During this sequence, the display shows Servo forced stop warning (E6.1). During normal operation, do not use Forced stop (EM1) to alternate stop and drive. The the servo amplifier life may be shortened.



Note. This is for sink I/O interface. For source I/O interface, refer to section 3.7.3.

(3) Wiring CNP1

POINT
・For the wire sizes used for wiring, refer to section 15.9.1.
・CNP1 wiring connector is supplied with the servo amplifier.

(a) Connector

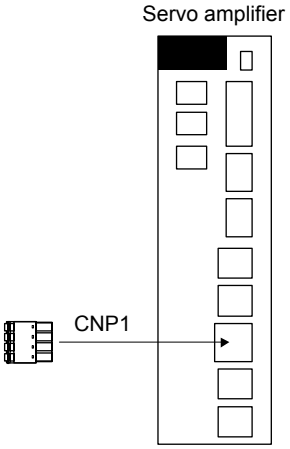


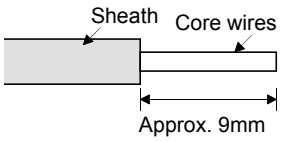
Table 15.1 Connector and applicable wire

Connector applications	Receptacle assembly	Applicable wire size	Stripped length [mm]	Open tool	Manufacturer
For CNP1	FK-MCP1.5/4-ST-3.5 or equivalent	AWG24 to AWG16	9	-	Phoenix Contact

(b) Cable connection procedure

1) Termination of the cables

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

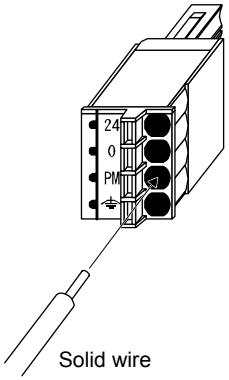


Twisted wire: Use the cable after stripping the sheath without twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault.

2) Inserting wire

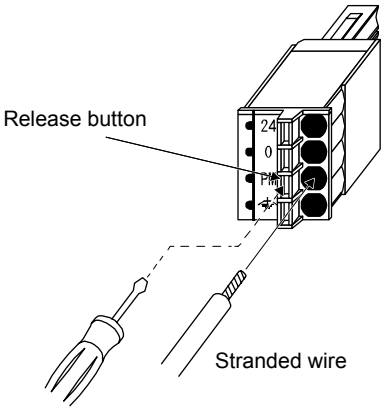
a) Solid wire

Insert the cable to the end.



b) Stranded wire

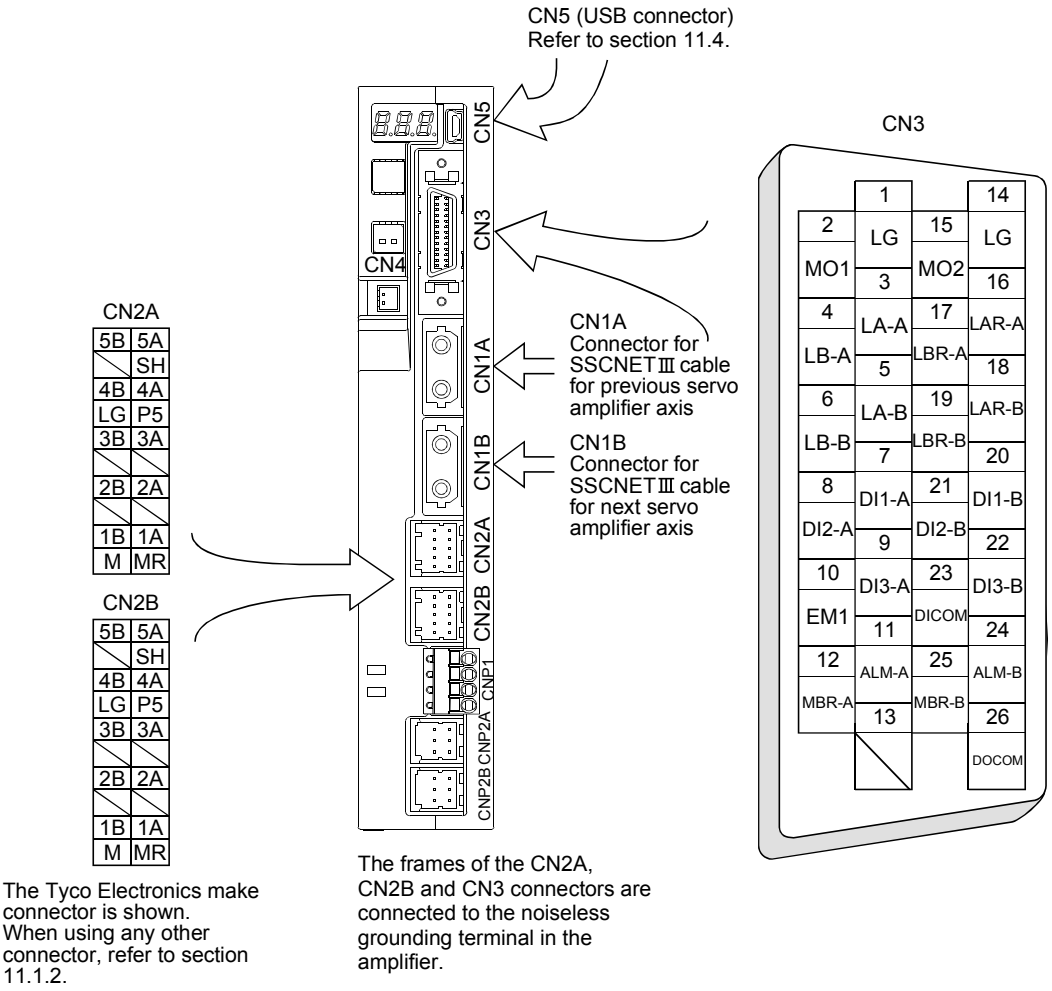
Insert the wire to the end with pushing down the button with a small flat head screwdriver, etc.



15.3.4 Connectors and pin assignment

POINT

- The pin assignment of the connectors are as viewed from the cable connector wiring section.
- For details of the devices and signals, refer to section 3.5 (2).



Connector	Name	Function/application
CN1A	Connector for SSCNETⅢ cable for previous servo amplifier axis	Used for connection with the controller or previous axis servo amplifier.
CN1B	Connector for SSCNETⅢ cable for next servo amplifier axis	Used for connection with the next axis servo amplifier or for connection of the cap.
CN2A	Connector for A-axis encoder	Connect with the A-axis servo motor encoder.
CN2B	Connector for B-axis encoder	Connect with the B-axis servo motor encoder.
CN3	I/O signal connector	Used to connect I/O signals.
CN4	Battery connector	When using it as absolute position detection system, connect to battery. Before connecting battery, turn off the main circuit power supply and check that the charge lamp turns off. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier. Replace the battery 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 (USB)	The personal computer is connected.

15.3.5 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. ・When alarms are occurring in both axes of A and B, shut off the main circuit power supply. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the regenerative resistor.

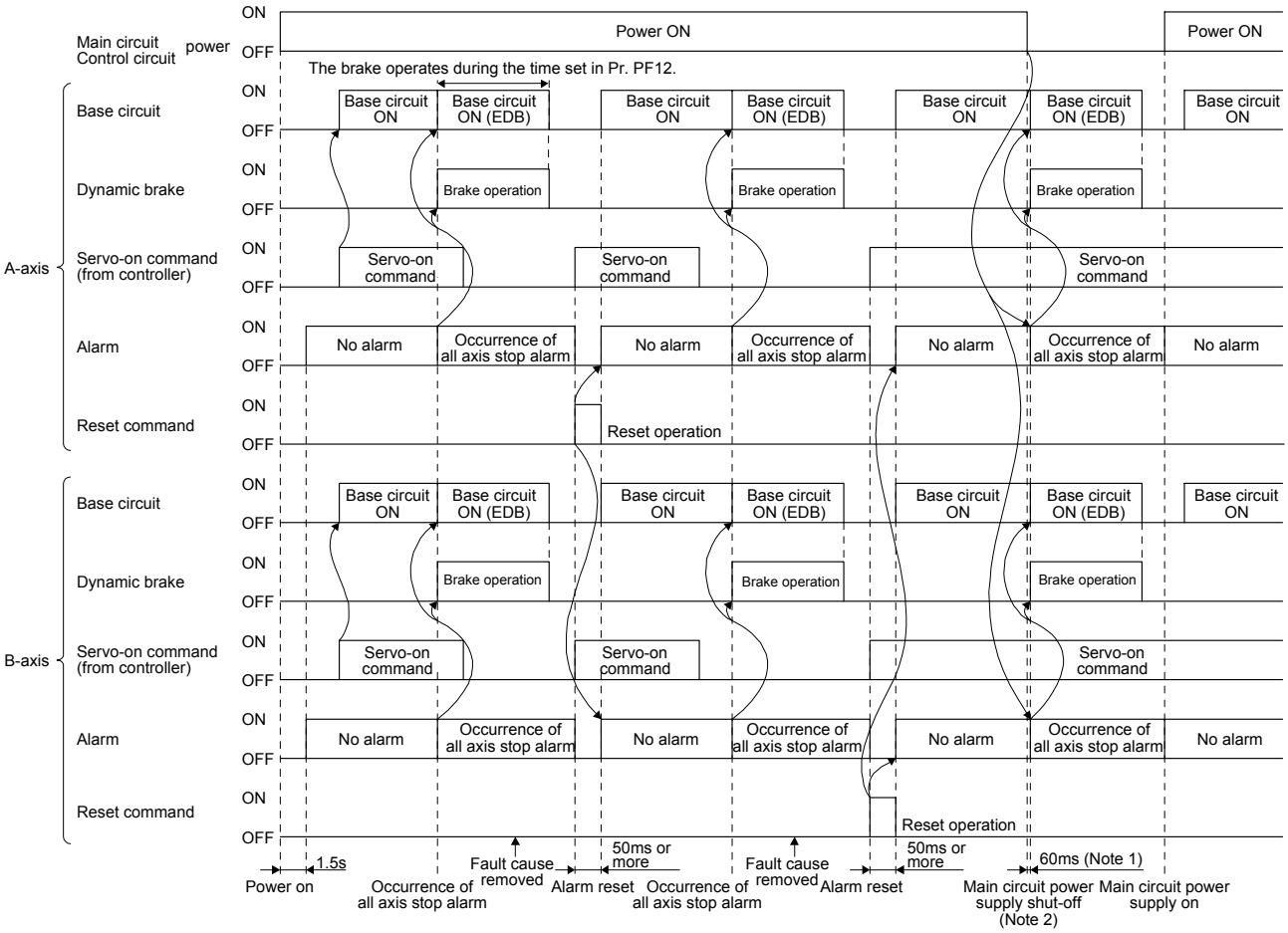
POINT

・If Servo-on (SON) is turned on during the electronic dynamic brake is operating, the servo-on status will not be enabled until electromagnetic brake is released.
・The time constant " τ " for the electronic dynamic brake will be shorter than that of normal dynamic brake. Therefore, coasting distance will be longer than that of normal dynamic brake. For how to set the electronic dynamic brake, refer to parameter No.PF06 and PF12.

When an alarm occurs in the servo amplifier, the electronic dynamic brake will operate and stop the servo motor. Shut off the main circuit power supply by the external sequence as soon as an alarm occurs. To deactivate the alarm, cycle the control circuit power 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.

(1) Timing chart

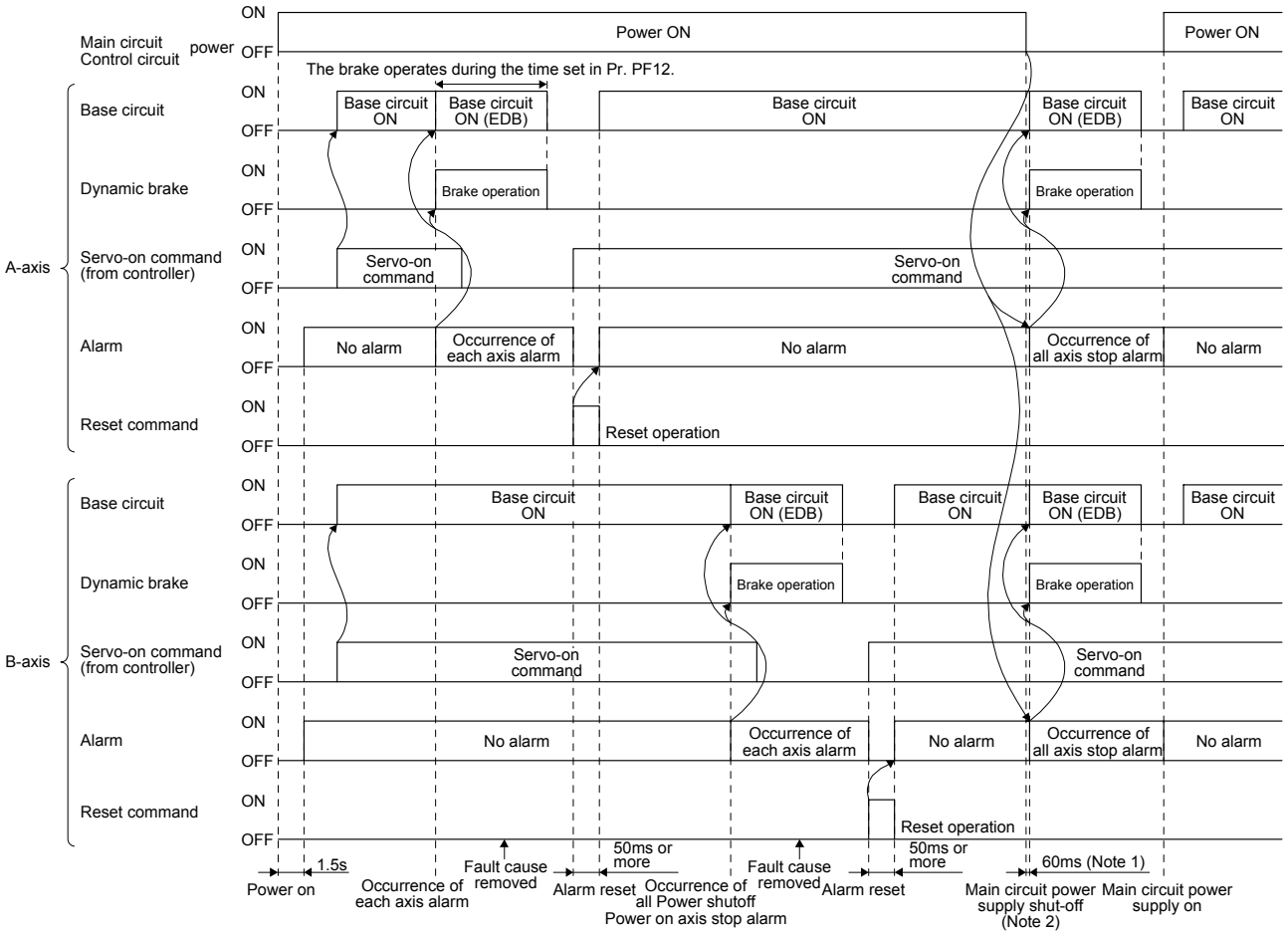
(a) When an all-axis stop alarm occurred



Note 1. It is different according to the operation status.

2. The dynamic brake does not operate while the control circuit power supply is cut.

(b) When a corresponding axis stop alarm occurred



Note 1. It is different according to the operation status.
2. The dynamic brake does not operate while the control circuit power supply is cut.

(2) Supplementary explanation

(a) Overcurrent/Overload 1/Overload 2

Driving the servo motor by cycling the control circuit power repeatedly to restart without removing the cause of an occurring alarm of Overcurrent (32.☐)/Overload 1 (50.☐)/Overload 2 (51.☐) will raise temperature. Doing so may result in a malfunction of the servo amplifier or servo motor. Remove its cause and allow about 30 minutes for cooling before resuming the operation.

(b) Regenerative error

Driving the servo motor by cycling the control circuit power repeatedly to restart without removing the cause of an occurring Regenerative error (30.☐) will raise the temperature of regenerative resistor. Doing so may result in a malfunction of the servo amplifier or servo motor.

(c) Undervoltage

Undervoltage (10.☐) occurs on the following conditions.

- A power failure occurred for 15 ms at the control circuit power supply and recovered.
- Bus voltage dropped to 24VDC, 15VDC/48VDC, 35VDC on the servo-on status.

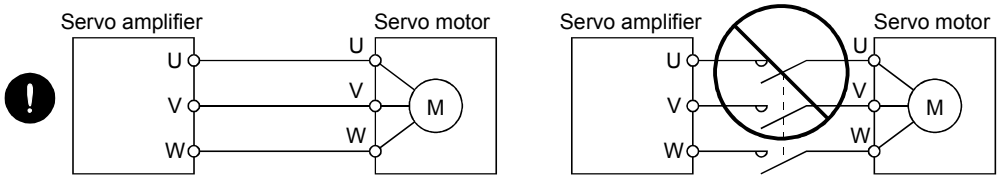
15.3.6 Connection of servo amplifier and HG-AK series servo motor

⚠ WARNING

- Any person who is involved in wiring should be fully competent to do the work.
- Ground the servo motor securely.
- Do not attempt to wire the servo motor until it has been mounted. Otherwise, it may cause an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
- To avoid an electric shock, insulate the connections of the power supply terminals.

⚠ CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly, resulting in injury.
- Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.
- Ensure that polarity (+/−) is correct. Otherwise, a burst, damage, etc. may occur.
- Do not install a power capacitor, surge killer or radio noise filter (FR-BIF option) with the power line of the servo motor.
- Do not modify the equipment.
- Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.



(1) Connection instructions

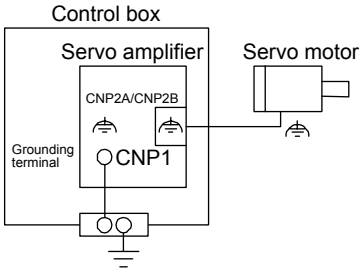
⚠ CAUTION

- To avoid a malfunction, connect the wires to the correct phase terminals (U, V, and W) of the servo amplifier and servo motor.
- Do not connect AC power supply directly to the servo motor. Otherwise, it may cause a malfunction.
- Do not use a power supply for the electromagnetic brake with other 24VDC power supplies. Always use the power supply designed exclusively for the electromagnetic brake. Otherwise, it may cause a malfunction.

POINT

- Refer to section 15.7.1 for selection of the encoder cable.
- Refer to "Servo Motor Instruction Manual (Vol. 2)" for the selection of a surge absorber for the electromagnetic brake.
- Connect the servo amplifier and servo motor by connecting an encoder cable and servo motor power cable.

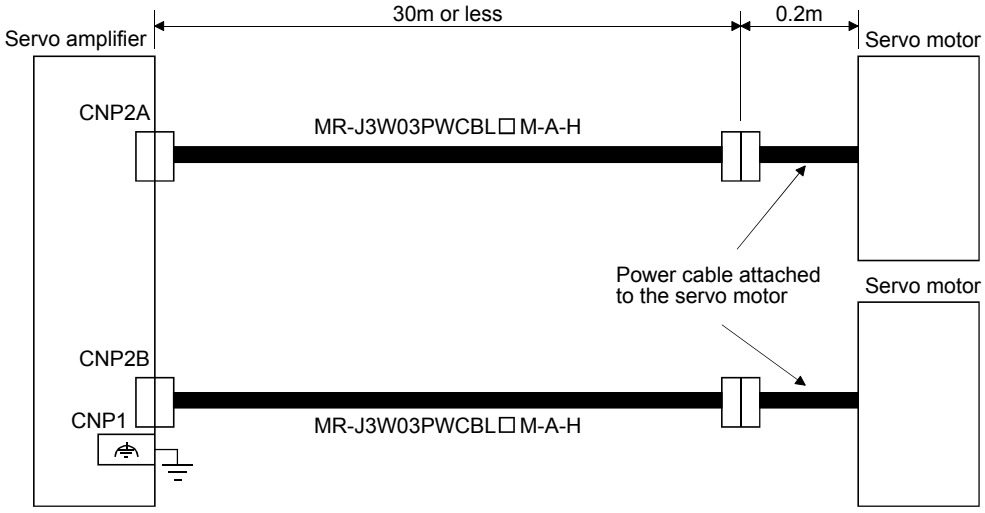
Ground wire from the servo motor to grounding terminal of cabinet via noiseless grounding terminal of the servo amplifier and ground it from cabinet to the ground. Do not connect the wire directly to the grounding terminal of the cabinet.



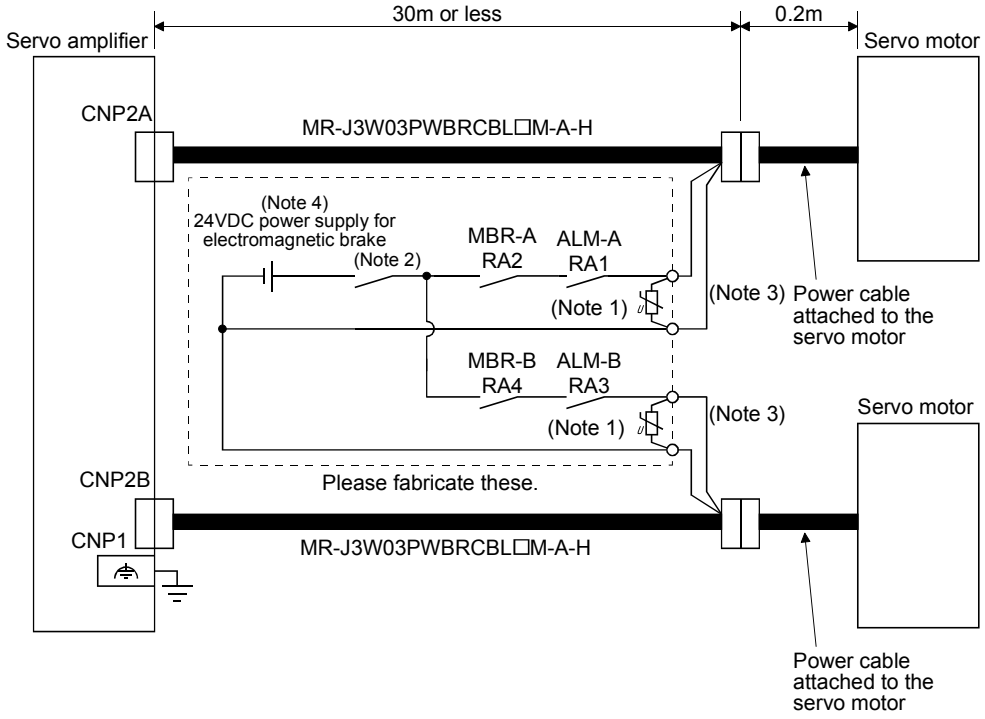
(2) Wiring

POINT
・For details of MR-J3W03PWCBL□M-A-H and MR-J3W03PWBRCBL□M-A-H cables, refer to section 15.7.1.

(a) Standard servo motor (without electromagnetic brake)



(b) Servo motor with electromagnetic brake



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. Do not use a power supply for the electromagnetic brake with other 24VDC power supplies.

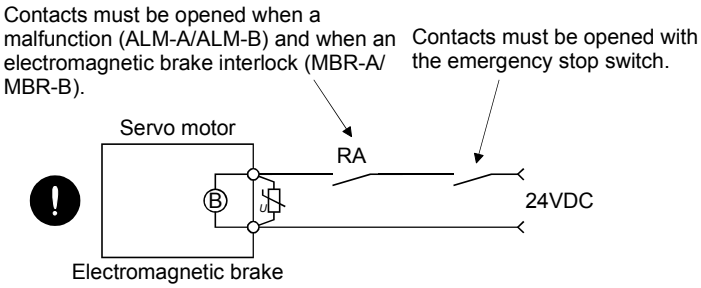
4. Create the circuit in order to shut off by interlocking with the emergency stop switch.

15.3.7 Servo motor with an electromagnetic brake

(1) Precautions

⚠ CAUTION

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



- The electromagnetic brake is provided for holding purpose and must not be used for ordinary braking.
- Before operating the servo motor, be sure to confirm that the electromagnetic brake operates properly.
- Do not use the 24VDC interface power supply for the electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake. Otherwise, it may cause a malfunction.

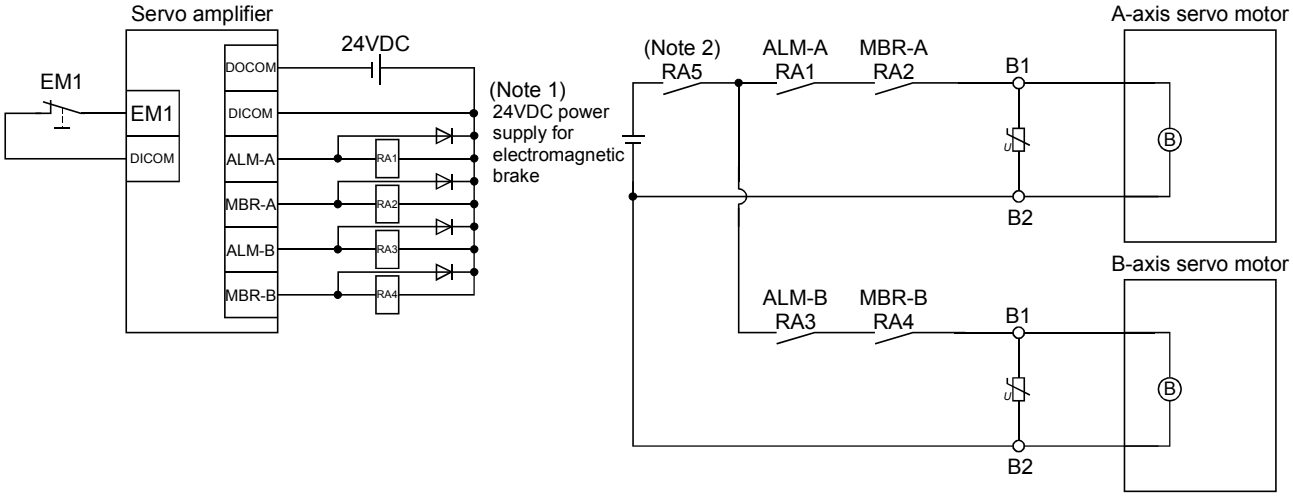
POINT

- Refer to "Servo Motor Instruction Manual (Vol. 2)" for specifications such as the power supply capacity and operation delay time of the electromagnetic brake.
- Refer to "Servo Motor Instruction Manual (Vol. 2)" 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) turns off.
2) Turn off the servo-on command after the servo motor stopped.

(a) Connection diagram



Note 1. Do not use a power supply for the electromagnetic brake with other 24VDC power supplies.
2. Create the circuit in order to shut off by interlocking with the emergency stop switch.

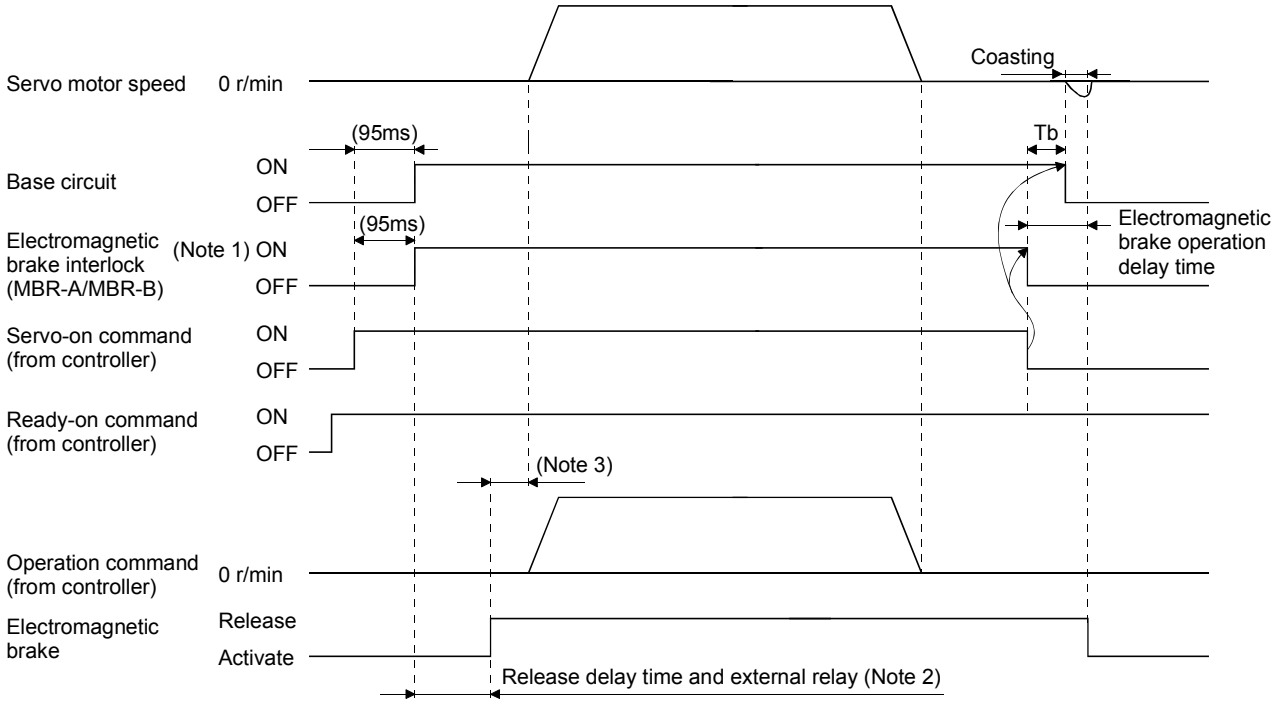
(b) Setting

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 as in the timing chart in (2) of this section.

(2) Timing chart

(a) Servo-on command (from controller) on/off

When servo-on command is turned off, the servo lock will be released after Tb [ms], and the servo motor will coast. If the electromagnetic brake is enabled during servo-lock, the brake life may be shorter. 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.



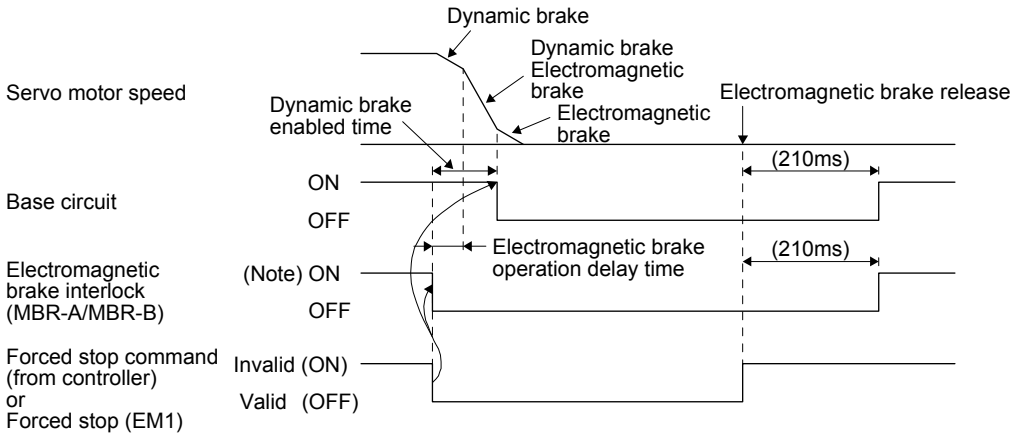
Note 1. ON: Electromagnetic brake is not activated.

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 "Servo Motor Instruction Manual (Vol. 2)".

3. Give the operation command from the controller after the electromagnetic brake is released.

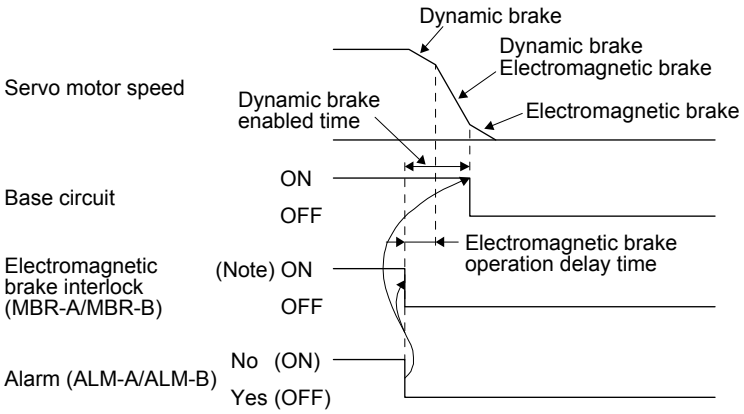
(b) ON/OFF of the forced stop command (from controller) or EM1 (Forced stop)



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

(c) Alarm occurrence

POINT
・When an alarm occurs, the dynamic brake will not operate and the servo motor will coast. Refer to chapter 8 for details.



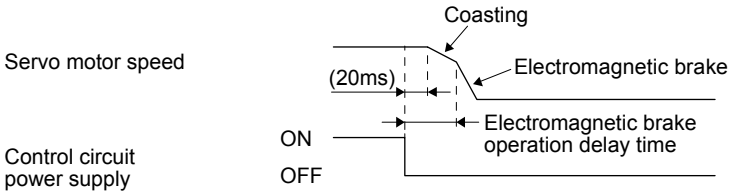
Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(d) Main circuit power supply off

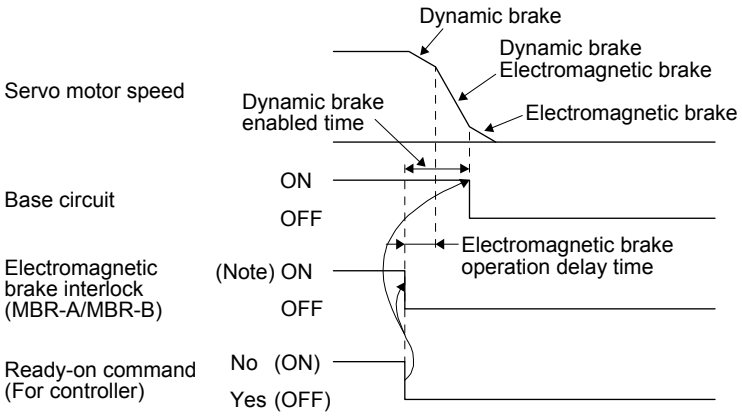
Main circuit power supply off causes Undervoltage alarm (10) and will be (c) of this section.

(e) Control circuit power supply off

POINT
▪ While the control circuit power supply is off, the dynamic brake does not operate.



(f) Ready-off command from controller

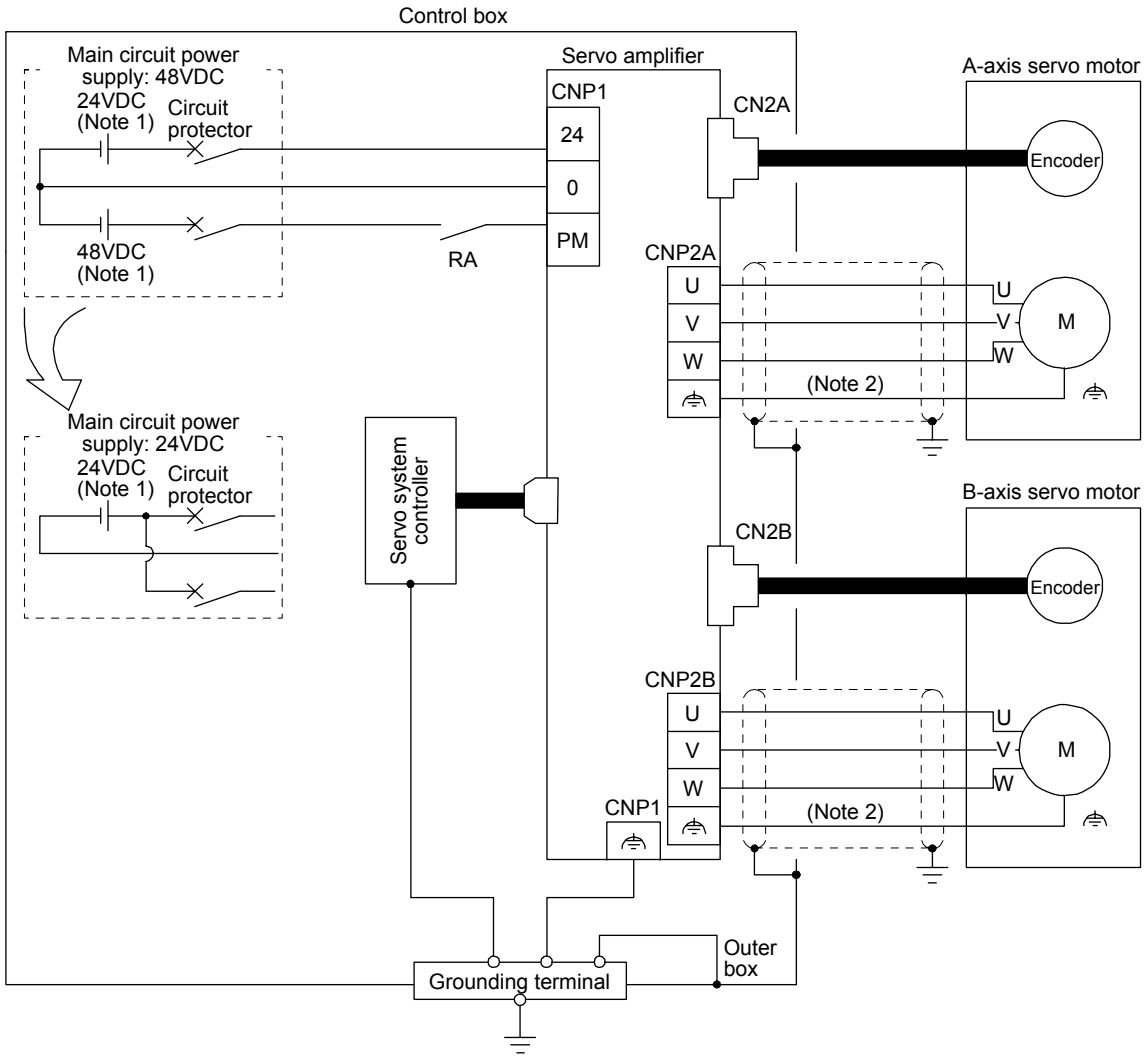


Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

15.3.8 Grounding

> **WARNING**
> - Ground the servo amplifier and the servo motor securely.
> - To prevent electric shock, be sure to connect the noiseless grounding (⏚) terminal of the servo amplifier to the grounding terminal of the cabinet.

The servo amplifier switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cable routing, the servo amplifier may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram and always ground.
To conform to the EMC Directive, refer to the EMC Installation Guidelines (IB(NA)67310).



Note 1. For power supply specifications, refer to section 15.1.2.
2. ⏚ of the servo motor must be connected to ⏚ of the CNP2A/CNP2B connector. Do not connect the wire directly to the grounding terminal of the cabinet.

15.4 Startup

⚠ WARNING	・Do not operate the switches with wet hands. Otherwise, it may cause an electric shock.

⚠ CAUTION	・Before starting operation, check the parameters. Improper settings may cause some machines to operate unexpectedly. ・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. Otherwise, it may cause a burn injury and parts damaged. ・During operation, never touch the rotor of the servo motor. Otherwise, it may cause injury.

POINT

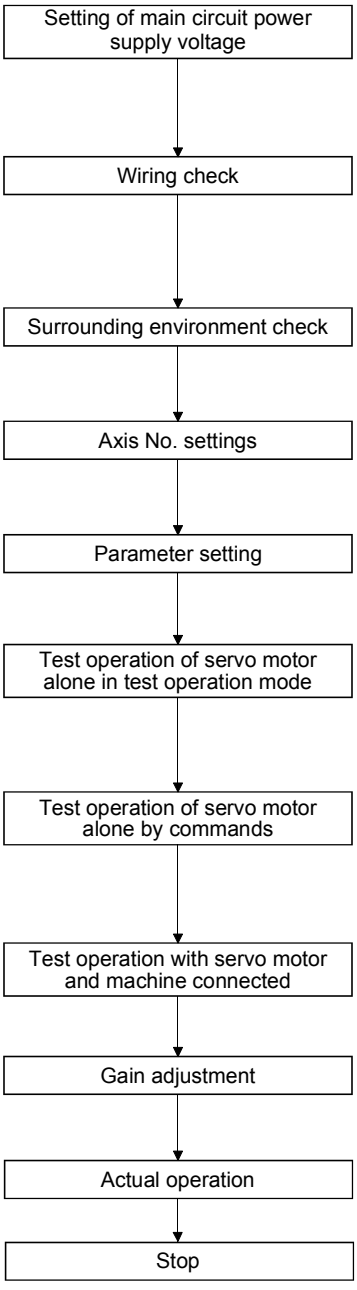
・When using either A-axis or B-axis without connecting servo motor, set parameter No.PC05 to "□□□1" to select the motor-less operation.

・This section does not include the following items. For details of the items, refer to each section of the detailed description field.

Item	Detailed explanation
Startup	Section 4.2
Servo amplifier display	Section 4.3
Test operation	Section 4.4
Test operation mode	Section 4.5

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

15.4.1 Startup procedure



Check that the parameter No.Po04 is set to the input voltage for the main circuit power supply. 24VDC: 1□□□, 48VDC/24VDC: 0□□□

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 15.4.3.)

Check the surrounding environment of the servo amplifier and servo motor. (Refer to section 15.4.4.)

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 control mode. (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.

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

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

Stop giving commands and stop operation.

15.4.2 Troubleshooting during "24V ERROR" lamp on.

(1) When Overvoltage is applied to the control circuit in the servo amplifier, power supply to the circuit will be shut off and the "24V ERROR" lamp will turn on. Then, the 3-digit, 7-segment LED on display will turn off. Immediately turn off the power and check the wiring, etc. to the main circuit power supply (48VDC).

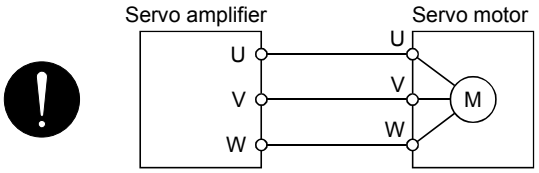
(2) If the "24V ERROR" lamp turned on with the 3-digit, 7-segment LED on, the control circuit power supply voltage (24VDC) may be failure. Check that the voltage of the control circuit power supply is 21.6V or more.

15.4.3 Wiring check

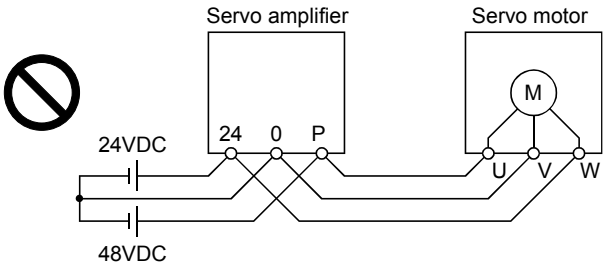
(1) Power supply system wiring
Before switching on the main circuit and control circuit power supplies, check the following items.

(a) Power supply system wiring
The power supplied to the power input terminals (24, 0, and PM) of the servo amplifier should satisfy the defined specifications. (Refer to section 1.3.)

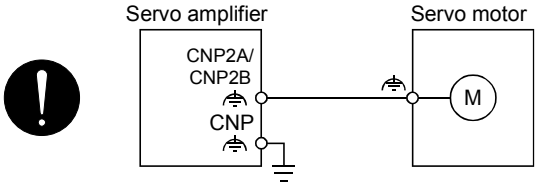
(b) Connection of servo amplifier and servo motor
1) The servo motor power terminals (U, V, and W) should match in phase with the servo motor power input terminals (U, V, and W).



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



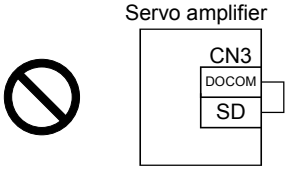
3) The grounding terminal of the servo motor should be connected to the noiseless grounding terminal of the servo amplifier.



(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 the CN3 connector.

(c) SD and DOCOM of the CN3 connector is not shorted.



15.4.4 Surrounding environment

(1) Cable routing
   (a) The wiring cables should not be stressed.
   (b) The encoder cable should not be used in excess of its bending life. (Refer to section 10.4.)
   (c) The connector of the servo motor should not be stressed.

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

15.5 Parameters

> POINT
> ・This section explains parameters only for MR-J3W-0303BN6. Refer to chapter 5 for the other parameters.

15.5.1 Basic setting parameters (No.PA□□)

Parameter			Each/ common	Default value	Unit	Setting range
No.	Symbol	Name				
PA19	*BLK	Parameter writing inhibit	Each	000Bh		Refer to the text.

> POINT
> ・To enable the parameter value, cycle the power or reset the controller after setting the parameter.

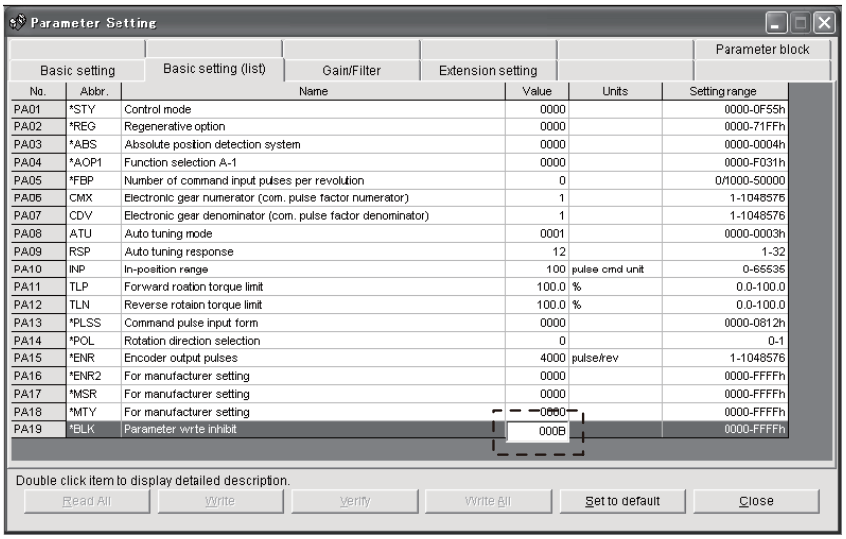
In the factory setting, this servo amplifier allows changes to the basic setting parameter, the gain/filter parameter and the extension setting parameter settings. With the setting of parameter No.PA19, write can be disabled to prevent accidental changes.
The following table indicates the parameters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

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□□	Manufacturer setting parameters No.PE□□	Other function parameters No.PF□□
0000h	Reference	○							
	Writing	○							
000Bh (default value)	Reference	○	○	○					
	Writing	○	○	○					
000Ch	Reference	○	○	○	○				
	Writing	○	○	○	○				
000Dh	Reference	○	○	○	○	○			
	Writing	○	○	○	○	○			
000Eh	Reference	○	○	○	○	○	○		
	Writing	○	○	○	○	○	○		
00ABh	Reference	○	○	○	○	○	○	○	○
	Writing	○	○	○	○	○	○	○	○
100Bh	Reference	○							
	Writing	PA19 only							
100Ch	Reference	○	○	○	○				
	Writing	PA19 only							
100Dh	Reference	○	○	○	○	○			
	Writing	PA19 only							
100Eh	Reference	○	○	○	○	○	○		
	Writing	PA19 only							
10ABh	Reference	○	○	○	○	○	○	○	○
	Writing	PA19 only							

Note. When using a rotary servo motor, you do not use the parameter.

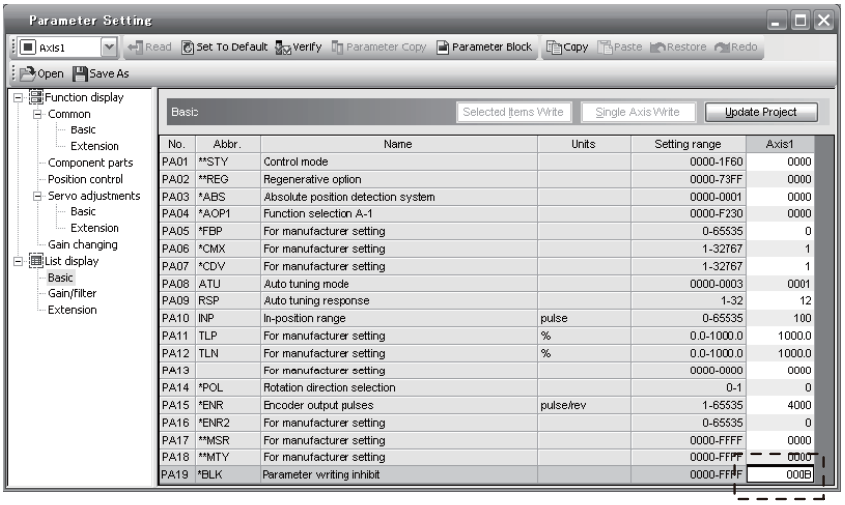
Other function parameters (No.PF□□) cannot be writable by using the "Parameter block" tab of MR Configurator or MR Configurator2. When making Other function parameters (No.PF□□) writable, open the "Parameter setting" window and input "00AB" or "10AB" to parameter No.PA19.

(1) MR Configurator



No.	Abbr.	Name	Value	Units	Setting range
PA01	*STY	Control mode	0000		0000-0F5Sh
PA02	*REG	Regenerative option	0000		0000-71FFh
PA03	*ABS	Absolute position detection system	0000		0000-0004h
PA04	*AOP1	Function selection A-1	0000		0000-F031h
PA05	*FBP	Number of command input pulses per revolution	0		0/1000-50000
PA06	CMX	Electronic gear numerator (com. pulse factor numerator)	1		1-1048576
PA07	CDV	Electronic gear denominator (com. pulse factor denominator)	1		1-1048576
PA08	ATU	Auto tuning mode	0001		0000-0003h
PA09	RSP	Auto tuning response	12		1-32
PA10	INP	In-position range	100	pulse cmd unit	0-65535
PA11	TLP	Forward roation torque limit	100.0	%	0.0-100.0
PA12	TLN	Reverse rotaion torque limit	100.0	%	0.0-100.0
PA13	*PLSS	Command pulse input form	0000		0000-0812h
PA14	*POL	Rotation direction selection	0		0-1
PA15	*ENR	Encoder output pulses	4000	pulse/rev	1-1048576
PA16	*ENR2	For manufacturer setting	0000		0000-FFFFh
PA17	*MSR	For manufacturer setting	0000		0000-FFFFh
PA18	*MTY	For manufacturer setting	0000		0000-FFFFh
PA19	*BLK	Parameter wrte inhibit	000B		0000-FFFFh

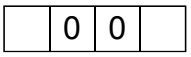
(2) MR Configurator2

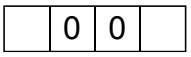


No.	Abbr.	Name	Units	Setting range	Axis1
PA01	**STY	Control mode		0000-1F60	0000
PA02	**REG	Regenerative option		0000-73FF	0000
PA03	*ABS	Absolute position detection system		0000-0001	0000
PA04	*AOP1	Function selection A-1		0000-F230	0000
PA05	*FBP	For manufacturer setting		0-65535	0
PA06	*CMX	For manufacturer setting		1-32767	1
PA07	*CDV	For manufacturer setting		1-32767	1
PA08	ATU	Auto tuning mode		0000-0003	0001
PA09	RSP	Auto tuning response		1-32	12
PA10	INP	In-position range	pulse	0-65535	100
PA11	TLP	For manufacturer setting	%	0.0-1000.0	1000.0
PA12	TLN	For manufacturer setting	%	0.0-1000.0	1000.0
PA13		For manufacturer setting		0000-0000	0000
PA14	*POL	Rotation direction selection		0-1	0
PA15	*ENR	Encoder output pulses	pulse/rev	1-65535	4000
PA16	*ENR2	For manufacturer setting		0-65535	0
PA17	**MSR	For manufacturer setting		0000-FFFF	0000
PA18	**MTY	For manufacturer setting		0000-FFFF	0000
PA19	*BLK	Parameter writing inhibit		0000-FFFF	000B

15.5.2 Extension setting parameters (No.PC□□)

(1) Detail list

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Each/ common</th><th>Default value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PC09</td><td>MOD1</td><td>Analog monitor 1 output
Select a signal to output to Analog monitor 1 (MO1). (Refer to (2) of this section.)


Analog monitor 1 (MO1) output selection
<table><tr><th>Setting</th><th>Item</th></tr><tr><td>0</td><td>Servo motor speed (10±4V/max. speed)</td></tr><tr><td>1</td><td>Torque (10±4V/max. torque)</td></tr><tr><td>2</td><td>Servo motor speed (10+4V/max. speed)</td></tr><tr><td>3</td><td>Torque (10+4V/max. torque)</td></tr><tr><td>4</td><td>Current command (10±4V/max. current command)</td></tr><tr><td>5</td><td>Speed command (10±4V/max. speed)</td></tr><tr><td>6</td><td>Droop pulses (10±5V/100 pulses)</td></tr><tr><td>7</td><td>Droop pulses (10±5V/1000 pulses)</td></tr><tr><td>8</td><td>Droop pulses (10±5V/10000 pulses)</td></tr><tr><td>9</td><td>Droop pulses (10±5V/100000 pulses)</td></tr><tr><td>D</td><td>Bus voltage (10+5V/400V)</td></tr><tr><td>E</td><td>Speed command 2 (10±4V/max. speed)</td></tr></table>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
Select a signal to output to Analog monitor 2 (MO2). (Refer to (2) of this section.)


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>

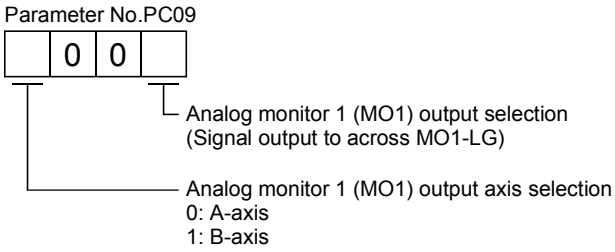
(2) Analog monitor

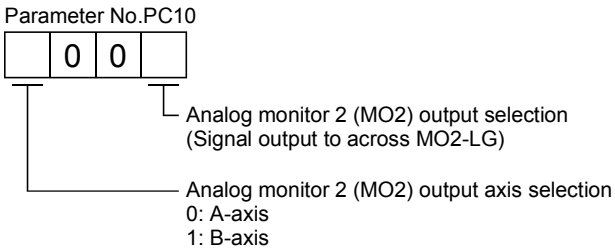
POINT
・A voltage of analog monitor output may be irregular at power-on.

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

(a) Setting

The following shows changing digits of parameter No.PC09 and PC10.





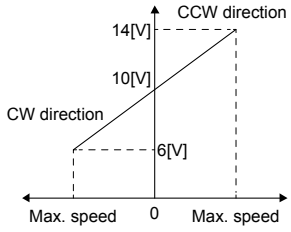
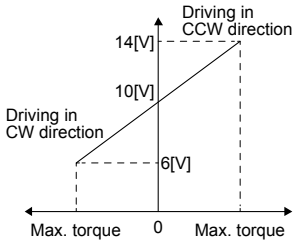
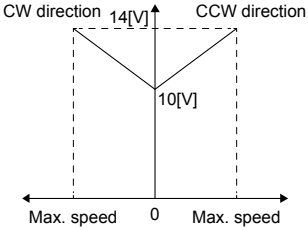
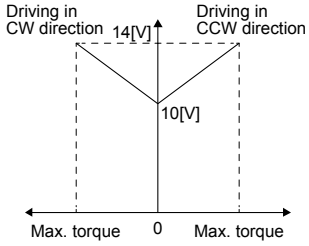
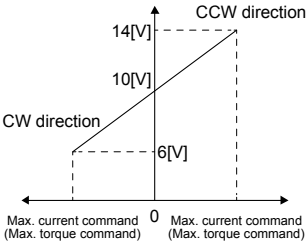
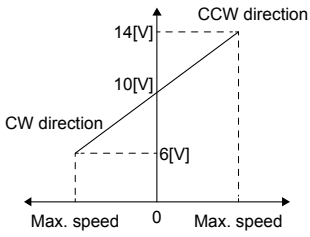
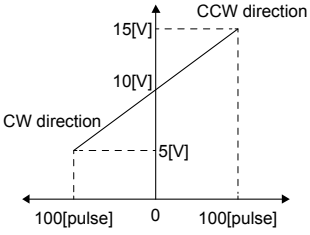
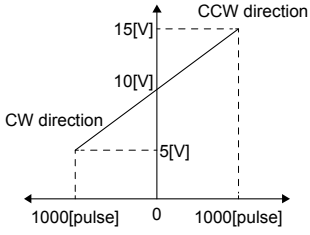
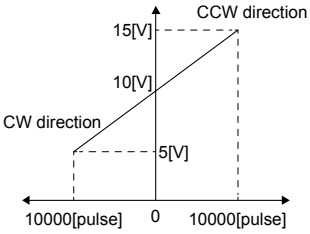
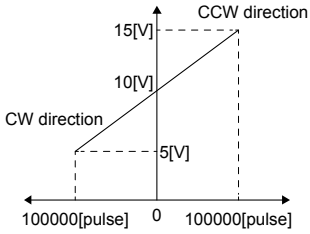
You can set offset voltages to the analog output voltages in parameter No.PC11/PC12. Setting value is −999mV to 999mV.

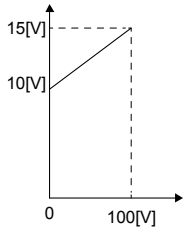
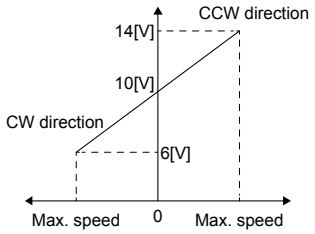
Parameter No.	Description	Setting range [mV]
PC11	This is used to set the offset voltage of Analog monitor 1 (MO1).	−999 to 999
PC12	This is used to set the offset voltage of Analog monitor 2 (MO2).	

(b) Set content

The servo amplifier outputs the servo motor speed to Analog monitor 1 (MO1) and torque to Analog monitor 2 (MO2) by default. The setting can be changed as listed below by changing parameter No.PC09 and PC10.

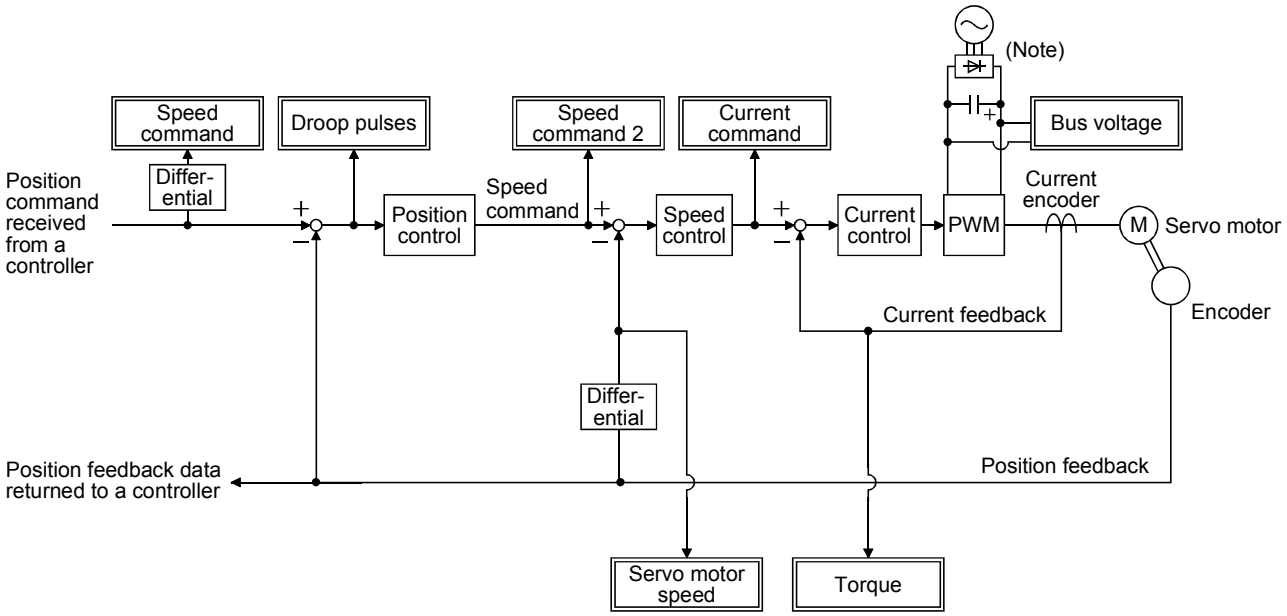
Refer to (c) for the measurement point.

Setting value	Output item	Description	Setting value	Output item	Description
0	Servo motor speed		1	Torque	
2	Servo motor speed		3	Torque	
4	Current command		5	Speed command (Note 2)	
6	Droop pulses (Note 1, 2, 3) (±10V/100pulses)		7	Droop pulses (Note 1, 2, 3) (±10V/1000pulses)	
8	Droop pulses (Note 1, 2, 3) (±10V/10000pulses)		9	Droop pulses (Note 1, 2, 3) (±10V/100000pulses)	

Setting value	Output item	Description	Setting value	Output item	Description
D	Bus voltage		E	Speed command 2 (Note 2, 4)	

Note 1. It is in the encoder pulse unit.
2. This cannot be used in the torque control mode.
3. This cannot be used in the speed control mode.
4. This setting can be used with the servo amplifier with software version B3 or later, and with MR Configurator2 with software version C5 or later.

(c) Analog monitor block diagram



Note. It is DC power.

15.5.3 Manufacturer setting parameters (No.PE□□)

No.	Symbol	Name	Each/ common	Default value (Note)	Unit
PE01		This parameter is not used. Do not change this value by any means.		0000h	
PE02				0102h	
PE03				0002h	
PE04				1	
PE05				1	
PE06				400	
PE07				100	
PE08				10	
PE09				0000h	
PE10				0000h	
PE11				0	
PE12				40	
PE13				FFFEh	
PE14				0111h	
PE15				20	
PE16				0000h	
PE17				0000h	
PE18				0000h	
PE19				0000h	
PE20				0000h	
PE21				0000h	
PE22				0000h	
PE23				0000h	
PE24				0000h	
PE25				0000h	
PE26				0000h	
PE27				0000h	
PE28				0000h	
PE29				0000h	
PE30				0000h	
PE31				0000h	
PE32				0000h	
PE33				0000h	
PE34				0000h	
PE35				0000h	
PE36				0000h	
PE37				0000h	
PE38				0000h	
PE39				0000h	
PE40				0000h	

Note. The values are common in A-axis and B-axis.

15.5.4 Other function parameters (No.PF□□)

> POINT
> ・Each parameter name of Other function parameters (No.PF□□) are displayed as manufacturer settings in the parameter setting window of MR Configurator and MR Configurator2. However, you can set parameter No.PF06 and PF12. The other parameters are for manufacturer. Do not change them.

No.	Symbol	Name and function	Each/ common	Default value	Unit	Setting range
PF06	*FOP5	Function selection F-5 Electronic dynamic brake selection 0 0 0 □ └ Electronic dynamic brake selection 0: Automatic setting 2: Disabled Set Electronic dynamic brake operating time with parameter No.PF12 (DBT). Setting "0" enables the electronic dynamic brake.	Each	0000h		Refer to Name and function column.
PF12	DBT	Electronic dynamic brake operating time Set a operating time for the electronic dynamic brake. Communication with the controller cannot be made during the electronic dynamic brake operation due to SSCNET communication brake. When reconnecting servo amplifier to the communication, be sure to perform after the setting value of the electronic dynamic brake operating time has passed and after checking that the motor has stopped.	Each	100	ms	0 to 10000

15.5.5 Option setting parameters (No.Po□□)

> POINT
> ・Each parameter name of Option setting parameters (No.Po□□) are displayed as manufacturer settings in the parameter setting window of MR Configurator and MR Configurator2. However, you can set parameter No.Po04. The other parameters are for manufacturer. Do not change them.

No.	Symbol	Name and function	Each/ common	Default value	Unit	Setting range
Po04	**OOP 2	Function selection O-2 □ 0 0 0 └ HG-AK servo motor main circuit power supply selection 0: 48VDC selection 1: 24VDC selection Select a voltage to connect to the main circuit power supply for connecting a HG-AK servo motor. When using a HG-AK servo motor with 24VDC, set the parameter to "1□□□". Overvoltage (33.1) will occur if "1□□□" is set and used with 48VDC.	Common	0000h		Refer to Name and function column.

15.6 Troubleshooting

POINT

- This section explains troubleshooting only for MR-J3W-0303BN6. For the troubleshooting other than MR-J3W-0303BN6, refer to chapter 8.

Alarm No.: 10		Name: Undervoltage			Stop system: All axes	
Alarm content		- The voltage of the control circuit power supply has dropped. - The voltage of the main circuit power supply has dropped.				
Display	Detail name	Cause		Check method	Check result	Action
10.1	Voltage drop in the control circuit power	1)	The control circuit power supply connector was disconnected. Loose connection	Check the control circuit power supply connector.	The connector was disconnected or connected loosely.	Connect it correctly.
					It has no problem.	Check 2).
		2)	The voltage of the control circuit power supply is low.	Check if the voltage of the control circuit power supply is lower than 17VDC.	It is lower than 17VDC.	Increase the voltage of the control circuit power supply.
					The voltage is over 17VDC.	Check 3).
		3)	An instantaneous power failure has occurred for longer than 15ms.	Check if the power has a problem.	It has a problem.	Review the power.
10.2	Voltage drop in the main circuit power	1)	The main circuit power supply connector was disconnected.	Check the main circuit power supply connector.	It is disconnected.	Connect it correctly.
					It has no problem.	Check 2).
		2)	The voltage of the main circuit power supply is low.	Check if the voltage of the main circuit power supply is 35VDC or lower when 48VDC is set for the main circuit power supply, or 15VDC or lower when 24VDC is set for the main circuit power supply.	The voltage of the main circuit power supply is 35VDC or lower when 48VDC is set for the main circuit power supply, or 15VDC or lower when 24VDC is set for the main circuit power supply.	Increase the voltage of the main circuit power supply.
					It is over 35VDC when 48VDC is set or over 15VDC when 24VDC is set.	Check 3) and 4).
		3)	The alarm has occurred during acceleration.	The bus voltage is 35VDC or higher when 48VDC is set for the main circuit power supply, or 15VDC or higher when 24VDC is set for the main circuit power supply.	The voltage is 35VDC or lower when 48VDC is set for the main circuit power supply, or 15VDC or lower when 24VDC is set for the main circuit power supply.	Increase the acceleration time constant. Or increase the power supply capacity.

Alarm No.: 10		Name: Undervoltage			Stop system: All axes	
Alarm content		・The voltage of the control circuit power supply has dropped. ・The voltage of the main circuit power supply has dropped.				
Display	Detail name	Cause		Check method	Check result	Action
10.2	Voltage drop in the main circuit power	4)	The servo amplifier is malfunctioning.	Check the bus voltage value with MR Configurator.	The voltage of the main circuit power supply is 35VDC when 48VDC is set for the main circuit power supply, or 15VDC when 24VDC is set for the main circuit power supply. However, the measured bus voltage value with MR Configurator is lower than 35VDC when 48VDC is set for the main circuit power supply, or lower than 15VDC when 24VDC is set for the main circuit power supply.	Replace the servo amplifier.

Alarm No.: 30		Name: Regenerative error			Stop system: All axes	
Alarm content		・Permissible regenerative power of regenerative resistor was exceeded. ・A regenerative transistor in the servo amplifier is malfunctioning.				
Display	Detail name	Cause		Check method	Check result	Action
30.1	Regeneration heat error	1)	The setting of regenerative resistor is incorrect.	Check the regenerative resistor and parameter No.PA02 setting.	The setting value is incorrect.	Set it correctly.
					It is set correctly.	Check 2).
		2)	Power supply voltage high.	Check the input power supply voltage.	The voltage is 70VDC or higher when 48VDC is set for the main circuit power supply, or 50VDC or higher when 24VDC is set for the main circuit power supply.	Reduce the power supply voltage.
					The voltage is lower than 70VDC when 48VDC is set for the main circuit power supply, or lower than 50VDC when 24VDC is set for the main circuit power supply.	Check 3).
		3)	The regenerative load ratio has been over 100%.	Check the regenerative load ratio with MR Configurator when alarm occurs.	100% or more	Reduce the frequency of positioning. Increase the deceleration time constant. Reduce the load. Use a regenerative option if it is not being used. Check the applied voltage of the main circuit is 48VDC when 24VDC is set for the main circuit power supply.

Alarm No.: 31		Name: Overspeed			Stop system: Each axis	
Alarm content		・The servo motor seed has exceeded the permissible instantaneous speed.				
Display	Detail name	Cause		Check method	Check result	Action
31.1	Abnormal motor speed	1)	The command from the controller is excessive.	Check if the command from the controller is over the permissible speed.	The command was over the permissible speed.	Check operation pattern.
					The command was below the permissible speed.	Check 2).
		2)	The servo motor was driven with maximum torque and the speed overshot.	Check if the torque at acceleration is the maximum torque.	It is the maximum torque.	Increase the acceleration/deceleration time constant. Or reduce the load.
					It is lower than the maximum torque.	Check 3).
		3)	The servo system is unstable and oscillating.	Check if the servo motor is oscillating.	It is oscillating.	Adjust the servo gain with the auto tuning. Or reduce the load. Check the applied voltage of the main circuit is 48VDC when 24VDC is set for the main circuit power supply.
					It is not oscillating.	Increase the acceleration time constant.
						Check 4).
		4)	The velocity waveform has overshot.	Check if it is overshooting because the acceleration time constant is short.	It is overshooting.	Increase the acceleration/deceleration time constant.
					It is not overshooting.	Check 5).
		5)	The speed overshot when the voltage was recovered from a temporary bus voltage drop during driving.	Check if a temporary bus voltage drop occurs during driving.	The bus voltage dropped.	Check the power supply capacity of the 24VDC main circuit power supply. Increase the voltage of the 24VDC main circuit power supply within the permissible range. Change the voltage of the main circuit power to 48VDC. Check operation pattern.
					Bus voltage did not drop.	Check 6).
		6)	Encoder failure	Check if the alarm is occurring when the actual speed of the servo motor is permissible instantaneous speed or lower.	It is lower.	Replace the servo motor.

Alarm No.: 32		Name: Overcurrent			Stop system: All axes	
Alarm content		・A current higher than the permissible current was applied to the servo amplifier.				
Display	Detail name	Cause		Check method	Check result	Action
32.1	Overcurrent detected at hardware detection circuit (during driving)	1)	The servo amplifier is malfunctioning.	The alarm occurs even after removing power cables (U/V/W).	It occurs.	Replace the servo amplifier.
					It does not occur.	Check 2).
		2)	Ground fault or short of a servo motor power.	Check if only the servo motor power cable is shorted.	It is shorted.	Replace the power cable.
					It is not shorted.	Check 3).
		3)	The servo motor is malfunctioning.	Remove power cables of the servo motor side and check insulation of the motor (between U, V, W, and ⏚).	A ground fault occurred at the servo motor.	Replace the servo motor.
					A ground fault did not occur at the servo motor.	Check 4).
		4)	Something near the device caused it.	Check for noise, and other factors.	Problem found.	Take countermeasures against its cause.
32.2	Overcurrent detected at software detection function (during driving)	1)	The servo gain is high.	Check if an oscillation is occurring.	It is occurring.	Reduce the speed loop gain. Check the applied voltage of the main circuit is 48VDC when 24VDC is set for the main circuit power supply.
					It did not occur.	Check 2).
		2)	The servo amplifier is malfunctioning.	Check it with the check method for alarm display "32.1".		
		3)	Ground fault or short of a servo motor power.			
		4)	The servo motor is malfunctioning.			
		5)	Something near the device caused it.			

Alarm No.: 33		Name: Overvoltage			Stop system: All axes	
Alarm content		・The voltage is 35VDC or lower when 48VDC is set for the main circuit power supply, or 15VDC or lower when 24VDC is set for the main circuit power supply.				
Display	Detail name	Cause		Check method	Check result	Action
33.1	Main circuit voltage error	1)	Lack of regenerative capacity	Set a larger deceleration time constant, and then check the repeatability.	It is not repeatable.	Use a regenerative option if it is not being used. Increase the deceleration time constant.
					It is repeatable.	Check 5).
		2)	Power supply voltage high.	Check the input voltage.	The voltage is 75VDC or higher when 48VDC is set for the main circuit power supply, or 55VDC or higher when 24VDC is set for the main circuit power supply.	Reduce the input voltage.
					The voltage is less than 75VDC when 48VDC is set for the main circuit power supply, or less than 55VDC when 24VDC is set for the main circuit power supply.	Replace the servo amplifier.

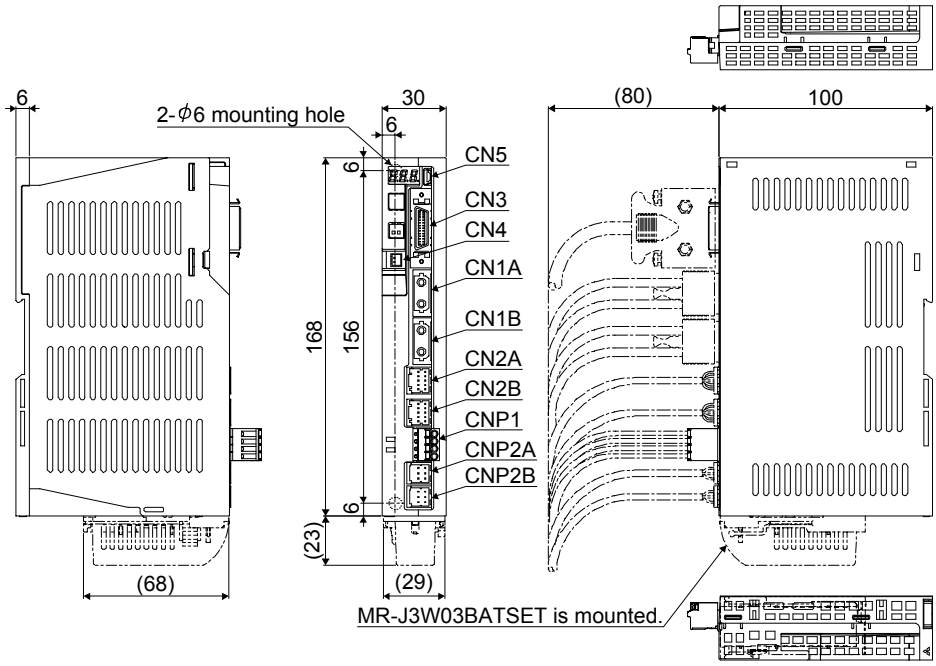
Alarm No.: 50		Name: Overload 1			Stop system: Each axis	
Alarm content		・Load exceeded overload protection characteristic of servo amplifier.				
Display	Detail name	Cause		Check method	Check result	Action
50.1	Thermal overload error 1 during operation	1)	The electromagnetic brake is operating.	Check if the electromagnetic brake does not operate during operation.	The brake is operating.	Review the wiring.
					The brake is not operating.	Check 2).
		2)	Servo amplifier was used in excess of its continuous output current.	Check the effective load ratio with MR Configurator.	The effective load ratio is high.	Reduce the load. Check operation pattern. Switch to a larger capacity servo motor.
					The effective load ratio is small.	Check 3).
		3)	The servo system is unstable and resonating.	Check if it is resonating.	It is resonating.	Adjust gains. Check the applied voltage of the main circuit is 48VDC when 24VDC is set for the main circuit power supply.
					It is not resonating.	Check 4).
		4)	The motor was driven without taking a cooling time after the overload alarm occurred.	Check if the alarm was released after 30 minutes from alarm occurrence.	It was not released.	Take enough time before resetting the alarm.
					It was released.	Check 5).
		5)	The servo amplifier is malfunctioning.	Replace the servo amplifier, and then check the repeatability.	It is not repeatable.	Replace the servo amplifier.
50.4	Thermal overload error 1 during a stop	1)	The electromagnetic brake is operating.	Check if the electromagnetic brake does not operate during a stop.	The brake is operating.	Review the wiring.
					The brake is not operating.	Check 2).
		2)	Servo amplifier was used in excess of its continuous output current.	Check the effective load ratio with MR Configurator.	The effective load ratio is high.	Reduce the load. Check operation pattern. Switch to a larger capacity servo motor.
					The effective load ratio is small.	Check 3).
		3)	Hunting occurs during servo-lock.	Check if the hunting is occurring.	The hunting is occurring.	Make gain adjustment.
					The hunting is not occurring.	Check 4).
		4)	The motor was driven without taking a cooling time after the overload alarm occurred.	Check if the alarm was released after 30 minutes from alarm occurrence.	It was not released.	Take enough time before resetting the alarm.
					It was released.	Check 5).
		5)	The servo amplifier is malfunctioning.	Replace the servo amplifier, and then check the repeatability.	It is not repeatable.	Replace the servo amplifier.

Alarm No.: 9F		Name: Battery warning			Stop method: No stop (each-axis detection)	
Warning description		・Battery voltage for absolute position detection system decreased.				
Display	Detail name	Cause		Check method	Check result	Action
9F.1	Low battery	1)	Battery voltage dropped. (Detected with the servo amplifier.)	Measure the battery voltage.	It is below 3.3VDC.	Replace the battery.

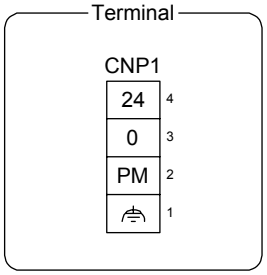
Alarm No.: E9		Name: Main circuit off warning			Stop system: All axes (common detection)	
Warning description		・The servo-on command was inputted with main circuit power supply off. ・The bus voltage dropped during the servo motor driving under 50r/min. ・The setting of the parameter No.Po04 is incorrect.				
Display	Detail name	Cause		Check method	Check result	Action
E9.1	Servo-on signal on during main circuit off	1)	The main circuit power supply is off.	Check if the main circuit power supply is inputted.	It is not inputted.	Turn on the main circuit power supply.
					It is inputted.	Check 2).
		2)	The main circuit power supply connector was disconnected.	Check the main circuit power supply connector.	It is disconnected.	Connect it correctly.
					It has no problem.	Check 3).
		3)	The bus voltage is lower than 38VDC when 48VDC is set for the main circuit power supply, or lower than 18VDC when 24VDC is set for the main circuit power supply.	Check the bus voltage value with MR Configurator.	The voltage is lower than 38VDC when 48VDC is set for the main circuit power supply, or lower than 18VDC when 24VDC is set for the main circuit power supply.	Review the wiring. Check the power supply capacity.
E9.2	Bus voltage drop during low speed operation	4)	The bus voltage dropped during the servo motor driving with under 50r/min.	Check the bus voltage value with MR Configurator.	The voltage is lower than 35VDC when 48VDC is set for the main circuit power supply, or lower than 15VDC when 24VDC is set for the main circuit power supply.	Review the power supply capacity. Increase the acceleration time constant.
E9.3	Ready-on signal on during main circuit off	1)	The setting of the parameter No.Po04 is incorrect.	Check that the parameter No. Po04 is set to the input voltage for the main circuit power supply. 24VDC: 1□□□ 48VDC: 0□□□	It is not set correctly.	Set it correctly.
					It is set correctly.	Check 2).
		2)	The main circuit power supply is off.	Check it with the check method for alarm display "E9.1".		
		3)	The main circuit power supply connector was disconnected.			
		4)	The bus voltage is lower than 38VDC when 48VDC is set for the main circuit power supply, or lower than 18VDC when 24VDC is set for the main circuit power supply.			

15.7 Dimensions

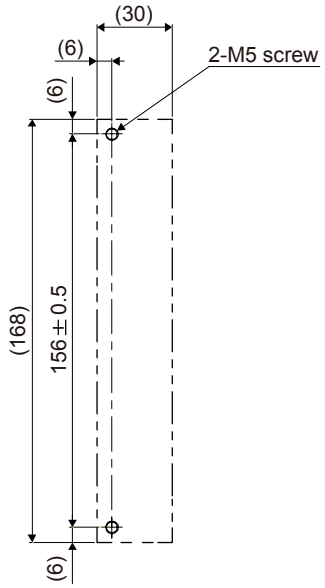
[Unit: mm]



Mass: 0.3 [kg] (0.66 [lb])



Mounting screw
Screw size: M5
Tightening torque: 1.87 [N・m]



Mounting hole process drawing

15.8 Characteristics

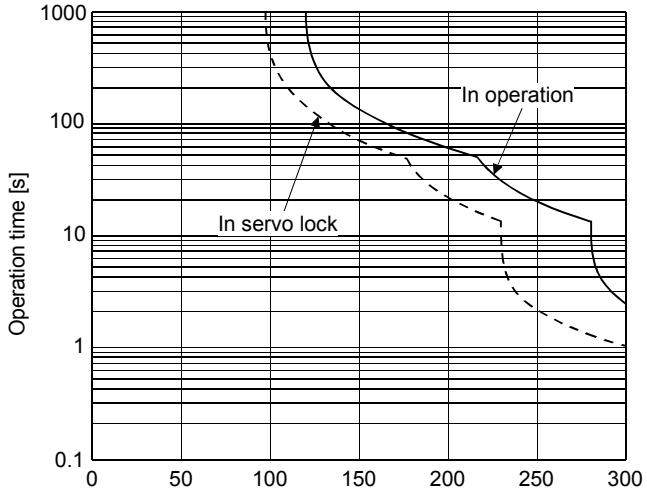
POINT

- This section does not include the following items. For details of the items, refer to each section of the detailed description field.

Item	Detailed explanation
Cable bending life	Section 10.4

15.8.1 Overload protection characteristics

An electronic thermal is built in the servo amplifier to protect the servo motor, servo amplifier and servo motor power lines from overloads.
Overload 1 alarm (50.☐) occurs if overload operation performed is above the electronic thermal protection curve shown in fig. 15.1. Overload 2 alarm (51.☐) occurs if the maximum current is applied continuously for several seconds due to machine collision, etc. Use the equipment on the left-side area of the continuous or broken line in the graph.
For the system where the unbalanced torque occurs, such as a vertical axis system, it is recommended that the unbalanced torque of the machine be kept at 70% or less of the motor's rated torque. When mounting MR-J3W-40303BN6 closely, use it with 75% or lower effective load ratio.
The MR-J3W servo amplifiers have servo motor overload protection function for each axis. (The servo motor overload current (full load current) is set on the basis of 115% rated current of the servo amplifier.)



HG-AK0136/0236/0336

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 malfunction regardless of the electronic thermal protection.

Fig. 15.1 Electronic thermal protection characteristics

15.8.2 Power supply capacity and generated loss

Amount of heat generated by the servo amplifier

Table 15.2 indicates the required power supply capacities for main circuit and losses generated under rated load of the servo amplifier. For thermal design of an enclosed type cabinet, use the values in the table in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and servo-off according to the duty used during operation. When the servo motor is run at less than the maximum speed, the required power supply capacity for main circuit will be smaller than the value in the table, but the servo amplifier's generated heat will not change.
The values in the table shows when the same motor is used for both A-axis and B-axis. When using different motors for each axis, estimate the values with averages of the motors.

Table 15.2 Power supply capacity and generated loss per servo amplifier at rated output

Servo motor ×2	Main circuit (48VDC/24VDC) Required power supply capacity [W]	(Note) Servo amplifier-generated heat [W]	
		At rated output	With servo-off
AK0136	460	13	3
AK0236	720	19	3
AK0336	960	27	3

Note. Heat generated during regeneration is not included in the servo amplifier-generated heat.

15.8.3 Dynamic brake characteristics

POINT

- The dynamic brake of MR-J3W-0303BN6 is an electronic type.
- 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.
- Be sure to enable Forced stop (EM1) after servo motor stops when using Forced stop (EM1) frequently in other than emergency.
- The time constant " τ " for the electronic dynamic brake will be shorter than that of normal dynamic brake. Therefore, coasting distance will be longer than that of normal dynamic brake. For how to set the electronic dynamic brake, refer to parameter No. PF06 and PF12.

(1) Dynamic brake operation

(a) Calculation of coasting distance

Fig. 15.2 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use equation 15.2 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.)

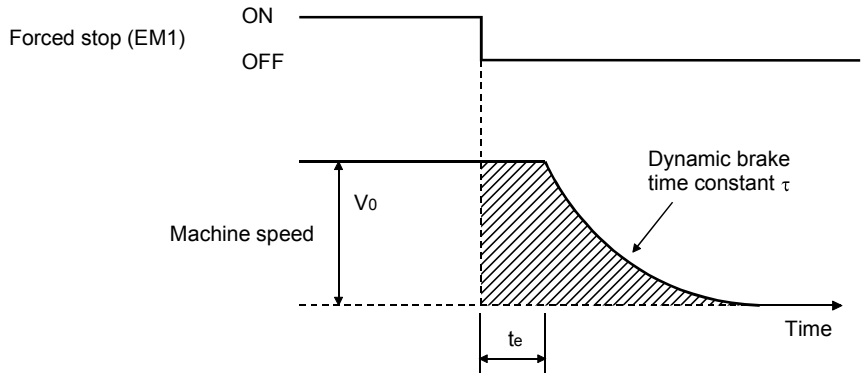


Fig. 15.2 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \quad \text{(15.1)}$$

L_{max} : Maximum coasting distance [mm]

Vo : Machine's fast feed speed [mm/min]

J_M : Moment of inertia of the servo motor [$\times 10^{-4}$ kg・m^2][oz・in^2]

J_L : Load inertia moment converted into equivalent value on servo motor shaft [$\times 10^{-4}$ kg・m^2][oz・in^2]

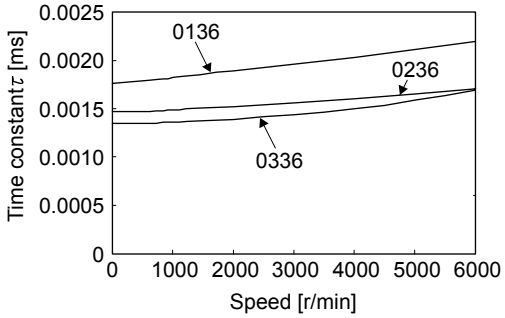
τ : Dynamic brake deceleration [s]

t_e : Delay time of control section [s]

The processing delay time about 3.5ms.

(b) Dynamic brake time constant

The following shows necessary dynamic brake time constant τ for equation 15.1.



HG-AK series

(2) Permissible load to motor inertia ratio when the dynamic brake is used

Use the dynamic brake under the load to motor inertia ratio indicated in the following table. If the ratio is higher than this value, the built-in dynamic brake may burn. If there is a possibility that the ratio may exceed the value, contact your local sales office.

The values of the permissible load to motor inertia ratio in the table are the values at the maximum rotation speed of the servo motor.

Servo motor series	Load to motor inertia ratio [multiplier]
HG-AK	30

15.8.4 Inrush currents at power-on of main circuit and control circuit

The following shows inrush current (reference) when the maximum permissible voltage (main circuit: 55.2VDC, control circuit: 26.4VDC) is applied on the conditions: main circuit power supply capacity; 48V/600W, control circuit power supply capacity; 24V/100W, wiring length; 1m.

Servo amplifier	Inrush current	
	Main circuit power supply (PM, 0)	Control circuit power supply (24, 0)
MR-J3W-0303BN6	160A (attenuated to approx. 2A in 1ms)	1A (attenuated to approx. 0A in 30ms)

Since large inrush currents flow in the power supplies, always use circuit protectors.
For circuit protectors, it is recommended that the inertia delay type, which is not tripped by an inrush current, be used.

15.9 Options and peripheral equipment

⚠ WARNING	・Before connecting options and peripheral equipment, turn off the power supply and check that the charge lamp turns off. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠ CAUTION	・Use specified auxiliary equipment and options. Otherwise, it may cause a malfunction or fire.

POINT

・This section does not include the following items. For details of the items, refer to each section of the detailed description field.

Item	Detailed explanation
MR Configurator	Section 11.4
Relays (recommended)	Section 11.8
Noise reduction techniques	Section 11.9
Junction terminal block MR-TB26A	Section 11.12

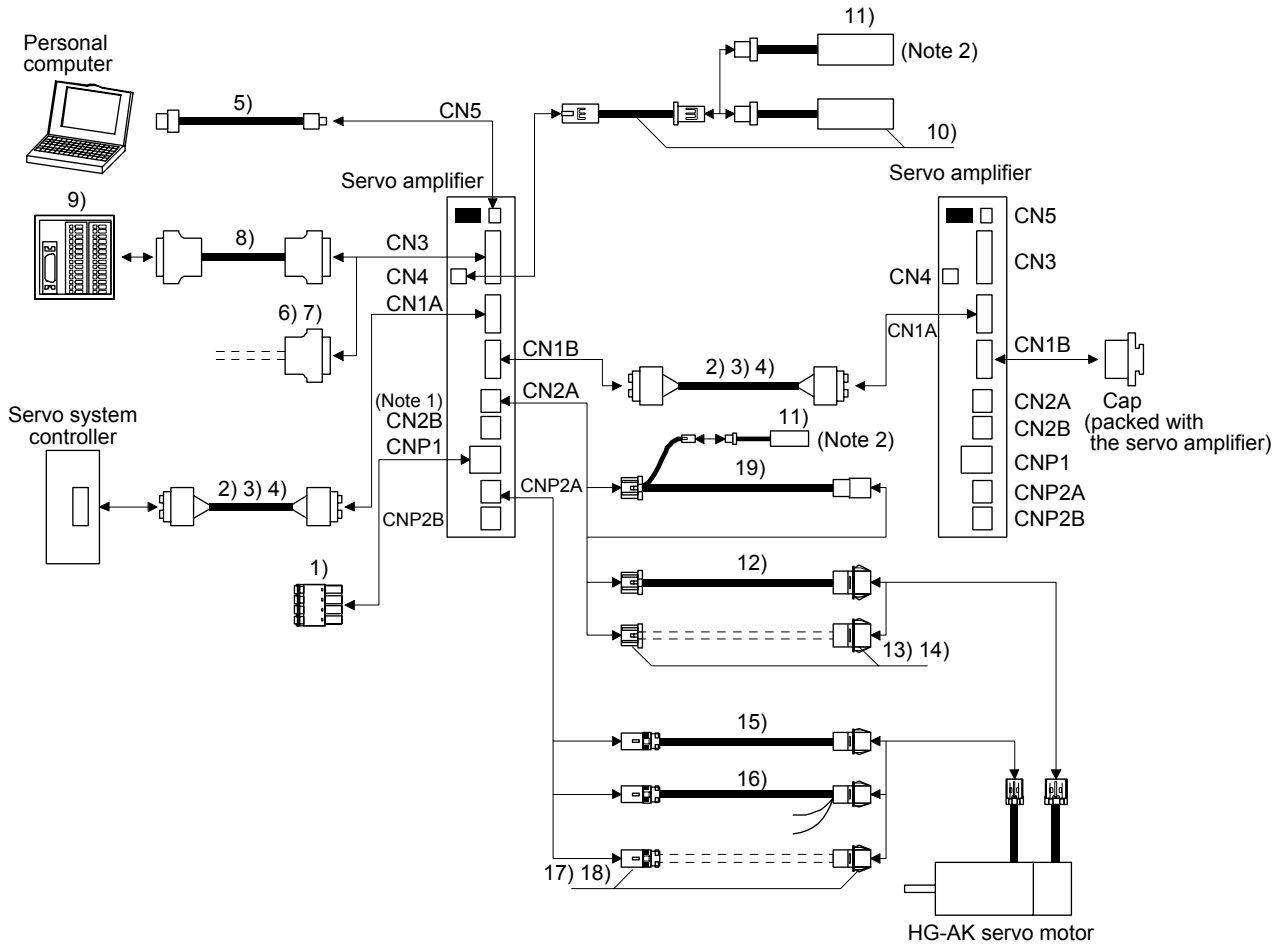
15.9.1 Cable/connector sets

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.

Please purchase the cable and connector options indicated in this section.

(1) Combinations of cable/connector sets



Note 1. Options for B-axis are the same as for A-axis.

2. Please purchase the battery set at first use. Only MR-J3BAT can be purchased for replacement. Use one battery to configure the absolute position detection system.

No.	Name	Model	Description	Application
1)	CNP1 connector		 Quantity: 1 Model: FK-MCP1,5/4-ST-3,5 or equivalent (Phoenix Contact) Applicable wire size: 0.14mm^2 (AWG26) to 1.5mm^2 (AWG16) Insulator OD: to 2.9mm	Supplied with servo amplifier
2)	SSCNETⅢ cable	MR-J3BUS□M Cable length: 0.15m to 3m (Refer to section 11.1.5.)	Connector: PF-2D103 (JAE) Connector: PF-2D103 (JAE)	Standard cord inside cabinet
3)	SSCNETⅢ cable	MR-J3BUS□M-A Cable length: 5m to 20m (Refer to section 11.1.5.)		Standard cable outside cabinet

No.	Name	Model	Description	Application
4)	SSCNETⅢ cable	MR-J3BUS□M-B Cable length: 30m to 50m (Refer to section 11.1.5.)	Connector: CF-2D103-S (JAE) Connector: CF-2D103-S (JAE) 	Long-distance cable
5)	USB cable	MR-J3USBCBL3M Cable length: 3m	CN5 connector mini-B connector (5 pins) Personal computer connector A connector 	For connection with PC-AT compatible personal computer
6)	Connector set	MR-J2CMP2	 Connector: 10126-3000PE Shell kit: 10326-52F0-008 (3M or equivalent)	Quantity: 1
				Quantity: 20
7)	Connector set	MR-ECN1		
8)	Junction terminal block cable	MR-TBNATBL□M Cable length: 0.5m/1m (Refer to section 11.12.)	Junction terminal block connector Connector: 10126-6000EL Shell kit: 10326-3210-000 (3M or equivalent) Servo amplifier-side connector Connector: 10126-6000EL Shell kit: 10326-3210-000 (3M or equivalent) 	For junction terminal block connection
9)	Junction terminal block	MR-TB26A	Refer to section 11.12.	
10)	Battery set	MR-J3W03BATSET (Refer to section 15.10.)	Battery extension cable  MR-J3BAT  Mounting attachment for MR-J3BAT 	
11)	Battery	MR-J3BAT (Refer to section 15.10.)		
12)	Encoder cable	MR-J3W03ENCBL□M-A-H Cable length: 1m/2m/5m/10m/20m/30m	 Refer to (2) of this section for details.	Long bending life
13)	Encoder connector set	MR-J3W03CN2-2P		Quantity: 2 of each
14)		MR-J3W03CN2-20P	Refer to (2) of this section for details.	Quantity: 20 of each
15)	Servo motor power cable	MR-J3W03PWCBL□M-A-H Cable length: 1m/2m/5m/10m/20m/30m	 Refer to (3) of this section for details.	Long bending life

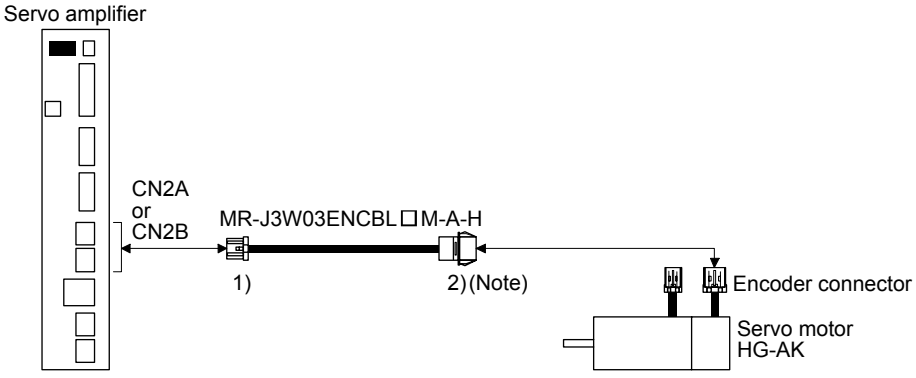
No.	Name	Model	Description	Application
16)	Servo motor power cable	MR-J3W03PWBRCBL□M-A-H Cable length: 1m/2m/5m/10m/20m/30m	 Refer to (3) of this section for details.	Long bending life Servo motor with an electromagnetic brake
17)	Motor power connector set	MR-J3W03CNP2-2P	 Refer to (3) of this section for details.	Quantity: 2 of each
18)		MR-J3W03CNP2-20P		Quantity: 20 of each
19)	Junction cable for battery connection	MR-J3W03BTCBL03M	 Use this cable with an encoder cable.	For connection of battery

(2) Encoder cable

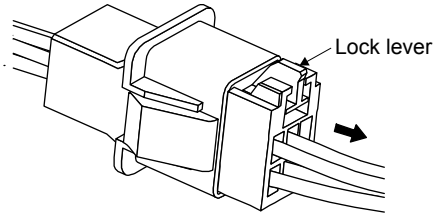
These cables are encoder cables for the HG-AK series servo motors. The numbers in the cable length field of the table indicate the symbol filling the square "□" in the cable model. The cables of the lengths with the symbols are available.

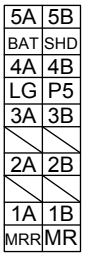
Cable model	Cable length						IP rating	Bending life	Application
	1m	2m	5m	10m	20m	30m			
MR-J3W03ENCBL□M-A-H	1	2	5	10	20	30		Long bending life	For encoder

(a) Connection of servo amplifier and servo motor

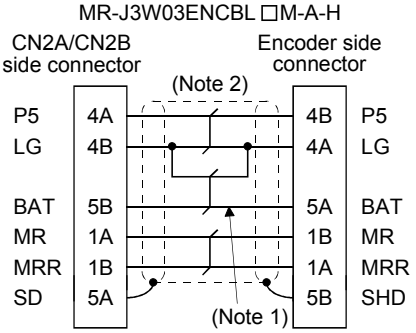


Note. Pull out the connector with pushing down the lock lever on the connector. There is not need to use the lock lever of the encoder cable.



Cable model	1) CN2A/CN2B side connector	2) Encoder-side connector
MR-J3W03ENCBL□M-A-H	Rec.housing: 1-1827862-5 Contact: 1827587-2 Crimping tool: 1762846-1 (TE Connectivity)  Note. Do not connect anything to the pins shown as ▨.	Tab housing: J21DPM-10V-KX Contact: SJ2M-01GF-M1.0N Crimping tool: YRS-8861 (JST)  Note. Do not connect anything to the pins shown as ▨.

(b) Cable internal wiring diagram



Note 1. Always make connection for use in an absolute position detection system. Wiring is not necessary for use in an incremental system.
2. When the cable is 20m or 30m, the wiring of P5 and LG will be three pairs.

(c) When fabricating the encoder cable

When fabricating the cable, prepare the following parts, and fabricate it according to the wiring diagram (2) (b) of this section. Refer to section 15.9.2 for the specifications of the cable to use.

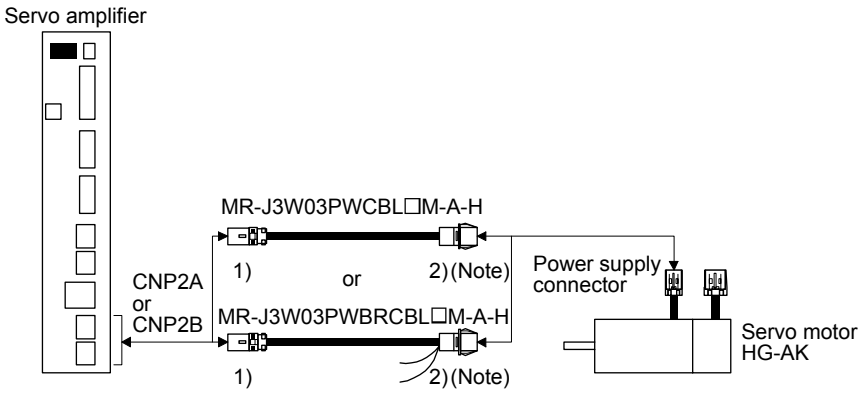
Parts	Description	
Connector set	MR-J3W03CN2-2P, MR-J3W03CN2-20P	
		
	CN2A/CN2B side connector Rec.housing: 1-1827862-5 Contact: 1827587-2 (TE Connectivity)	Encoder-side connector Tab housing: J21DPM-10V-KX Contact: SJ2M-01GF-M1.0N (JST)

(3) Servo motor power cable

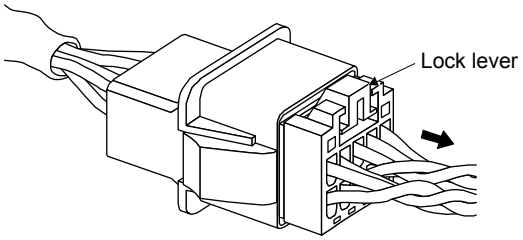
These cables are servo motor power cables for the HG-AK series servo motors. The numbers in the cable length field of the table indicate the symbol filling the square "□" in the cable model. The cables of the lengths with the symbols are available. Refer to section 15.4 when wiring.

Cable model	Cable length						IP rating	Bending life	Application
	1m	2m	5m	10m	20m	30m			
MR-J3W03PWCBL□M-A-H	1	2	5	10	20	30		Long bending life	Standard servo motor (without electromagnetic brake)
MR-J3W03PWBRCBL□M-A-H	1	2	5	10	20	30		Long bending life	Servo motor with electromagnetic brake

(a) Connection of servo amplifier and servo motor

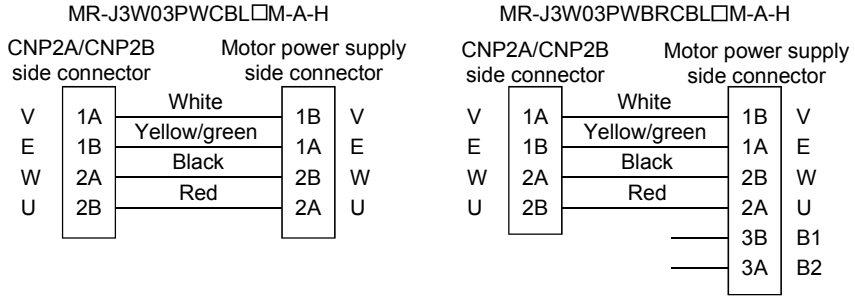


Note. Pull out the connector with pushing down the lock lever on the power connector. There is not need to use the lock lever of the servo motor power cable.



Cable model	1) CN2A/CN2B side connector	2) Servo motor-side connector
MR-J3W03PWCBL□M-A-H MR-J3W03PWBRCBL□M-A-H	Rec. housing: 1-1827864-3 or equivalent Contact: 1871745-1 Crimping tool: 1762625-1 (TE Connectivity) 3B 3A ⧅ ⧅ 2B 2A U W 1B 1A E V Note. Do not connect anything to the pins shown as ⧅.	Tab housing: J21DPM-06V-KX Contact: SJ2M-21GF-M1.0N Crimping tool: YRF-1120 (JST) 3A 3B B1 B2 2A 2B U W 1A 1B E V Note. Do not connect anything to the pins shown as ⧅.

(b) Internal wiring diagram



(c) When fabricating the servo motor power cable

When fabricating the servo motor power cable, prepare the following parts, and fabricate it according to the wiring diagram (3) (b) of this section. Refer to section 15.9.2 for the specifications of the cable to use.

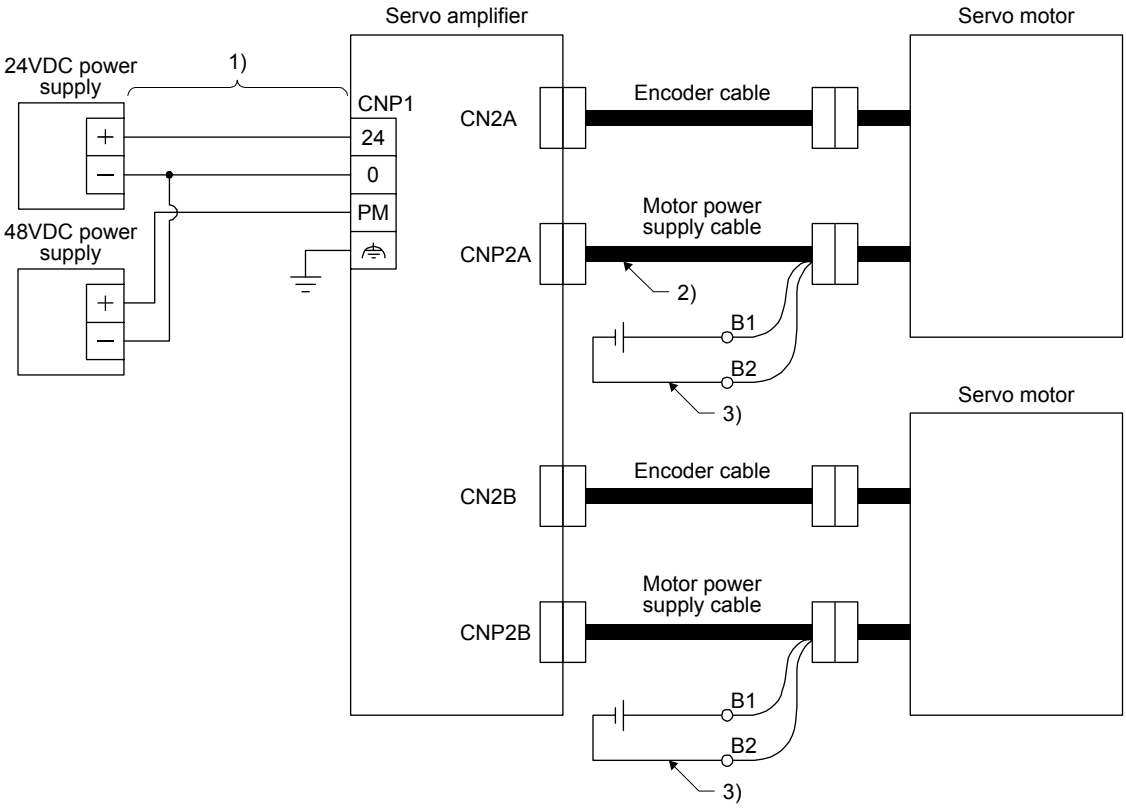
Parts	Description	
Connector set	MR-J3W03CNP2-2P, MR-J3W03CNP2-20P	
		
	CN2A/CN2B side connector	Servo motor-side connector
	Rec. housing: 1-1827864-3 or equivalent Contact: 1871745-1 (TE Connectivity)	Tab housing: J21DPM-06V-KX Contact: BJ2M-21GF-M1.0N (JST)

15.9.2 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 conditions 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 the wire size selection example.



600V polyvinyl chloride insulated wires (IV wires) and 600V grade heat-resistant polyvinyl chloride insulated wires (HIV wires) are common size.

Table 15.3 Wire size selection example (IV/HIV wire)

Servo amplifier	Wire (Note 1)		
	1) 24/0/PM/⏚	2) U/V/W/⏚	3) B1/B2
MR-J3W-0303BN6	AWG16 (Note 2, 3)	AWG19	1.25mm^2(AWG16)

Note 1. This is a selection example when HG-AK0336(B) are used for two axes.
2. Insulator OD: 2.9mm
3. Voltage drop will occur according to line impedance and current supplied to the servo amplifier. Be sure to use this wire.

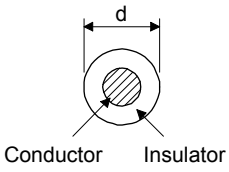
(2) For cables

To fabricate encoder cables and servo motor power cables, use the following cables or equivalent.

Table 15.4 Wires for option cables

Type	Model	Length [m]	Core size	Number of cores	Characteristics of one core			(Note 2) Overall diameter [mm]	Wire model
					Structure [Wires/mm]	Conductor resistance [Ω/km]	(Note 1) Insulation coating OD d [mm]		
Encoder cable	MR-J3W03ENCBL□M-A-H	1 to 10	AWG22	6	70/0.08	56 or less	1.17	7.1±0.3	(Note 3) TPE・SVP 70/0.08 (AWG#22 or equivalent)-3P KB-2237-2 (Bando Densen)
		20/30	AWG22	10	70/0.08	56 or less	1.17	7.7±0.3	(Note 3) TPE・SVP 70/0.08 (AWG#22 or equivalent)-5P (Bando Densen)
Servo motor power cable	MR-J3W03PWCBL□M-A-H	1 to 30	AWG19	4	150/008	29.1 or less	1.63	5.7±0.5	(Note 4) RMFES-A(CL3X) AWG19 4-cores (Dyden)
	MR-J3W03PWBRCBL□M-A-H	1 to 30	AWG19	4	150/0.08	29.1 or less	1.63	5.7±0.5	(Note 4) RMFES-A(CL3X) AWG19 4-cores (Dyden)

Note 1. d is as shown below.



2. Standard OD Maximum OD is about 10% greater.
3. Purchase from Toa Electric Industry Co. Ltd.
4. Purchase from Taisei Co., Ltd.

15.9.3 Circuit protector

Power supply specification	Circuit protector (Note)
Control circuit power supply (24VDC)	CP30-BA 1P 1-M 1A
Main circuit power supply (48VDC)	CP30-BA 1P 1-M 5A
Control circuit power supply/main circuit power supply (24VDC)	CP30-BA 1P 1-M 10A

Note. For operation characteristics, use an intermediate speed type.

15.10 Absolute position detection system

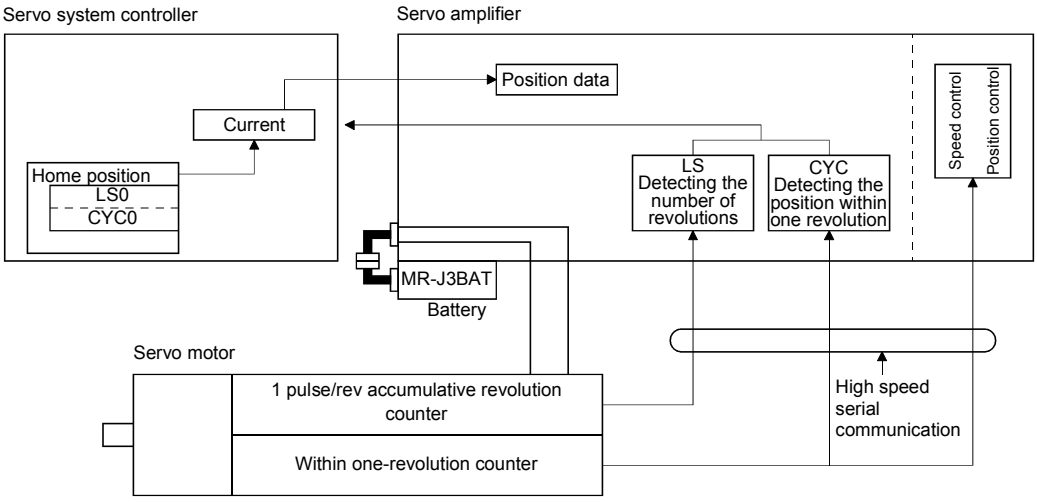
> **CAUTION**
> - If Absolute position erased (25.1) or Absolute position counter warning (E3.□) has occurred, always perform home position setting again. Otherwise, it may cause an unexpected operation.

> **POINT**
> - For HG-AK series servo motors, if the encoder cable is disconnected, absolute position data will be erased. After disconnecting the encoder cable, always execute home position setting and then positioning operation.
> - This section does not include the following items. For details of the items, refer to each section of the detailed description field.

Item	Detailed explanation
Confirmation of absolute position data	Section 12.4

15.10.1 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.



15.10.2 Specifications

⚠ WARNING	・Before mounting battery, check the control circuit power supply on, turn off the main circuit power supply, and check that the charge lamp turns off. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

POINT

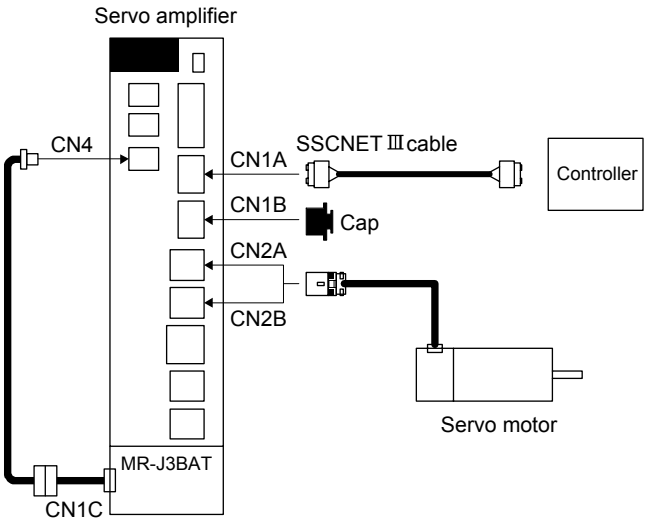
・The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions.
  ・Ground human body and work bench.
  ・Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.
・Replace the battery with control circuit power supply on and with main circuit power supply off. Replacing battery with the control circuit power off will erase the absolute position data.

(1) Specification list

Item	Description
System	Electronic battery backup type
Battery	Lithium battery (primary battery, nominal＋3.6V) Type: MR-J3BAT
Maximum revolution range	Home position±32767 rev.
(Note 1) Maximum speed at power failure	500r/min
(Note 2) Battery backup time	Approximately 10,000 hours/2 axes (equipment power supply: off, ambient temperature: 25℃) (Note 4)
	Approximately 20,000 hours/1 axis (equipment power supply: off, ambient temperature: 25℃)
(Note 3) Battery life	5 years from date of manufacture

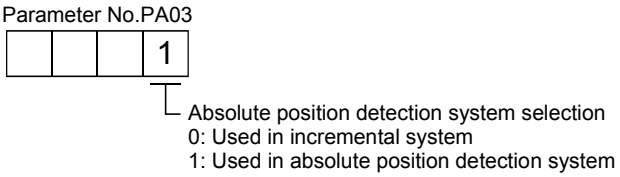
Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like
2. Time to hold data by a battery with power off. Replace the batteries within three years since the operation start whether the power supply is on/off. If the battery is used out of specification, Absolute position erased (25) may occur.
3. Quality of battery degrades by the storage condition. It is recommend that the battery be used within two years from the production date. The life of battery is five years from the production date regardless of the connection.
4. Even if the absolute position detection system is used with one axis, the battery backup time will be approximately 10,000 hours.

(2) Structure



(3) Parameter setting

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

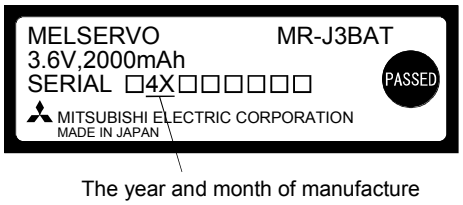


(4) Year and month of manufacture of MR-J3BAT

Production year and month of the MR-J3BAT are indicated in a serial number on the rating plate of the battery back face.

The year and month of manufacture are indicated by the last one digit of the year and 1 to 9, X(10), Y(11), Z(12).

For October 2004, the Serial No. is like, "SERIAL: □4X□□□□□□".



15.10.3 Battery replacement procedure

⚠ WARNING	・Before mounting battery, turn off the main circuit power supply and check that the charge lamp turns off. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

POINT

・The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions.
  ・Ground human body and work bench.
  ・Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

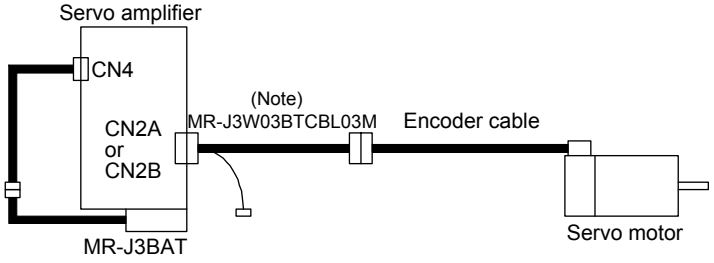
(1) When replacing battery with the control circuit power on

POINT

・Replacing battery with the control circuit power off will erase the absolute position data.

Replacing battery with the control circuit power on will not erase the absolute position data. Refer to section 15.10.4 for mounting procedure of battery on the servo amplifier.
To replace battery with the control circuit power off, refer to (2) of this section.

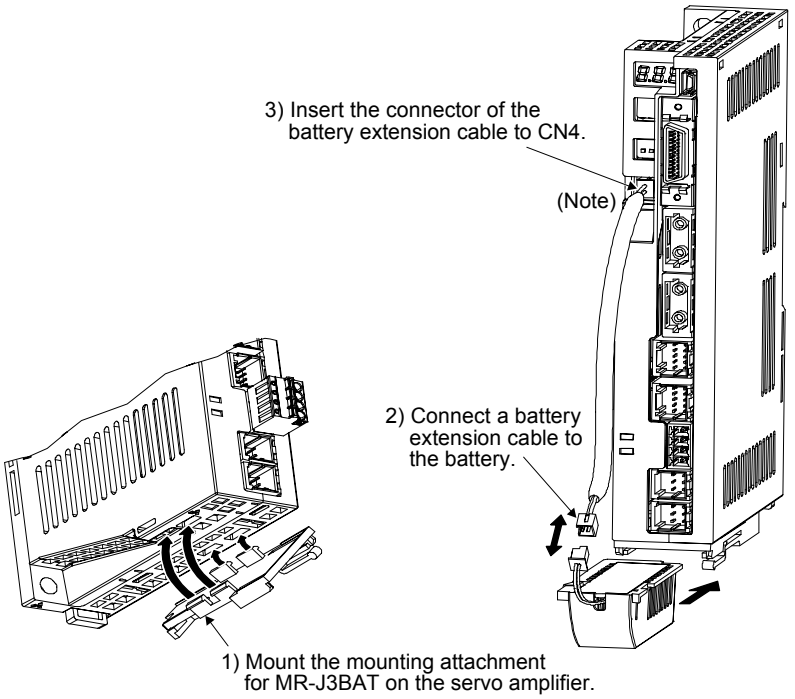
(2) When replacing battery with the control circuit power off
Replacing battery with the control circuit power off will erase the absolute position data, but battery can be replaced without erasing the absolute position data in the following procedure.
In this procedure, MR-J3W03BTCBL03M battery connection cable is required.
MR-J3W03BTCBL03M cannot be added after home position is set. Make sure to connect MR-J3W03BTCBL03M between the servo amplifier and the encoder cable when setting up the encoder cable.
Refer to section 12.5 for the replacement procedure of the battery.



Note. Make sure to install MR-J3W03BTCBL03M when setting up the encoder cable.

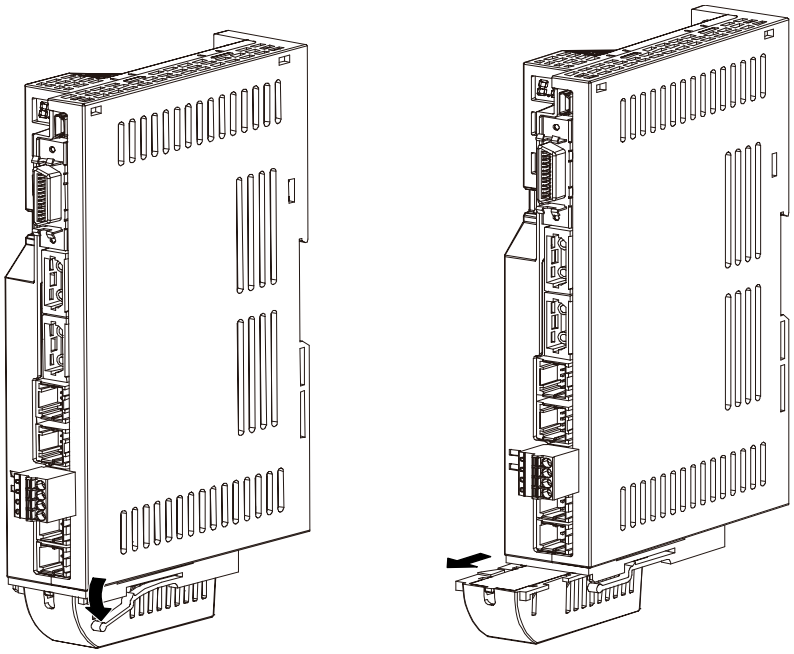
15.10.4 Battery mounting/removing procedure

(1) Battery mounting procedure



Note. Be careful not to catch battery extension cable on peripheral equipment or by your fingers. Doing so may cause a disconnection of the CN4 connector due to stress on the connector connection part.

(2) Battery removing procedure



1) Push down the lever of the mounting attachment for MR-J3BAT.

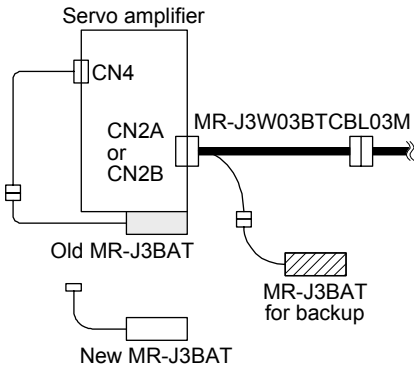
2) Pull out the battery.

15.10.5 Procedure to replace battery with the control circuit power off

(1) Preparation for battery replacement
For the battery replacement, battery for backup is required separately from the battery to be replaced.
Prepare the following batteries.

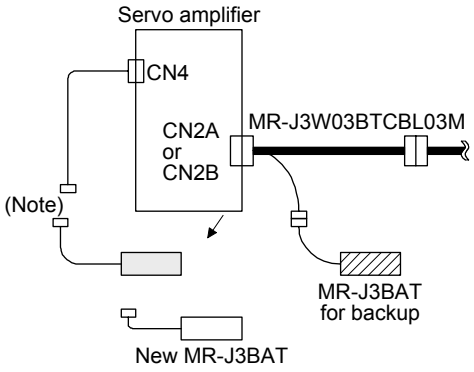
Name	Number and Use	Remarks
MR-J3BAT	1 for backup 1 for replacement	Battery within two years from the production date.

(2) Replacement procedure



Step 1

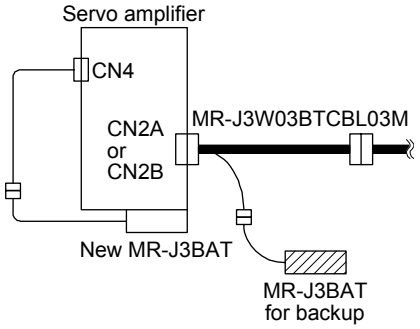
Connect MR-J3BAT for backup to the battery connector of MR-J3W03BTCBL03M.



Step 2

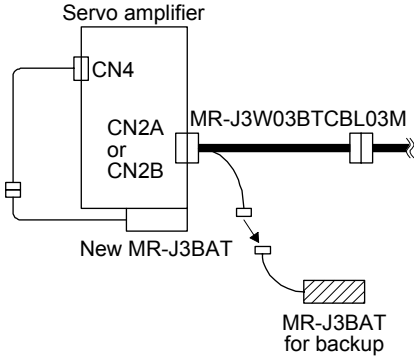
Remove old MR-J3BAT from the servo amplifier.

Note. When replacing MR-J3BAT, connect/disconnect the junction-side connector.



Step 3

Mount new MR-J3BAT to the servo amplifier. Connect the lead wire plug of MR-J3BAT to the battery extension cable connected to the CN4 connector of the servo amplifier.



Step 4

Remove the MR-J3BAT for backup from the battery connector of MR-J3W03BTCBL03M, and the procedure is completed.

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	This parameter is not used.			
PA08	Auto tuning mode	Each axis		
PA09	Auto tuning response	Each axis		
PA10	In-position range	Each axis		
PA11 to PA13	This parameter is not used.			
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	This parameter is not used.		None	
PB04	Feed forward gain	Each axis		
PB05	This parameter is not used.			
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	This parameter is not used.			
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	This parameter is not used.			
PB23	Low-pass filter selection	Each axis		
PB24	Slight vibration suppression control selection	Each axis		
PB25	This parameter is not used.			
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	This parameter is not used.			

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	This parameter is not used.			
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	This parameter is not used.			
PC14				
PC15	Station number selection	Common	Specification added	The setting to select a communicating axis of MR Configurator is added.
PC16	This parameter is not used.		None	
PC17	Function selection C-4	Each axis		
PC18 to PC20	This parameter is not used.			
PC21	Alarm history clear	Each axis		

Parameter No.	Name	Setting	Difference from MR-J3-B	Comment
PC22 to PC26	This parameter is not used.		None	
PC27	Function selection C-9	Each axis		
PC28 to PC32	This parameter is not used.			

Parameter No.	Name	Setting	Difference from MR-J3-B	Comment
PD01	This parameter is not used.		None	
PD02	Input signal automatic ON selection	Each axis	Function added	Automatically ON function for FLS and RLS is added.
PD03 to PD06	This parameter is not used.		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	This parameter is not used.		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	This parameter is not used.		None	
PD14	Function selection D-3	Each axis		
PD15 to PD32	This parameter is not used.			

Parameter No.	Name	Setting	Difference from MR-J3-B	Comment
PF06	Function selection F-5	Each axis	New addition	Used for MR-J3W-0303BN6 servo amplifier.
PF12	Electronic dynamic brake operating time	Each axis	New addition	

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	This parameter is not used.		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	This parameter is not used.		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 data (MR Configurator)	Common	New addition	Axis selection for analog data channels in MR Configurator is added.
Po03	Axis selection for graphing digtal data (MR Configurator)	Common	New addition	Axis selection for digital data channels in MR Configurator is added.
Po04	Function selection O-2	Common	New addition	Used for MR-J3W-0303BN6 servo amplifier.
Po05 to Po16	This parameter is not used.		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

CN3

		1				14	
2		LG		15		LG	
MO1				MO2			
		3				16	
4		LA-A		17		LAR-A	
LB-A				LBR-A			
		5				18	
6		LA-B		19		LAR-B	
LB-B				LBR-B			
		7				20	
8		DI1-A		21		DI1-B	
DI2-A				DI2-B			
		9				22	
10		DI3-A		23		DI3-B	
EM1				DICOM			
		11				24	
12				25			
		13				26	
						DOCOM	

App. 3 COMPLIANCE WITH CE MARKING

App. 3.1 What is CE marking?

The CE marking is mandatory and must be affixed to specific products placed on the European Union. When a product conforms to the requirements, the CE marking must be affixed to the product. The CE marking also applies to machines and equipment incorporating servos.

(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).

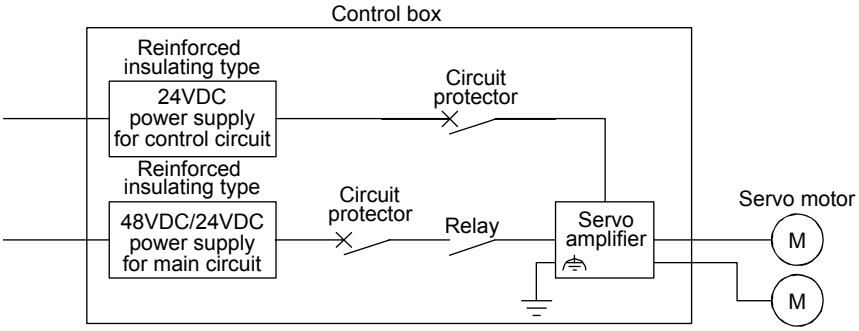
(2) Low voltage directive
The low voltage directive applies also to servo units alone. This servo is designed to comply with the low voltage directive.

App. 3.2 For compliance

Be sure to perform an appearance inspection of every unit before installation. In addition, have a final performance inspection on the entire machine/system, and keep the inspection record.

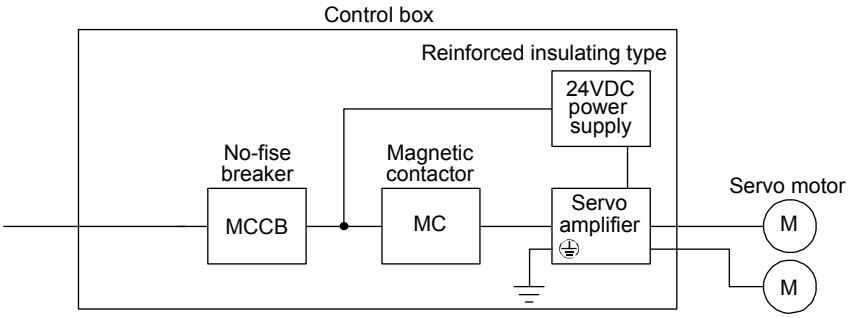
(1) Servo amplifiers and servo motors used
Use the servo amplifiers and servo motors which standard product.
Servo amplifier : MR-J3W-0303BN6・MR-J3W-□B
Servo motor series : HG-AK□・HF-MP□・HF-KP□・HF-SP□・HC-UP□・HC-LP□・HG-JP□

(2) Structure
(a) MR-J3W-0303BN6



(b) MR-J3W-22B to MR-J3W-1010B

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



(3) Environment

(a) Operate the servo amplifier at pollution degree 2 or 1 set forth in 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) Use the product under the following conditions.

Item			Environment
(Note) Ambient temperature	Operation	[°C]	0 to 55
		[°F]	32 to 131
	Storage, Transportation	[°C]	−20 to 65
		[°F]	−4 to 149
Ambient humidity	Operation, Storage, Transportation		90% RH or less
Altitude	Operation, Storage		1000m or less
	Transportation		10000m or less

Note. Ambient temperature is the internal temperature of the control box.

(4) Power supply

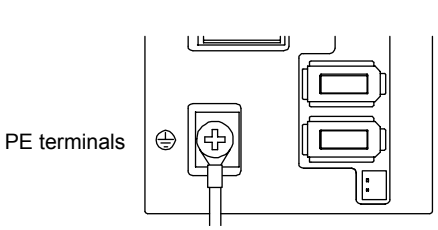
(a) This servo amplifier can be supplied from star-connected supply with earthed neutral point of overvoltage category III set forth in EN 60664-1. However, when using the neutral point of 400V system for single phase supply, a reinforced insulating transformer is required in the power input section.

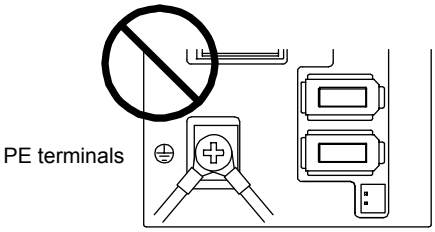
(b) For the interface power supply, use a 24VDC power supply with reinforced insulation on I/O terminals.

(5) Grounding (except MR-J3W-0303BN6)

(a) To prevent an electric shock, the PE terminal (marked ⏚) of the servo amplifier must be connected to the 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.

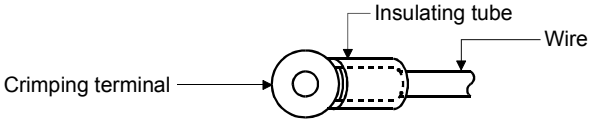




(c) If an earth leakage circuit breaker is used, always earth the protective earth (PE) terminal of the servo amplifier to prevent an electric shock.

(6) Wiring and installation

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



(b) Use the servo motor side power connector which complies with the EN Standard. The EN Standard-compliant power connector sets are available as options.

(c) The Servo amplifier must be installed in the metal cabinet (control box).

(7) Peripheral devices, options

(a) Use the circuit breaker and magnetic contactor models which are EN Standard-compliant products given this Servo Amplifier Instruction Manual. Use a residual current device (RCD) of type B. 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.

(b) The sizes of the wires given this Servo Amplifier Instruction Manual meet the following conditions. For use in any other conditions, follow Table 6 and Annex D of EN 60204-1.

- Ambient temperature: 40℃ (104℉)
- Sheath : PVC (polyvinyl chloride)
- Installation on wall surface or open cable 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.

App. 4 COMPLIANCE WITH UL/CSA STANDARD

This servo amplifier complies with UL 508C and CSA C22.2 No.14 standard.
Refer to section 1.3 (2) for the servo amplifier model names described in the tables and figures.

(1) Servo amplifiers and servo motors used
Use the servo amplifiers and servo motors which standard product.

Servo motor	Servo amplifier				
	MR-J3W-0303BN6	MR-J3W-22B	MR-J3W-44B	MR-J3W-77B	MR-J3W-1010B
	A-axis/B-axis	A-axis/B-axis	A-axis/B-axis	A-axis/B-axis	A-axis/B-axis
HG-AK0136	○				
HG-AK0236	○				
HG-AK0336	○				
HF-MP053		○	○ (Note1)		
HF-MP13		○	○ (Note1)		
HF-MP23		○	○		
HF-MP43			○	○ (Note1)	○ (Note1)
HF-MP73				○	○
HF-KP053		○	○ (Note1)		
HF-KP13		○	○ (Note1)		
HF-KP23		○	○		
HF-KP43			○	○ (Note1)	○ (Note1)
HF-KP73				○	○
HF-SP51				○ (Note1)	○
HF-SP81					○
HF-SP52				○ (Note1)	○
HF-SP102					○
HC-LP52				○ (Note1)	○
HC-LP102					○
HC-UP72				○ (Note1)	○
HF-JP53				○ (Note2)	○ (Note2, 3)
HF-JP73				○ (Note2)	○ (Note2)
HF-JP103					○ (Note2)

Note 1. When using this servo amplifier with software version B2 or below, it is required to set parameter No.Po04 to "□□1□". For the servo amplier with software version B3 or above, setting the parameter is not required.
2. The servo motor is available for servo amplifiers with software version B3 or above.
3. For this combination, the maximum torque of the HF-JP53 servo motor will be 400% of rated torque.

(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 be installed 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, 500V Maximum.

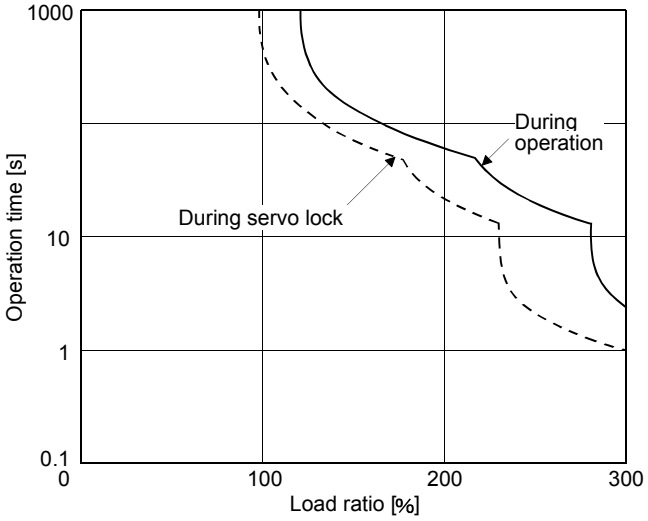
(4) Flange
Mount the servo motor on a flange which has the following size or produces an equivalent or higher heat dissipation effect.

Flange size [mm]	Servo motor						
	HG-AK	HF-MP	HF-KP	HF-SP	HC-UP	HC-LP	HF-JP
150 × 150 × 3	0136/0236/ 0336						
250 × 250 × 6		053/13/23	053/13/23				
250 × 250 × 12		43	43	51/81 52/102		52/102	53/73/103
300 × 300 × 12		73	73				
550 × 550 × 30					72		

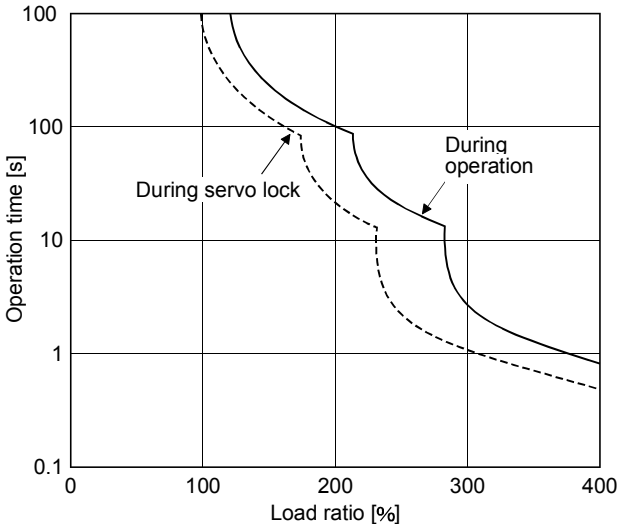
(5) Capacitor discharge time
The capacitor discharge time is as follows. To ensure safety, do not touch the charging section for 15 minutes after power-off. (except MR-J3W-0303BN6)

Servo amplifier	Discharge time (min)
MR-J3W-22B	5
MR-J3W-44B	6
MR-J3W-77B/ MR-J3W-1010B	11

(6) Overload protection characteristics
An electronic thermal relay is built in the servo amplifier to protect the servo motor, servo amplifier and servo motor power line 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-0303BN6, use it with 75% or less effective load torque, and with ambient temperature between 0 to 45℃. When closely mounting MR-J3W-44B, use it with 90% or less of effective load torque.
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
HG-AK0136/0236/0336



HF-MP23/43/73
HF-KP23/43/73
HF-SP51/81/52/102
HC-UP72
HC-LP52/102
HF-JP53/73/103

(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.

<table>
<tr><td rowspan="2">Servo amplifier</td><td colspan="8">Wires (Note 1)</td></tr>
<tr><td>(Note 3)
L_1・L_2・L_3・⏚</td><td>L_{11}・L_{21}</td><td>(Note 2, 3)
U・V・W・⏚</td><td>P＋・C</td><td>P＋・D</td><td>(Note 2)
B1・B2</td><td>THM1・
THM2</td><td>24・0・PM・⏚</td></tr>
<tr><td>MR-J3W-0303BN6</td><td colspan="2"></td><td>AWG19</td><td colspan="2"></td><td rowspan="5">1.25mm² (AWG16)</td><td></td><td>AWG16 (Note 4)</td></tr>
<tr><td>MR-J3W-22B</td><td colspan="5" rowspan="4">2mm² (AWG14)</td><td rowspan="4">0.2mm² (AWG24)</td><td rowspan="4"></td></tr>
<tr><td>MR-J3W-44B</td></tr>
<tr><td>MR-J3W-77B</td></tr>
<tr><td>MR-J3W-1010B</td></tr>
</table>

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

4. Insulator OD : 2.9mm

(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 molded-case circuit breaker or a Class T fuse indicated in the table below.

(a) MR-J3W-0303BN6

Power supply specification	Circuit protector (Note)
Control circuit power supply (24VDC)	CP30-BA 1P 1-M 1A
Main circuit power supply (48VDC)	CP30-BA 1P 1-M 5A
Control circuit power supply/Main circuit power supply (24VDC)	CP30-BA 1P 1-M 10A

Note. For operation characteristics, use an intermediate speed type.

(b) MR-J3W-22B to MR-J3W-1010B

Servo motor total output	Molded-case circuit 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 2.0kW	30A frame 20A		30	

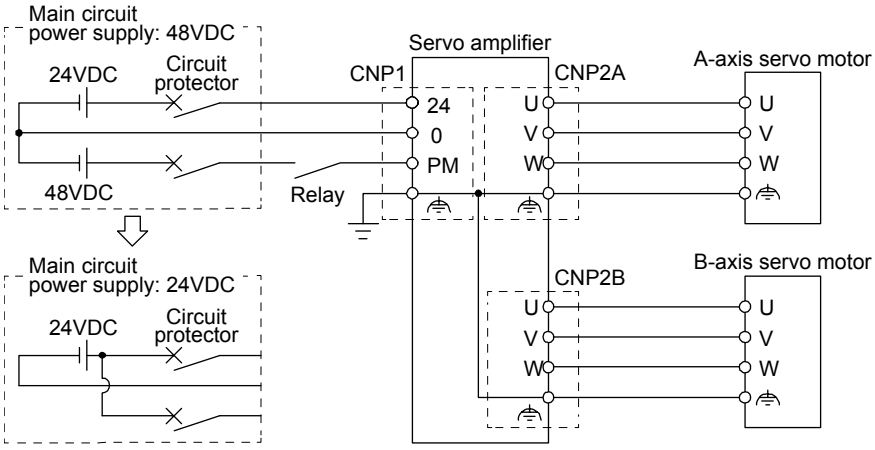
Note. Listed no-fuse breakers are for when the power factor improving reactor is not used.

(9) Options, peripheral devices

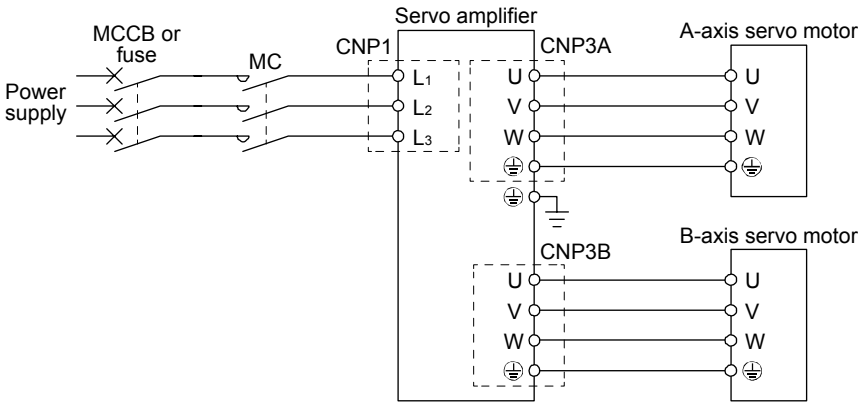
Use the UL/CSA Standard-compliant products.

(10) Connection example

(a) MR-J3W-0303BN6



(b) MR-J3W-22B to MR-J3W-1010B



(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 September 2012. 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-ERG02CBL01M-L	AWG14 × 1pcs.		—		

A symbol "□" in the model name indicates a cable length.

Motor side power supply cable

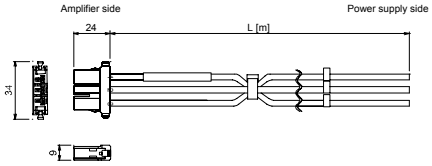
Product			Model	Wire size	Material		Minimum bend radius	Finished outer diameter	Applicable standard (wire part)
					Insulator	Outer sheath			
5)	Direct connection to rotary servo (up to 10m)	Standard	SC-EPWS1CBL□M-■-L	AWG18 × 4C	ETFE	PVBC (black)	50mm	Approximately 6.2mm	UL 13/CL3
6)		Long bending life	SC-EPWS1CBL□M-■-H	AWG19 × 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 bending 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 bending life. A model name with the characters "-H" has a long bending life. A model name with the characters “-L” has a standard bending life.

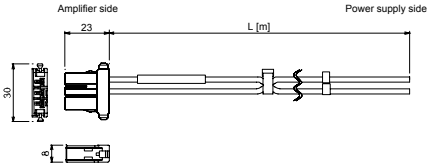
(2) Outline drawing

[Unit: mm]

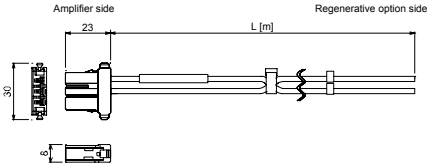
1) [SC-EMP01CBL☐M-L]



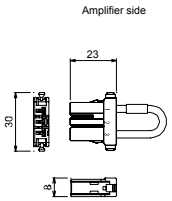
2) [SC-ECP01CBL☐M-L]



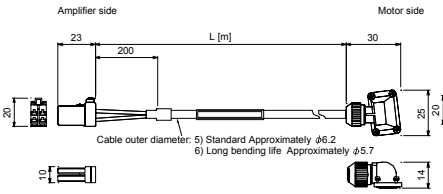
3) [SC-ERG01CBL☐M-L]



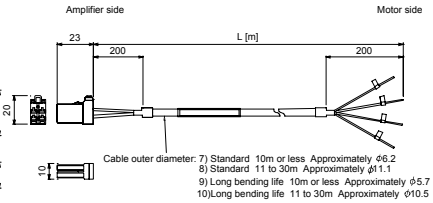
4) [SC-ERG02CBL01M-L]



5)/6) [SC-EPWS1CBL☐M-■-L/ SC-EPWS1CBL☐M-■-H]



7) 8)/9) 10) [SC-EPWS2CBL☐M-L/ SC-EPWS2CBL☐M-H]



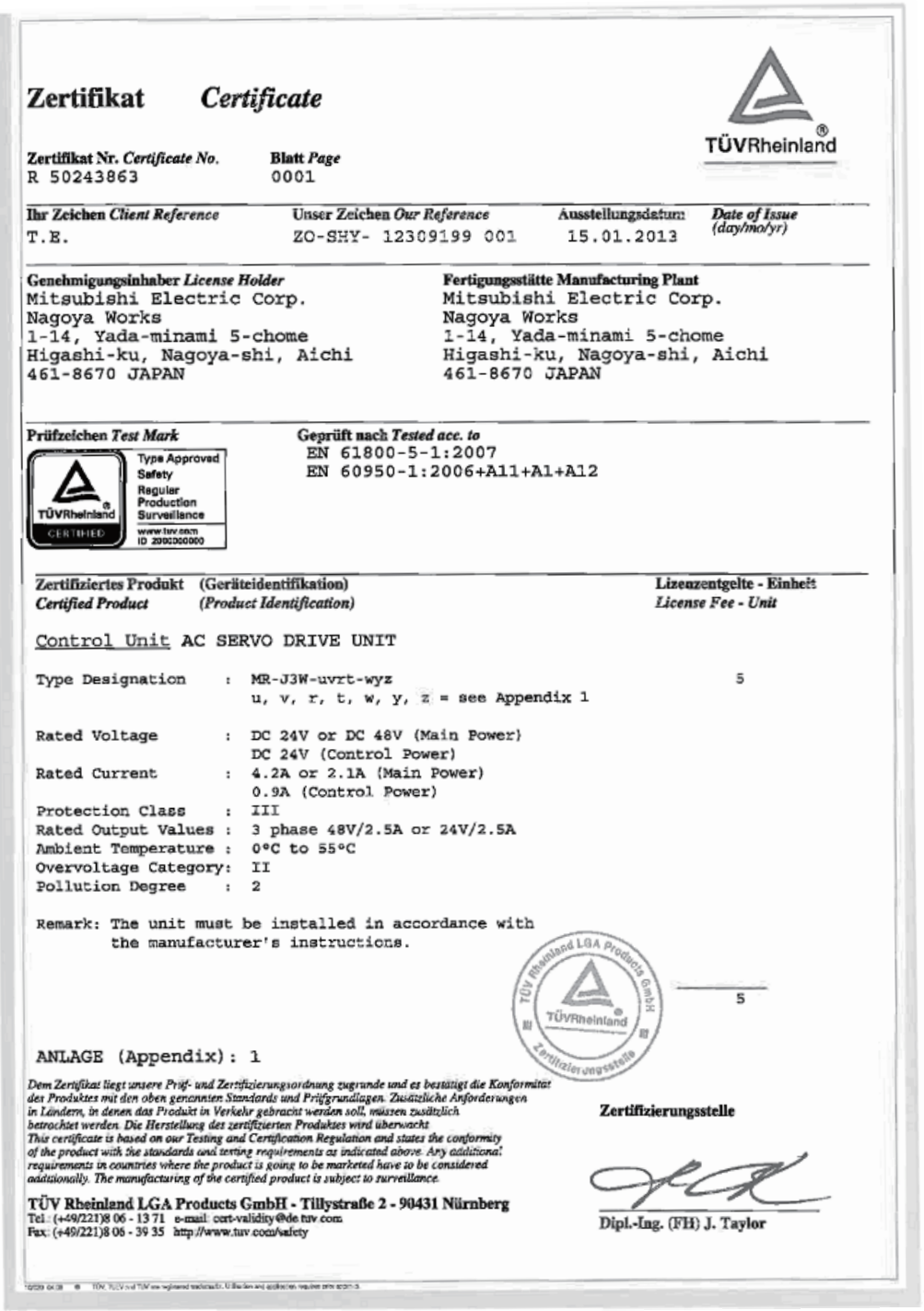
A symbol "☐" in the model name indicates a cable length.

App. 8 Certificate by Certification Body

(1) EN

MR-J3W series servo amplifiers are certificated in compliance with EN described in the Low-voltage directive.

(a) MR-J3W-0303BN6



Zertifikat ***Certificate***

TÜVRheinland

Zertifikat Nr. *Certificate No.* R 50243863 — **Blatt** *Page* 0001

Ihr Zeichen *Client Reference*	Unser Zeichen *Our Reference*	Ausstellungsdatum	*Date of Issue (day/mo/yr)*
T.E.	ZO-SHY- 12309199 001	15.01.2013	

Genehmigungsinhaber *License Holder*
Mitsubishi Electric Corp.
Nagoya Works
1-14, Yada-minami 5-chome
Higashi-ku, Nagoya-shi, Aichi
461-8670 JAPAN

Fertigungsstätte *Manufacturing Plant*
Mitsubishi Electric Corp.
Nagoya Works
1-14, Yada-minami 5-chome
Higashi-ku, Nagoya-shi, Aichi
461-8670 JAPAN

Prüfzeichen *Test Mark*
TÜVRheinland CERTIFIED — Type Approved Safety Regular Production Surveillance — www.tuv.com ID 2000000000

Geprüft nach *Tested acc. to*
EN 61800-5-1:2007
EN 60950-1:2006+A11+A1+A12

Zertifiziertes Produkt (Geräteidentifikation) *Certified Product (Product Identification)*		Lizenzentgelte - Einheit *License Fee - Unit*
Control Unit AC SERVO DRIVE UNIT		
Type Designation	: MR-J3W-uvrt-wyz u, v, r, t, w, y, z = see Appendix 1	5
Rated Voltage	: DC 24V or DC 48V (Main Power) DC 24V (Control Power)	
Rated Current	: 4.2A or 2.1A (Main Power) 0.9A (Control Power)	
Protection Class	: III	
Rated Output Values	: 3 phase 48V/2.5A or 24V/2.5A	
Ambient Temperature	: 0°C to 55°C	
Overvoltage Category	: II	
Pollution Degree	: 2	

Remark: The unit must be installed in accordance with the manufacturer's instructions.

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ANLAGE (Appendix): 1

TÜV Rheinland LGA Products GmbH — TÜVRheinland — Zertifizierungsstelle

Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde und es bestätigt die Konformität des Produktes mit den oben genannten Standards und Prüfgrundlagen. Zusätzliche Anforderungen in Ländern, in denen das Produkt in Verkehr gebracht werden soll, müssen zusätzlich betrachtet werden. Die Herstellung des zertifizierten Produktes wird überwacht.
This certificate is based on our Testing and Certification Regulation and states the conformity of the product with the standards and testing requirements as indicated above. Any additional requirements in countries where the product is going to be marketed have to be considered additionally. The manufacturing of the certified product is subject to surveillance.

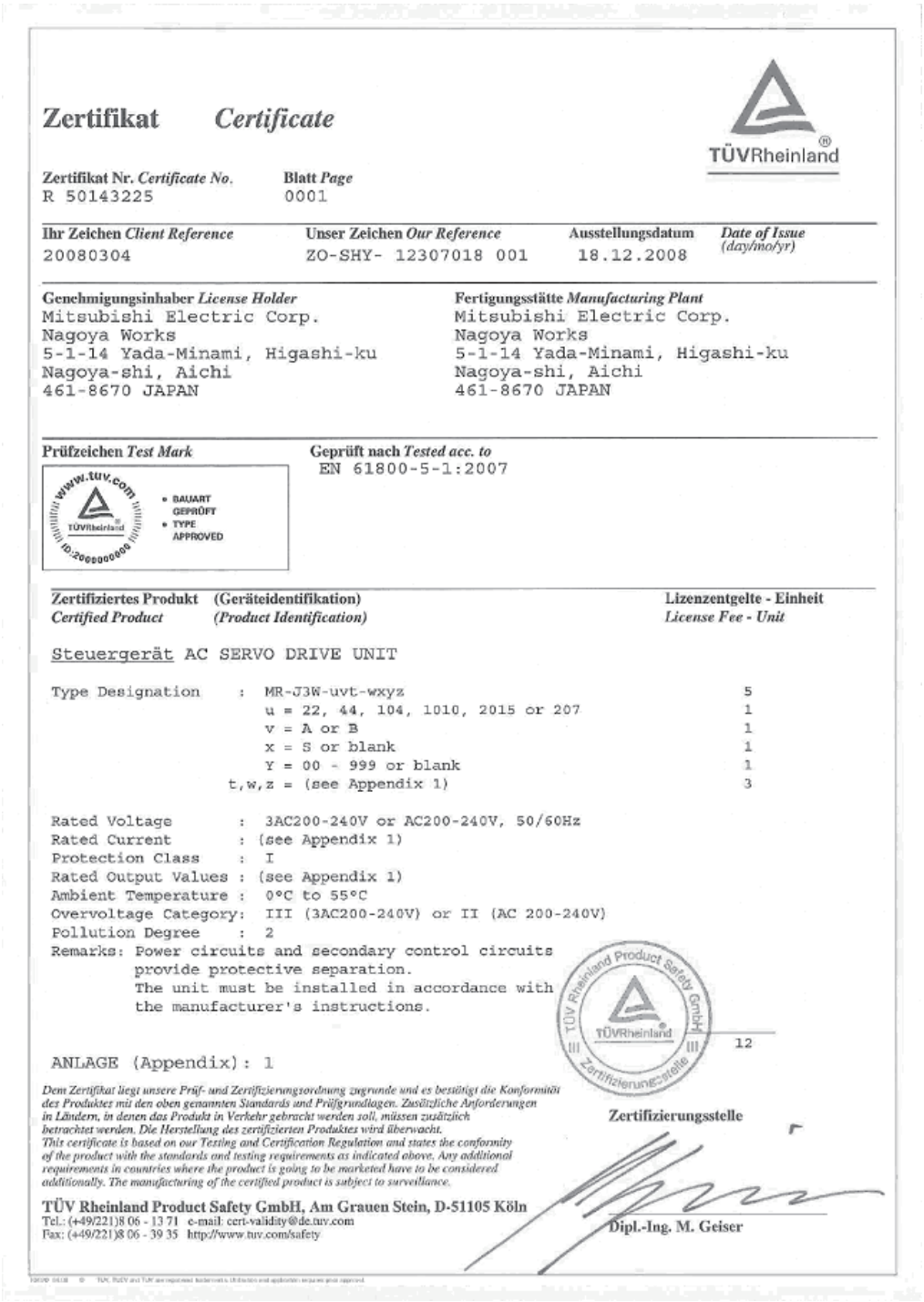
Zertifizierungsstelle

TÜV Rheinland LGA Products GmbH - Tillystraße 2 - 90431 Nürnberg
Tel.: (+49/221)8 06 - 13 71 e-mail: cert-validity@de.tuv.com
Fax: (+49/221)8 06 - 39 35 http://www.tuv.com/safety

Dipl.-Ing. (FH) J. Taylor

Supplementation: Refer to section 15.1.3 (2) for the models shown in "see Appendix 1".

(b) MR-J3W-□B



Zertifikat *Certificate*

TÜVRheinland

Zertifikat Nr. *Certificate No.* R 50143225 | **Blatt** *Page* 0001

Ihr Zeichen *Client Reference*	Unser Zeichen *Our Reference*	Ausstellungsdatum	*Date of Issue* (day/mo/yr)
20080304	ZO-SHY- 12307018 001	18.12.2008	

Genehmigungsinhaber *License Holder*
Mitsubishi Electric Corp.
Nagoya Works
5-1-14 Yada-Minami, Higashi-ku
Nagoya-shi, Aichi
461-8670 JAPAN

Fertigungsstätte *Manufacturing Plant*
Mitsubishi Electric Corp.
Nagoya Works
5-1-14 Yada-Minami, Higashi-ku
Nagoya-shi, Aichi
461-8670 JAPAN

Prüfzeichen *Test Mark*
www.tuv.com ID:2000000000 TÜVRheinland • BAUART GEPRÜFT • TYPE APPROVED

Geprüft nach *Tested acc. to*
EN 61800-5-1:2007

Zertifiziertes Produkt (Geräteidentifikation) *Certified Product (Product Identification)*	Lizenzentgelte - Einheit *License Fee - Unit*
Steuergerät AC SERVO DRIVE UNIT	
Type Designation : MR-J3W-uvt-wxyz	5
u = 22, 44, 104, 1010, 2015 or 207	1
v = A or B	1
x = S or blank	1
Y = 00 - 999 or blank	1
t,w,z = (see Appendix 1)	3

Rated Voltage : 3AC200-240V or AC200-240V, 50/60Hz
Rated Current : (see Appendix 1)
Protection Class : I
Rated Output Values : (see Appendix 1)
Ambient Temperature : 0°C to 55°C
Overvoltage Category: III (3AC200-240V) or II (AC 200-240V)
Pollution Degree : 2
Remarks: Power circuits and secondary control circuits provide protective separation.
The unit must be installed in accordance with the manufacturer's instructions.

TÜV Rheinland Product Safety GmbH TÜVRheinland Zertifizierungsstelle 12

ANLAGE (Appendix): 1

Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde und es bestätigt die Konformität des Produktes mit den oben genannten Standards und Prüfgrundlagen. Zusätzliche Anforderungen in Ländern, in denen das Produkt in Verkehr gebracht werden soll, müssen zusätzlich betrachtet werden. Die Herstellung des zertifizierten Produktes wird überwacht.
This certificate is based on our Testing and Certification Regulation and states the conformity of the product with the standards and testing requirements as indicated above. Any additional requirements in countries where the product is going to be marketed have to be considered additionally. The manufacturing of the certified product is subject to surveillance.

TÜV Rheinland Product Safety GmbH, Am Grauen Stein, D-51105 Köln
Tel.: (+49/221)8 06 - 13 71 e-mail: cert-validity@de.tuv.com
Fax: (+49/221)8 06 - 39 35 http://www.tuv.com/safety

Zertifizierungsstelle

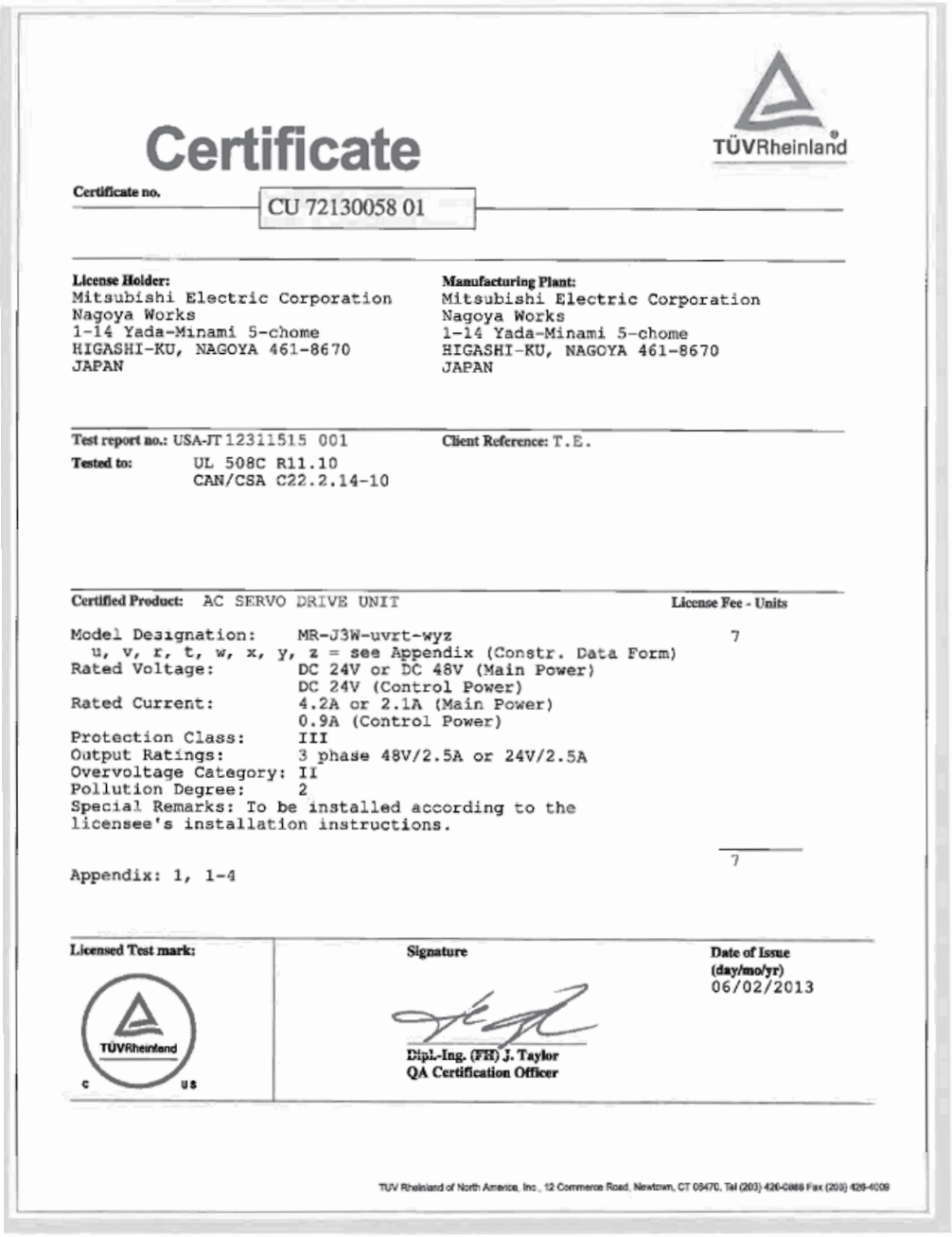
Dipl.-Ing. M. Geiser

Supplementation: Refer to section 1.5 (2) for the models shown in "(see Appendix 1)".

(2) UL/CSA standard

MR-J3W series servo amplifiers are certificated in compliance with UL/CSA standard.

(a) MR-J3W-0303BN6



Certificate

TÜVRheinland

Certificate no. CU 72130058 01

License Holder:
Mitsubishi Electric Corporation
Nagoya Works
1-14 Yada-Minami 5-chome
HIGASHI-KU, NAGOYA 461-8670
JAPAN

Manufacturing Plant:
Mitsubishi Electric Corporation
Nagoya Works
1-14 Yada-Minami 5-chome
HIGASHI-KU, NAGOYA 461-8670
JAPAN

Test report no.: USA-JT 12311515 001 **Client Reference:** T.E.

Tested to: UL 508C R11.10
CAN/CSA C22.2.14-10

Certified Product: AC SERVO DRIVE UNIT **License Fee - Units**

Model Designation: MR-J3W-uvrt-wyz 7
u, v, r, t, w, x, y, z = see Appendix (Constr. Data Form)
Rated Voltage: DC 24V or DC 48V (Main Power)
DC 24V (Control Power)
Rated Current: 4.2A or 2.1A (Main Power)
0.9A (Control Power)
Protection Class: III
Output Ratings: 3 phase 48V/2.5A or 24V/2.5A
Overvoltage Category: II
Pollution Degree: 2
Special Remarks: To be installed according to the licensee's installation instructions.

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Appendix: 1, 1-4

Licensed Test mark: TÜVRheinland c US

Signature
Dipl.-Ing. (FH) J. Taylor
QA Certification Officer

Date of Issue (day/mo/yr)
06/02/2013

TUV Rheinland of North America, Inc., 12 Commerce Road, Newtown, CT 06470, Tel (203) 426-0888 Fax (203) 426-4009

(b) MR-J3W-□B



Certificate

TÜVRheinland

Certificate no. CU 72091981 01

License Holder:
Mitsubishi Electric Corporation
Nagoya Works
1-14 Yada-Minami 5-chome
HIGASHI-KU, NAGOYA 461-8670
JAPAN

Manufacturing Plant:
Mitsubishi Electric Corporation
Nagoya Works
1-14 Yada-Minami 5-chome
HIGASHI-KU, NAGOYA 461-8670
JAPAN

Test report no.: USA-DS 30972607 001 **Client Reference:** Takeo Enomoto

Tested to: UL 508C R2.08
CAN/CSA C22.2 No. 14-05+GI1+GI2+GI3

Certified Product: AC Servo Drive Unit **License Fee - Units**

Model Designation: MR-J3W-uvt-wxyz
u=22,44,104,1010,2015,207; v=A,B; t=blank;
w=EA,EB,ED,EE,EG,FG,EH,ES,FH,FR,FS,Kn,
Ln,Mn,Nn,Pn,Qn,Rn,blank; x=S,blank; y=00-999,blank;
z=blank,Tx,Ux,Vx,Wx,Xx,Yx,Zx (x=00-999)

Rated Voltage: AC 200-240V or 3 AC 200-240V, 50/60Hz
Rated Current: 3.5A (u=22); 6.1A (u=44); 9.8A (u=104);
13.9A (u=1010); 19.1A (u=2015); 25.1A (u=207)
Protection Class: I
Output Current: 1.5A (u=22); 2.8A (u=44); 6.0/2.8A (u=104);
6.0A (u=1010); 11.0/8.0A (u=2015); 18.6/6.7A (u=207)
Appendix: 1, 1-3

Licensed Test mark: TÜV Rheinland of North America, Inc. C US

Signature

Dipl.-Ing. M. Glagla
QA Certification Officer

Date of Issue (day/mo/yr) 25/09/2009

TÜV Rheinland of North America, Inc., 12 Commerce Road, Newtown, CT 06470, Tel (203) 426-0888 Fax (203) 426-4009

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	
Dec. 2011	SH(NA)030073-B	Section 2.4(2)(3) The description is changed.	
Nov. 2012	SH(NA)030073-C	MR-J3W-0303BN6 and MR-J3W-1010B servo amplifiers are added.	
		HF-SP81/HF-SP102/HC-LP102/HF-JP53/HF-JP73/HF-JP103/HG-AK0136/HG-AK0236/HG-AK0336 servo motors are added.	
		LM-K2 linear servo motor is added.	
		Direct drive motor is added.	
		«About the manual»	The table is changed.
		Section 1.1	The sentences are changed.
		Section 1.3	Servo motor is added.
			Note 3 is changed.
		Section 1.4	The sentences about gain changing function are added.
		Section 1.5 (2)	The diagram is changed.
		Section 1.6	The table is changed and the sentences are added.
		Section 3.1	The sentences are added to CAUTION.
			Note 5 is changed.
		Section 3.3.1 (2)	MR-J3W-1010B is added.
		Section 3.3.3	The sentences of POINT is changed.
		Section 3.3.3 (2)	Added.
		Section 3.5 (2)(b)	The sentences of INP-A/INP-B, SA-A/SA-B, TLC-A/TLC-B and ABSV-A/ABSV-B are changed or added.
			VLC-A/VLC-B is added.
		Section 3.7.1	The part of diagram is changed.
		Section 3.7.2 (4)	Note is added.
		Section 3.10.2 (1)(b)	The connector model is changed.
		Section 3.10.2 (2)(a)	Note 2 and 3 are added.
		Section 3.10.2 (2)(b)	Servo motor and connector are added.
		Section 3.11.1	The part of POINT is changed.
		Section 3.11.1 (1)	Note 1 and 2 are added.
		Section 3.11.2 (1)	The ready-on command is added to the diagram.
		Section 3.11.3 (1)	Note 3 and 4 are added.
		Section 3.11.3 (2)	Note 3 and 5 are added.
		Section 3.13	The sentences are added to POINT.
		Section 3.14	The part of POINT is changed.
			The part of table is changed.
		Chapter 4	The part of POINT is changed.
		Section 4.4	The sentences are changed.
		Section 4.5.1	The sentences are added to POINT.
		Section 4.5.1 (2)	The diagram is changed.
		Chapter 5	The sentences are added to CAUTION.
		Section 5.1	POINT is partially deleted.
		Section 5.1.3	The sentences are added to POINT.
			The setting value is added.
		Section 5.1.4	The sentences are added to POINT.
			The setting value is added.
		Section 5.1.5	The sentences are added to POINT.
		Section 5.1.7	POINT is added.
		Section 5.1.8	The sentences in POINT are changed.

Print Data	*Manual Number	Revision	
Nov. 2012	SH(NA)030073-C	Section 5.1.9	The setting content is changed.
		Section 5.2.2	PB24: The setting content is changed.
		Section 5.3.2	PC01: The sentences are changed.
			PC09: The setting content is changed.
			PC17: The sentences are changed.
		Section 5.3.3 (2)	"Speed command 2" is added, Note 2 to 4 are added.
		Section 5.3.3 (3)	"Speed command 2" is added.
		Section 5.4	The factory setting of PD20 to PD23 are changed.
		Section 5.4.2	PD07: The table is changed, Note is added and changed.
		Section 5.5	Po02: The setting content of the first digit is changed.
			Po03: The setting content of the first digit is changed.
			Po04: The setting content is changed.
		Chapter 6	POINT is added.
		Section 7.5	The sentences are changed.
		Section 7.5.2	The sentences are changed.
		Chapter 8	The sentences in POINT are changed.
		Section 8.1	MR-J3W-0303BN6 is added.
		Section 8.2	POINT is added.
		Section 8.3	16.3(1): Added.
			45.5: Changed from 45.2.
			46.1: Name is changed.
		Section 8.4	The sentences are changed.
			E3: The content is changed.
			E9.3: Added.
			EB.1: (1) to (3) are added.
		Section 9.1 (2)	MR-J3W-1010B is added.
		Section 10.1	The part of diagram is changed.
			Servo motor and Note 2 are added.
		Section 10.2	Servo motor is added.
		Section 10.3	HF-JP series is added.
		Section 10.5	MR-J3W-1010B is added.
		Section 11.1.1	Servo amplifier and servo motor are added.
			Connector set is added.
		Section 11.1.2 (5)(b)	Note is added.
		Section 11.2	MR-J3W-1010B is added.
			MR-RB3B is added.
		Section 11.2 (2)(a)	The contents are entirely changed.
		Section 11.4 (1)	The part of table is changed.
		Section 11.4 (2)	The part of table is changed.
		Section 11.5 Table11.1	MR-J3W-1010B is added.
		Section 11.5 (2)	The recommended cables of "Servo motor power cable" and "Electromagnetic brake cable" are changed.
		Section 11.6	The sentences are added.
			The table is changed.
		Section 11.7	The table is changed and the sentences are added.
		Section 11.9 (2)(b)	The surge killer is changed.
		Section 11.10	Servo amplifier and servo motor are added.
		Section 11.11	MR-J3W-1010B is added.
		Section 11.12 (2)	The part of table is changed.

Print Data	*Manual Number	Revision	
Nov. 2012	SH(NA)030073-C	Chapter 13	The contents are entirely changed.
		Chapter 14	Added.
		Chapter 15	Added.
		App. 1.1	PF06, PF12 and Po04 are added.
		App. 3.2	MR-J3W-0303BN6 is added.
		App. 4	MR-J3W-0303BN6 and MR-J3W-1010B servo amplifier are added. HG-AK and HF-JP series servo motor are added.
Apr. 2013	SH(NA)030073-D	4. Additional instructions (1)	The sentences are added.
		Chapter 2	The sentences are added.
		Section 3.3.2	The sentences in POINT are changed.
		Section 5.3.3	POINT is added.
		Section 8.4	The part of table is changed.
		Section 10.5	The sentences are added.
		Section 11.4 (2)	The sentences are changed.
		Section 13.6.4 (3)	POINT is added.
		Section 13.7.3	The part of table is changed.
		Section 14.6.3	The part of table is changed.
		Section 15.1.2	Note 6 is added.
		Section 15.3.3 (2)	POINT is added.
		Section 15.5.2 (2)	POINT is added.
		Section 15.6	The part of table is changed.
		Section 15.9.2	The part of note is changed.
		App. 8	Added.

This manual confers no industrial property rights or any rights of any other kind, nor does it confer any patent licenses. Mitsubishi Electric Corporation cannot be held responsible for any problems involving industrial property rights which may occur as a result of using the contents noted in this manual.

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Country/Region	Sales office	Tel/Fax
USA	Mitsubishi Electric Automation Inc. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, USA	Tel : +1-847-478-2100 Fax : +1-847-478-0327
Germany	Mitsubishi Electric Europe B.V. German Branch Gothaer Strasse 8, D-40880 Ratingen, Germany	Tel : +49-2102-486-0 Fax : +49-2102-486-1120
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
China	Mitsubishi Electric Automation (China) Ltd. 4F Zhi Fu Plazz, No. 80 Xin Chang Road Shanghai 200003, China	Tel : +86-21-6120-0808 Fax : +86-21-6121-2444
Taiwan	Setsuyo Enterprise Co., Ltd. 6F, No.105 Wu-Kung 3rd Rd, Wu-Ku Hsiang, Taipei Hsine, Taiwan	Tel : +886-2-2299-2499 Fax : +886-2-2299-2509
Korea	Mitsubishi Electric Automation Korea Co., Ltd. 3F, 1480-6, Gayang-dong, Gangseo-gu, Seoul 157-200, Korea	Tel : +82-2-3660-9552 Fax : +82-2-3664-8372
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

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